Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Flore, Faune et Forêts de la Polynésie française : diversités, menaces, conservation et restauration

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« Back to the past » !

Parmi les îles les plus isolées au monde (> 5000-6000 km des continents)

ZEE = 4.8 millions km²

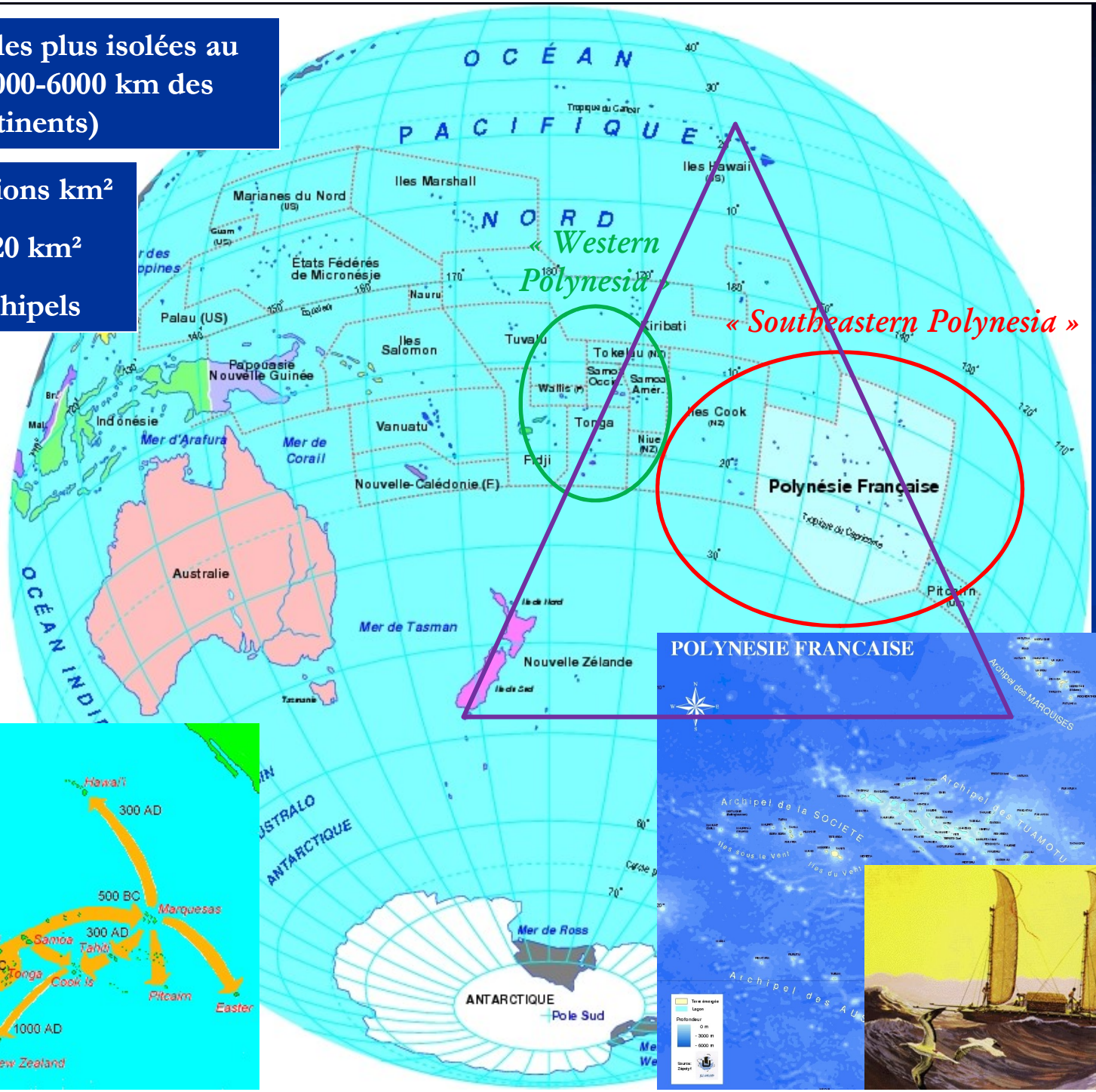
Surface = 3520 km²

120 îles, 5 archipels

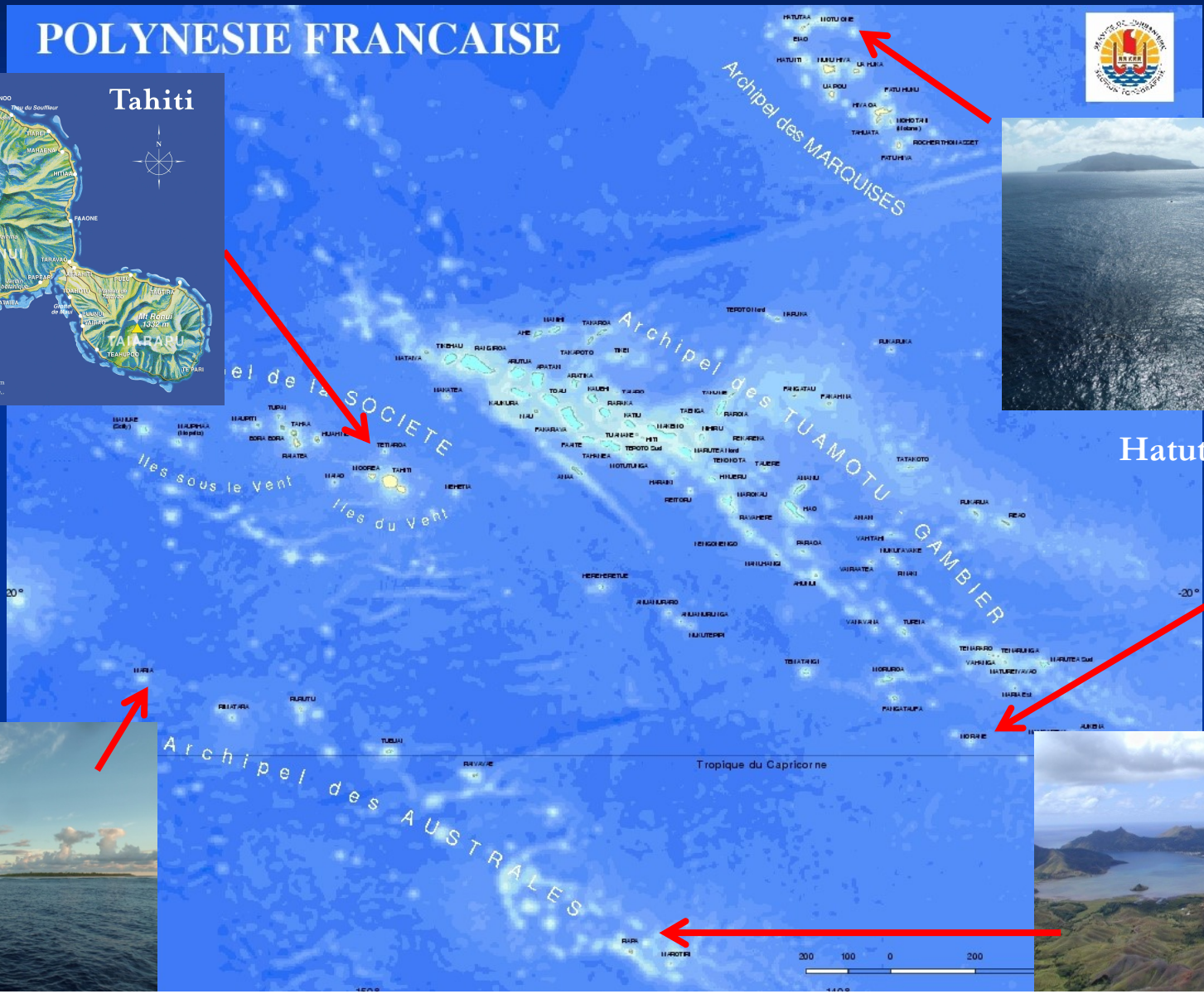
Polynésiens arrivés il y a 1000 ans

Européens : 1767-1768

280 000 habitants (2020)



Multi-insularité



Tahiti

Hatutaa & Eiao

Atoll de Morane

Atoll de Maria

Rapa

Diversité(s)

- 120+ îles océaniques
- 30 000 ans à 60 MA
- climat tropical à subtropical
- 34 îles hautes, presqu'atolls, îles « composites »
