Workshop "Biodiversity in Oceania", Nouméa, New Caledonia, 24 June 2019

# Biological invasions and biodiversity crisis in terrestrial island ecosystems of Oceania




**Jean-Yves MEYER[1], Eric VIDAL[2] & Hervé JOURDAN[2]**

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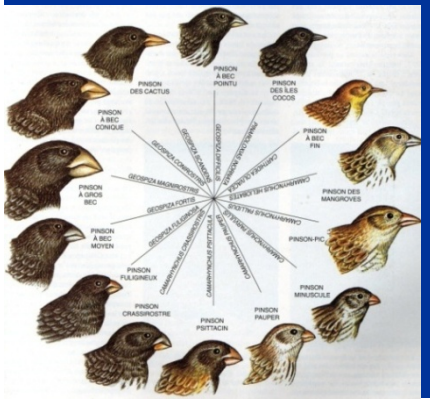
# Oceania and the Pacific islands

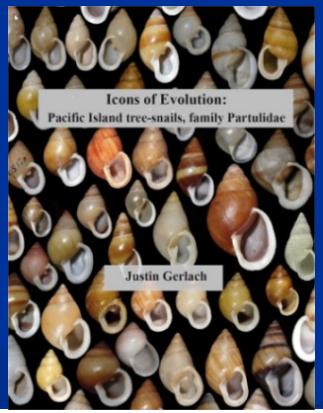
- The largest ocean on Earth (ca. 30 million km², 20,000 km wide)
- > 10,000 islands
- 554,000 km² of land (ca. 0.4% of the world area)*
- 24 Pacific Islands Countries and Territories (PICTS) including 13 Small Island Developing States (SIDS)
- ca. 12 million people*
- "Big Brothers" (Australia, New Zealand, USA, France…and China)


(* https://en.wikipedia.org/wiki/Demographics_of_Oceania, excluding Australia and New Zealand)

# Pacific Islands: a unique biota…

- **Relative high species richness** (30,000 plant species, ca. 3,000 vertebrates) **and habitat diversity** (from atolls to high volcanic islands)
- **Very high endemism** (*e.g.* 89% flowering plants in Hawaii, 80% in New Caledonia, up to 100% for molluscs)
- **Spectacular adaptative radiations** (*e.g.* Galápagos finches, Hawaii honeycreepers, Polynesian tree snails)
- **Much more taxa to be discovered!**






A global assessment of endemism and species richness across island and mainland regions

Gerold Kier[a,1], Holger Kreft[a,b,1,2], Tien Ming Lee[b], Walter Jetz[b], Pierre L. Ibisch[c], Christoph Nowicki[c], Jens Mutke[a], and Wilhelm Barthlott[a]

9322–9327 | PNAS | June 9, 2009 | vol. 106 | no. 23

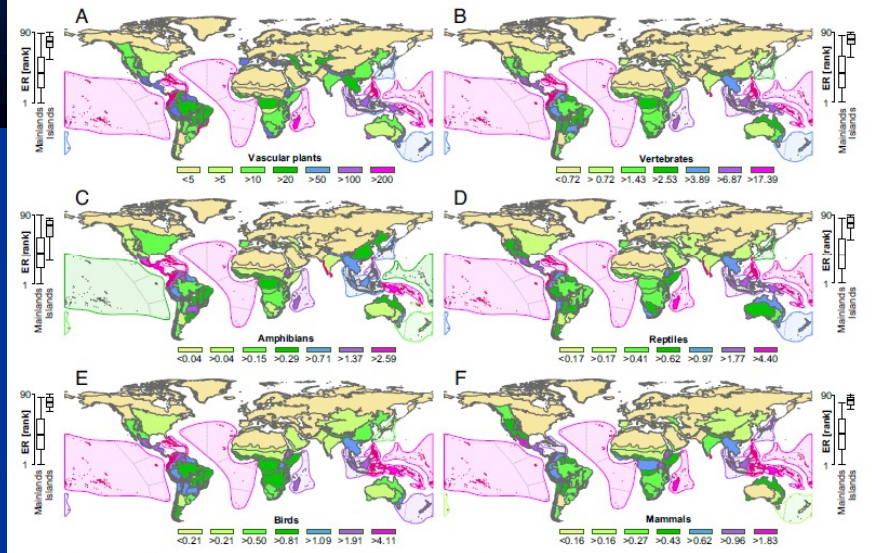



Fig. 1. Global patterns of endemism richness (ER; range equivalents per 10,000 km$^2$) for (*A*) vascular plants, (*B*) terrestrial vertebrates, (*C*) amphibians, (*D*) reptiles, (*E*) birds, and (*F*) mammals across 90 biogeographic regions. Map legends were classified using quantiles, i.e., each color class contains a comparable number of regions. Box-and-whisker plots illustrate rank-based differences in endemism richness between mainland ($n$ = 76; white boxes) and island regions ($n$ = 14; gray boxes). Boxes mark second and third quartiles; whiskers mark the range of the data.

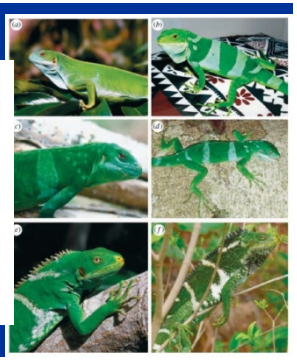
PHILOSOPHICAL TRANSACTIONS OF THE ROYAL SOCIETY B

*Phil. Trans. R. Soc. B* (2008) **363**, 3413–3426
doi:10.1098/rstb.2008.0120
*Published online* 5 September 2008

**Molecular and morphological analysis of the critically endangered Fijian iguanas reveals cryptic diversity and a complex biogeographic history**

J. Scott Keogh[1,*], Danielle L. Edwards[1], Robert N. Fisher[2] and Peter S. Harlow[3]

[1]*School of Botany and Zoology, The Australian National University, Canberra, ACT 0200, Australia*
[2]*U.S. Geological Survey, Western Ecological Research Station, San Diego Field Station, 4165 Spruance Road, Suite 200, San Diego, CA 92101-0812, USA*
[3]*School of Biological Sciences, Macquarie University, NSW 2109, Australia*



# Portraits gallery of some emblematic endemic species

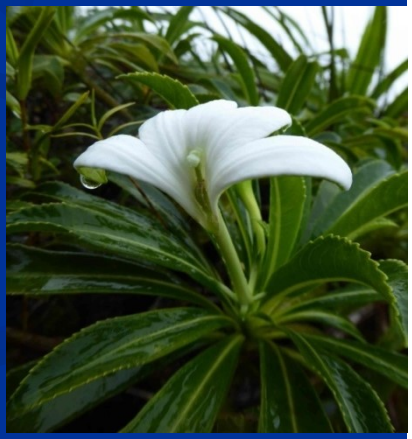
*Gymnomyza samoensis* (Samoa)

*Medinilla waterhousei* (Taveuni, Fiji)

*Fitchia speciosa* (Rarotonga, Cook Is.)
Photo : R. Thaman

*Rhynochetos jubatus* (New Caledonia)
Photo : H. Jourdan

*Brachylophus vitiensis* (Viti Levu, Fiji)
Photo : R. Thaman



*Microcystis saintjohni* (Tubuai, Austral Is., French Polynesia) Photo : O. Gargominy

*Lentipes rubrofasciatus* (Marquesas, French Polynesia) Photo : P. Keith

*Sclerotheca raiateensis* (Raiatea, Society Is., French Polynesia)

# …but highly threatened

- **Front line of global changes** (sea-level rise, extreme climate events, pollutions, over-exploitation, biological invasions…)
- **Massive past extinction events** (> 1000 extinct birds since 1600)
- **ca. 30% of 3769 plant and animal species from 24 PICTs are threatened** (IUCN's Red List of Threatened Species™ 2008).
- **Four global biodiversity hotspots** (areas with high endemism and high level of threat)

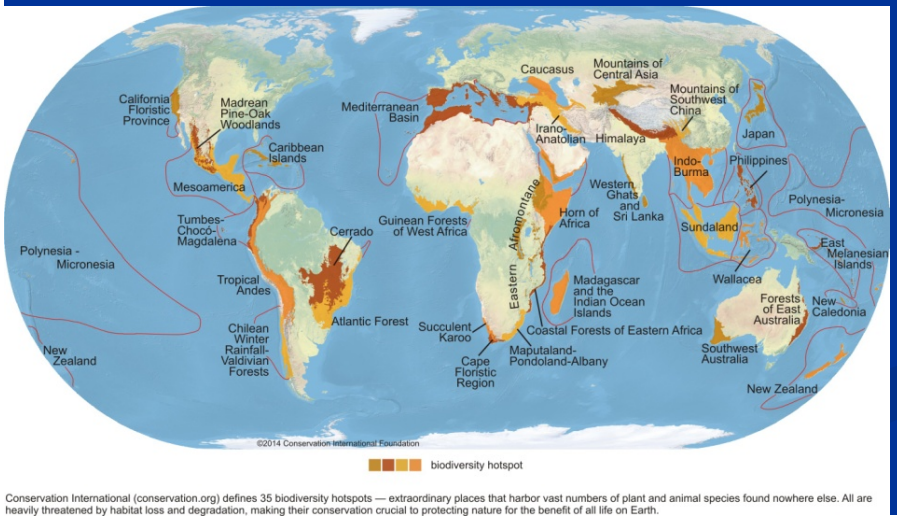



Magnitude and variation of prehistoric bird extinctions in the Pacific

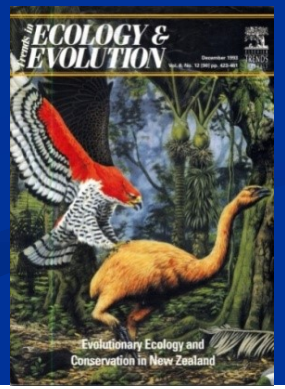
Richard P. Duncan[a,1], Alison G. Boyer[b], and Tim M. Blackburn[c,d]

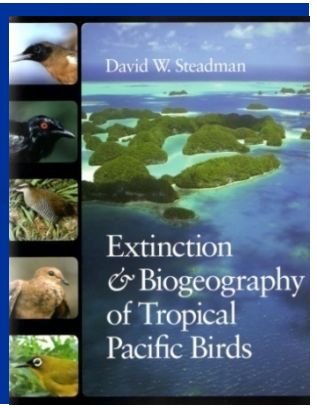
[a]Institute for Applied Ecology, University of Canberra, Canberra, ACT 2601, Australia; [b]Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN 37996-1610; [c]Institute of Zoology, Zoological Society of London, London NW1 4RY, United Kingdom; and [d]Distinguished Scientist Fellowship Program, King Saud University, Riyadh 1145, Saudi Arabia

6436–6441 | PNAS | April 16, 2013 | vol. 110 | no. 16




Conservation International (conservation.org) defines 35 biodiversity hotspots — extraordinary places that harbor vast numbers of plant and animal species found nowhere else. All are heavily threatened by habitat loss and degradation, making their conservation crucial to protecting nature for the benefit of all life on Earth.



- **Epicenter of the 6th extinction crisis!**

## Pinpointing and preventing imminent extinctions

Taylor H. Ricketts[a,b], Eric Dinerstein[a], Tim Boucher[c], Thomas M. Brooks[d], Stuart H. M. Butchart[e], Michael Hoffmann[d], John F. Lamoreux[f], John Morrison[a], Mike Parr[g], John D. Pilgrim[d], Ana S. L. Rodrigues[d], Wes Sechrest[f,h], George E. Wallace[g], Ken Berlin[i], Jon Bielby[i], Neil D. Burgess[a], Don R. Church[d], Neil Cox[h], David Knox[d], Colby Loucks[a], Gary W. Luck[k], Lawrence L. Master[l], Robin Moore[m], Robin Naidoo[a], Robert Ridgely[g], George E. Schatz[n], Gavin Shire[g], Holly Strand[a], Wes Wettengel[a], and Eric Wikramanayake[a]

PNAS | December 20, 2005 | vol. 102 | no. 51 | 18497–18501

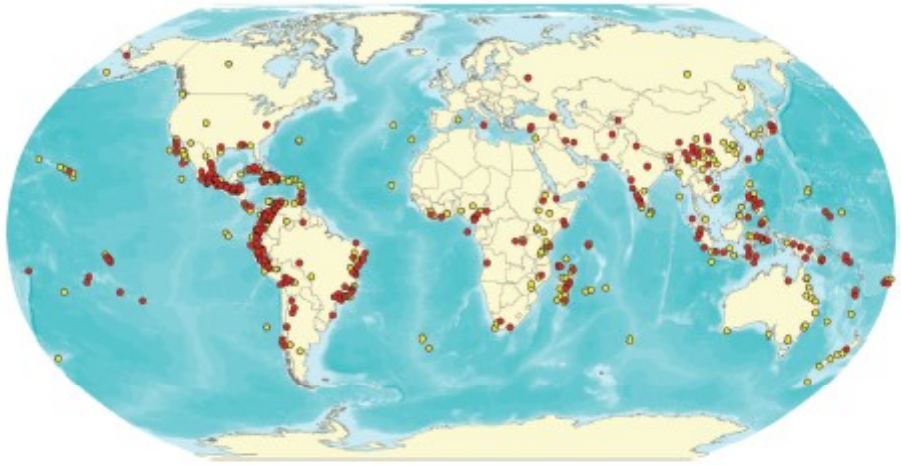
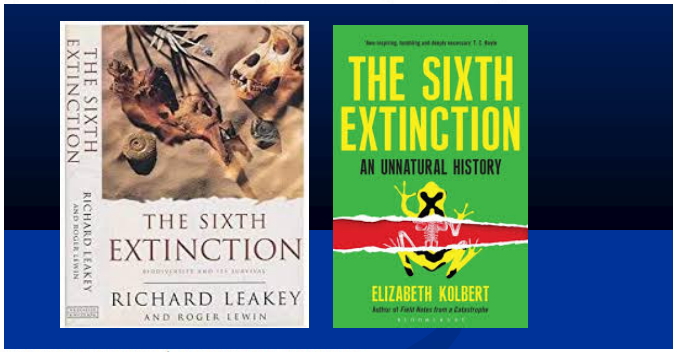


Fig. 1. Map of 595 sites of imminent species extinction. Yellow sites are either fully or partially contained within declared protected areas ($n$ = 203 and 8 respectively), and red sites are completely unprotected or have unknown protection status ($n$ = 257 and 48, respectively; see *Methods*). In areas of overla unprotected (red) sites are mapped above protected (yellow) sites to highlight the more urgent conservation priorities.




SCIENCE ADVANCES | RESEARCH ARTICLE

CONSERVATION BIOLOGY

## Globally threatened vertebrates on islands with invasive species

Dena R. Spatz,[1,2]* Kelly M. Zilliacus,[1] Nick D. Holmes,[2,3] Stuart H. M. Butchart,[4,5] Piero Genovesi,[6] Gerardo Ceballos,[7] Bernie R. Tershy,[1,8] Donald A. Croll[1]

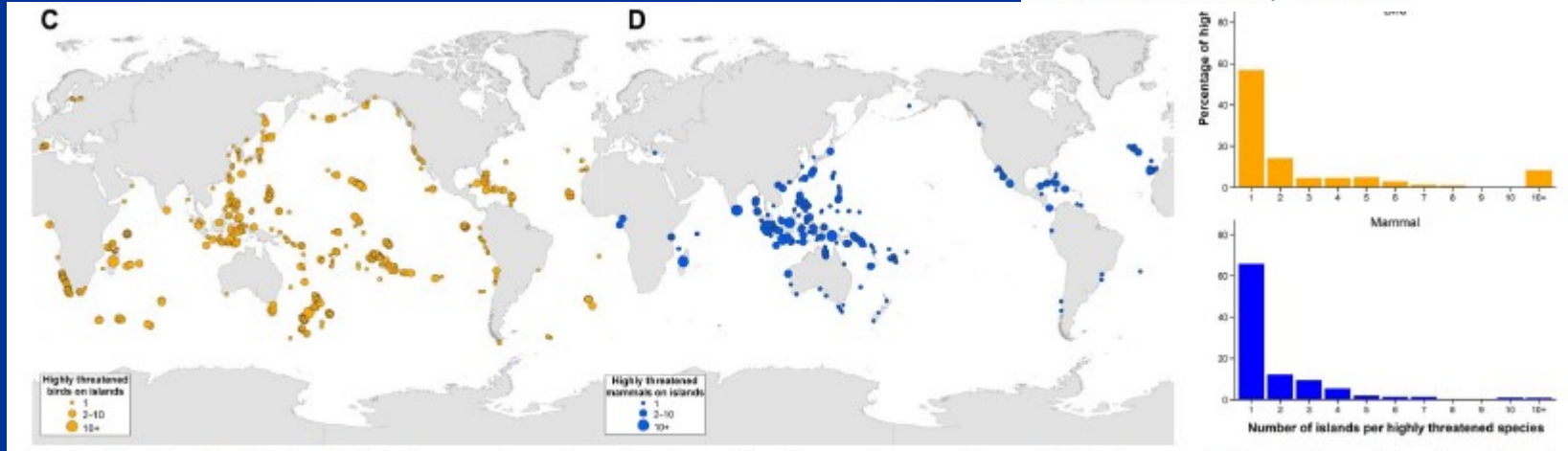
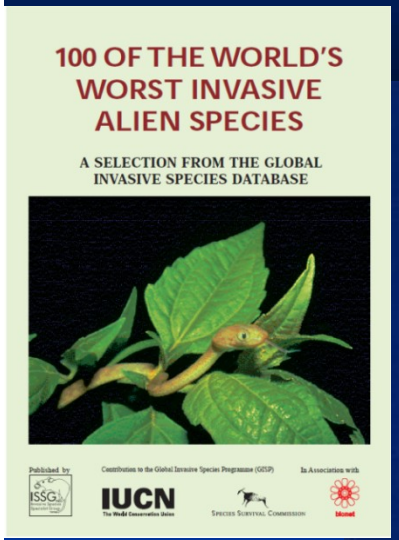


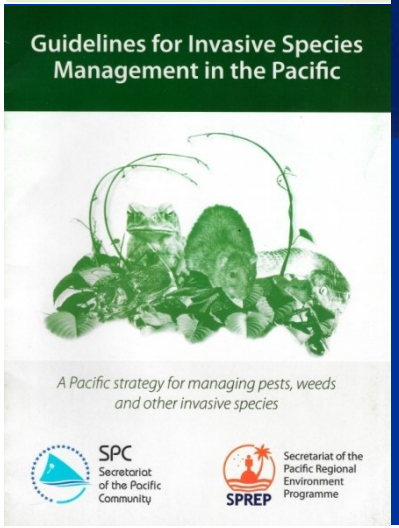

**Fig. 4. The global distribution of highly threatened vertebrates.** Location of islands supporting populations of highly threatened (**A**) amphibians, (**B**) reptiles, (**C**) birds, (**D**) mammals, and the number of islands with breeding populations per highly threatened species (**E**).

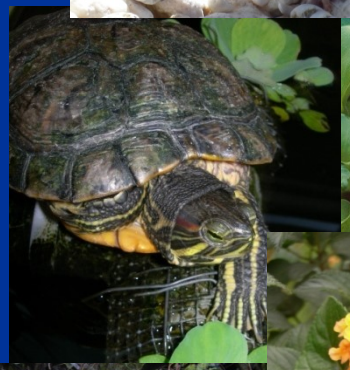
# Invasive Alien Species

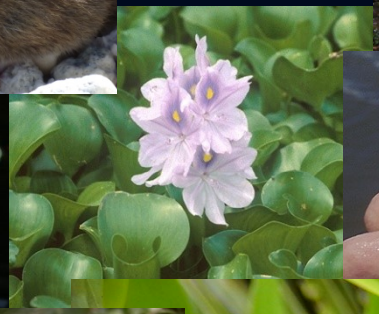
- 70% of the 100 Worst World's IAS found in Oceania !



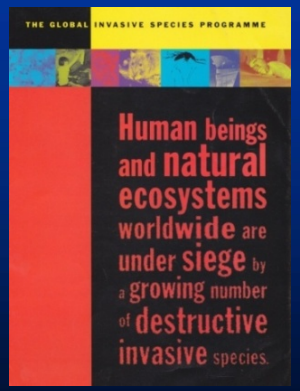


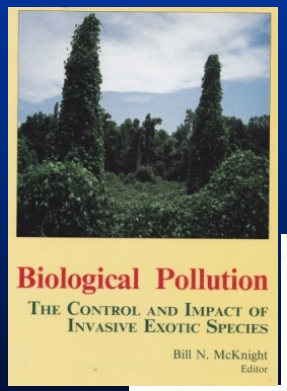




- Homogeinization of island biota
- Dramatic ecological impacts




## Critical issues and new challenges for research and management of invasive plants in the Pacific Islands

JEAN-YVES MEYER[1]

*Table 1.* Comparison between native and alien flora (flowering plants and ferns) in selected Pacific tropical islands (by size of terrestrial area) and number of naturalized and invasive alien plants (including dominant or major IAP).

| Island or island group | Area (km²) | Native flora (number of indigenous species) | Alien flora (number of introduced species) | Naturalized alien plant species | Invasive alien plant species | Dominant IAP |
|---|---|---|---|---|---|---|
| New Caledonia | 19 060 | 3 261[a] | 2 008[b] | 597[b] | 97[c] | 67[b] |
| Fiji | 18 270 | 1 622[d] | 977[d] | 461[d] | 107[e] | 30[f] |
| Hawai'i | 16 880 | 1 138[g] | 8 134[h] | 1 104[i] | 469[i] | 86[j] |
| Galápagos | 7 900 | 550[k] | 870[l] | 229[l] | 109[l] | 22[l] |
| French Polynesia | 3 519 | 885[m] | > 1 700[n] | 593[n] | - | 57[n] |
| Cook Is. | 238 | 296[o] | 997[o] | 333[o] | 76[p] | 12[q] |
| Rapa Nui (Easter Island) | 166 | 48[r] | 370[s] | 180[s] | - | 36[s] |
| Wallis et Futuna | 142 | 351[t] | 338[u] | 151[u] | - | 18[u] |

[a]Jaffré *et al.* 2004, [b]Meyer *et al.* 2010, [c]Hequet *et al.* 2009, [d]Brownlie 1977 and Smith 1996, [e]GISP, [f]Meyer 2000, [g]Wagner *et al.* 1999, [h]Staples and Herbst 2005, [i]Staples and Cowie 2001, [j]Smith 1985, [k]Mauchamp 1997, Trueman *et al.* 2010, [l]Florence *et al.* 2007, [m]Fourdrigniez and Meyer 2008, [n]McCormack 2007, [o]Space and Flynn 2002, [p]Meyer 2004, [q]Dubois *et al.* 2013, [r]Meyer 2008, [s]Morat *et al.*, [t]Meyer *et al.* 2010

[1]Délégation à la Recherche, Government of French Polynesia, B.P. 20981 Papeete, Tahiti. jean-yves.meyer@recherche.gov.pf

PACIFIC CONSERVATION BIOLOGY Vol. 20(2): 146–164. Surrey Beatty & Sons, Sydney. 2014.

BioScience Advance Access published April 1, 2015

Overview Articles

## The Importance of Islands for the Protection of Biological and Linguistic Diversity

BERNIE R. TERSHY, KUO-WEI SHEN, KELLY M. NEWTON, NICK D. HOLMES, AND DONALD A. CROLL

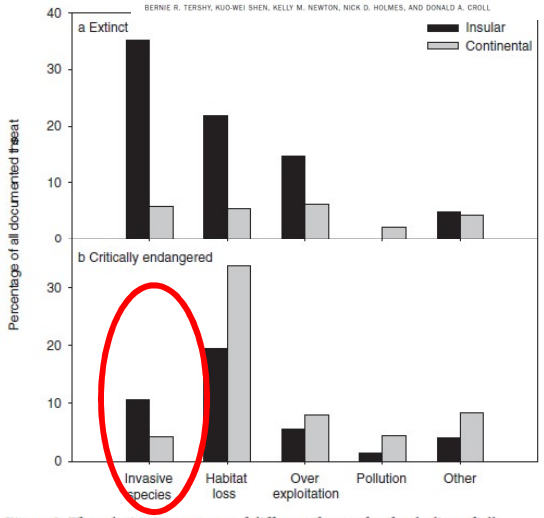



*Figure 3. The relative importance of different threats for the decline of all extinct species (a) and all critically endangered species (b) confined to islands (insular) and species occurring primarily on continents (continental) from all taxa in IUCN (2010). The* other *category includes climate change, disease, and other threats.*

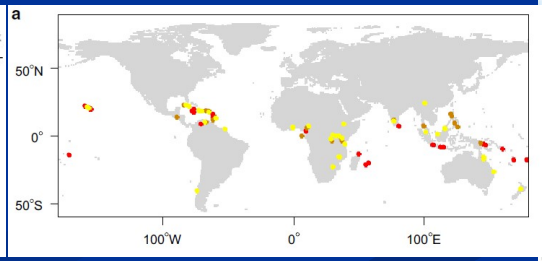
Biol Invasions (2015) 17:3337–3350
DOI 10.1007/s10530-015-0960-x

CrossMark

ORIGINAL PAPER

## Assessing current and future risks of invasion by the "green cancer" *Miconia calvescens*

Noelia González-Muñoz · Céline Bellard · Camille Leclerc · Jean-Yves Meyer · Franck Courchamp






# Invasive predators and global biodiversity loss

Tim S. Doherty[a,b,1], Alistair S. Glen[c], Dale G. Nimmo[d], Euan G. Ritchie[a], and Chris R. Dickman[e]

[a]Centre for Integrative Ecology, School of Life and Environmental Sciences, Deakin University, Geelong, VIC 3216, Australia; [b]Centre for Ecosystem Management, School of Natural Sciences, Edith Cowan University, Joondalup, WA 6027, Australia; [c]Landcare Research, Auckland 1072, New Zealand; [d]Institute for Land, Water and Society, School of Environmental Science, Charles Sturt University, Albury, NSW 2640, Australia; and [e]Desert Ecology Research Group, School of Life and Environmental Sciences, University of Sydney, Sydney, NSW 2006, Australia

PNAS | October 4, 2016 | vol. 113 | no. 40 | 11261–11265

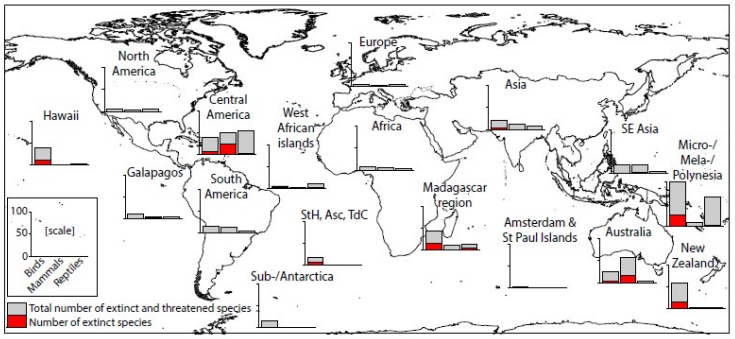
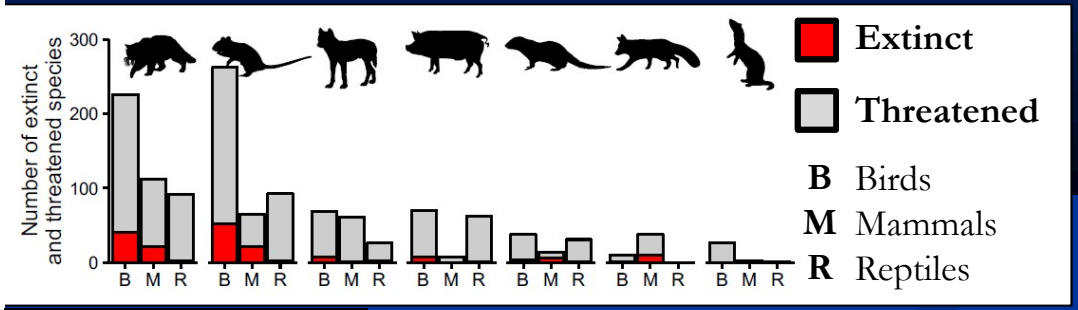



Fig. 4. Numbers of threatened and extinct bird, mammal, and reptile species impacted by invasive predators in 17 regions (Fig. S3 and Table S2). Gray bars represent the total number of extinct and threatened species, and red bars represent the number of extinct species (including those classed as extinct in the wild). StH, Asc, and TdC indicate the islands of St. Helena, Ascension, and Tristan da Cunha, respectively.




Biological Conservation 214 (2017) 250–259

Contents lists available at ScienceDirect

Biological Conservation

journal homepage: www.elsevier.com/locate/biocon

## Feral cats threaten the outstanding endemic fauna of the New Caledonia biodiversity hotspot

Pauline Palmas[a,b,*], Hervé Jourdan[a], Frédéric Rigault[a], Léo Debar[a], Hélène De Meringo[c], Edouard Bourguet[a], Mathieu Mathivet[a], Matthias Lee[a], Rachelle Adjouhgniope[a], Yves Papillon[a], Elsa Bonnaud[b], Eric Vidal[a]

SCIENCE ADVANCES | RESEARCH ARTICLE

CONSERVATION BIOLOGY

## Globally threatened vertebrates on islands with invasive species

Dena R. Spatz,[1,2]* Kelly M. Zilliacus,[1] Nick D. Holmes,[2,3] Stuart H. M. Butchart,[4,5] Piero Genovesi,[6] Gerardo Ceballos,[7] Bernie R. Tershy,[1,8] Donald A. Croll[1]

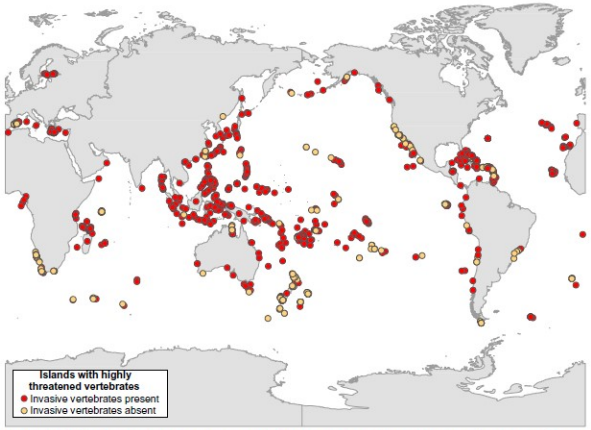



Fig. 5. The 1030 islands with highly threatened native vertebrates and information on the presence or absence of invasive vertebrates. Of these, 779 (76%) had at least one invasive vertebrate species present. Mammals were the most common invader on these islands (753 islands; 97% of islands with highly threatened vertebrates).

# Huge socio-economical and health impacts

Coconut rhinoceros beetle *Oryctes rhinoceros*


Oriental fruit-fly *Bactrocera dorsalis*

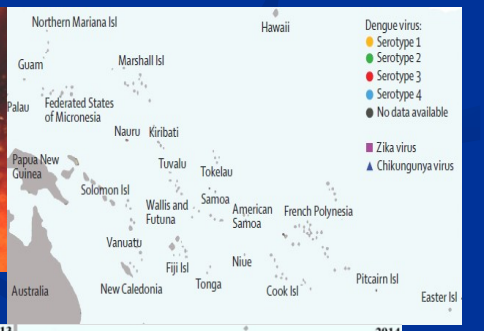
PeerJ

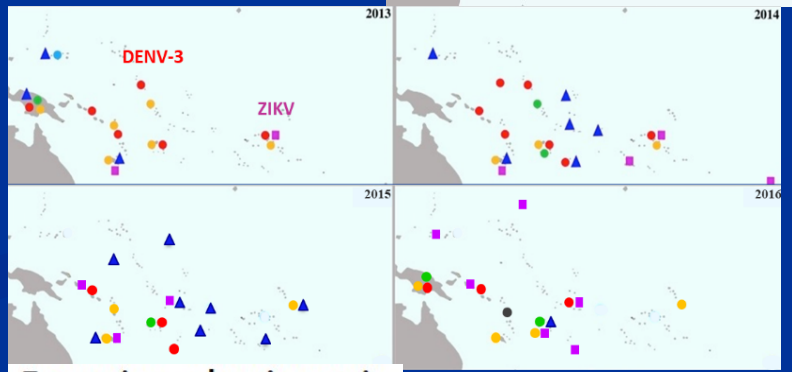
**The invasive land planarian *Platydemus manokwari* (Platyhelminthes, Geoplanidae): records from six new localities, including the first in the USA**

Jean-Lou Justine[1], Leigh Winsor[2], Patrick Barrière[3], Crispus Fanai[4], Delphine Gey[5], Andrew Wee Kien Han[6], Giomara La Quay-Velázquez[7], Benjamin Paul Yi-Hann Lee[8,9], Jean-Marc Lefevre[10], Jean-Yves Meyer[11], David Philippart[12], David G. Robinson[13], Jessica Thévenot[14] and Francis Tsatsia[4]


Figure 7 ***Platydemus manokwari*, map of distribution records.** Blue: previous records (*Justine et al., 2014*); Red: new records reported in this paper.

*Aedes aegypti*



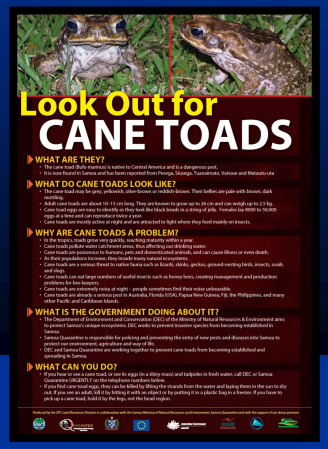




**Emerging arboviruses in the Pacific**

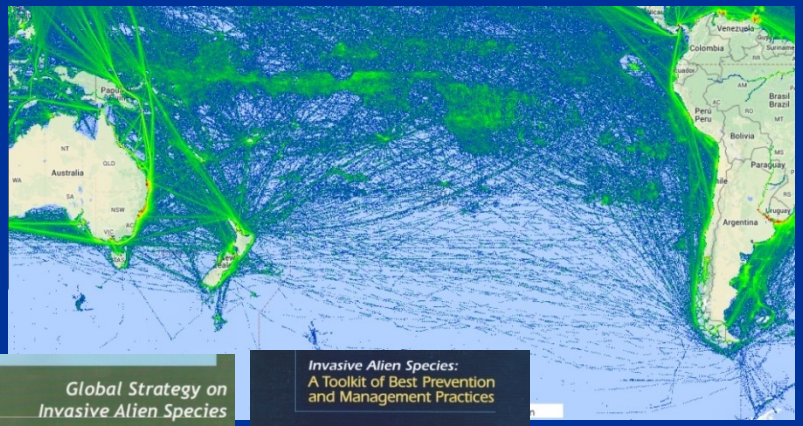
Van-Mai Cao-Lormeau, Didier Musso

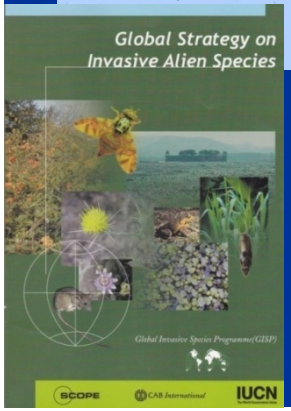
thelancet.com Vol 384 November 1, 2014

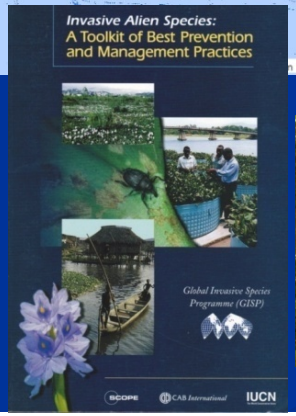
# From biosecurity to biocontrol

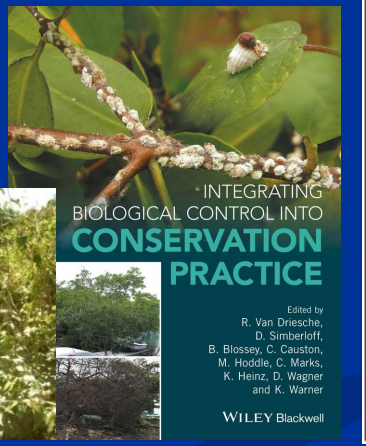



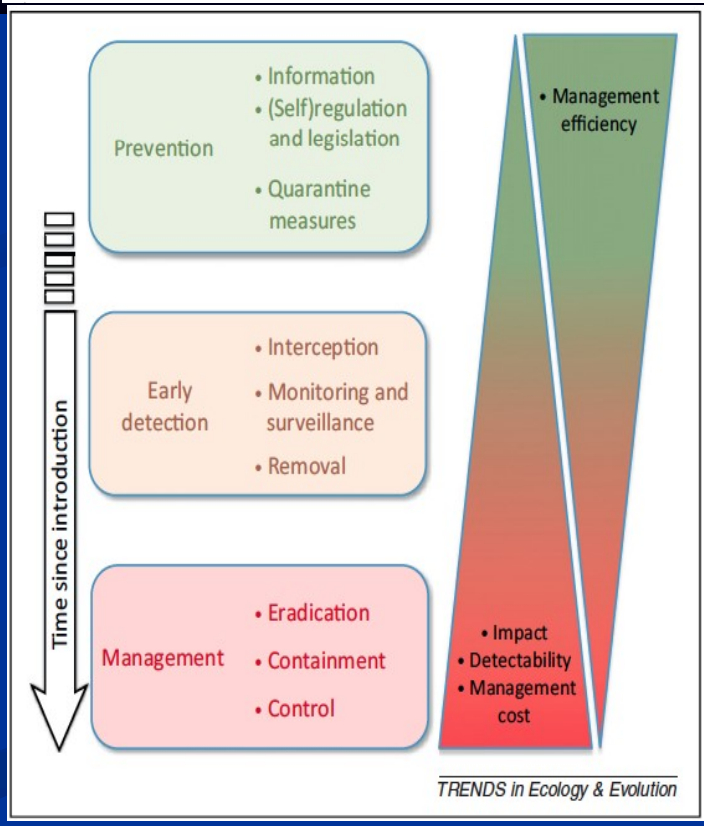


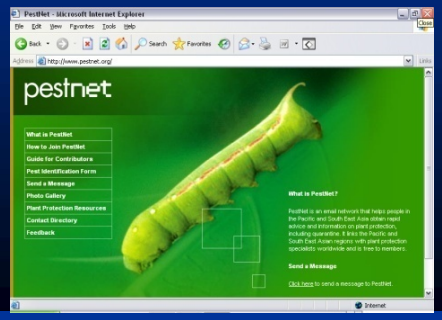



# Networks


Aliens: The Invasive Species Bulletin
Newsletter of the IUCN/SSC Invasive Species Specialist Group
Issue Number 31, 2011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How to Join PestNet
Guide for Contributors
Pest Identification Form
Send a Message
Photo Gallery
Plant Protection Resources
Contact Directory
Feedback


IUCN
Island Invasives:
Eradication and Management
Proceedings of the
International Conference on Island Invasives
Edited by C. R. Veitch, M. N. Clout, and D. R. Towns


IUCN
Island invasives:
scaling up to meet the challenge
Proceedings of the
international conference on island invasives 2017


Moorea, French Polynesia, 2007


PACIFIC INVASIVES LEARNING NETWORK
PILN


IUCN


GRIIS
GLOBAL REGISTER OF
INTRODUCED AND INVASIVE SPECIES


ISSG
Invasive Species
Specialist Group


UICN
Comité
Français


Poindimié, New Caledonia, 2010


SPREP


Pacific
INVASIVES
INITIATIVE

# Future Directions

- An updated assessment of biodiversity in Oceania is needed
- Prioritization of key taxa and habitats is essential
- Long-term monitoring of ecosystem dynamics is crucial
- Collaboration (international, regional, national, local) between researchers, managers and other stakeholders is paramount
- We need to integrate invasive species management to ecosystem restoration and global changes projects
- We need to have the full support of local communities and authorities!