- 83 atolls dont 6 soulevés

Makatea (Tuamotu)

Mehetia (Société)

Etage subalpin, Mt Orohena, Tahiti

Ua Pou (Marquises)

Roto Rahi & Roto Iti, Maiao (Societé)

Forêt sèches, Pariati, Rapa (Australes)

Forêts de nuage, Mt Aorai, Tahiti

Endémisme

- **> 3000 arthropodes** (dont 1570 endémiques)
- **> 900 plantes vasculaires** (570 endémiques)
- **> 525 mollusques** (95% endemisme)
- **37 poissons d'eau douce** (15 endémiques)
- **36 oiseaux terrestres** (27 endémiques)
- **9 reptiles** (geckos & scinques)

Rhyncogonus adamsonii (Hiva Oa)

Nacaduba tahitiensis (Tahiti)

Lentipes rubrofasciatus (Marquises) Photo : P. Keith

Microcystis sp. (Australes) Photo : O. Gargominy

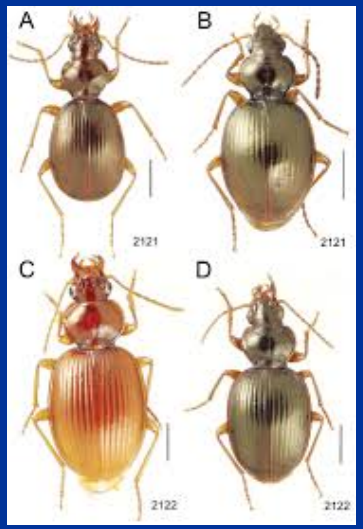
Sclerotheca (Apetahia) raiateensis (Raiatea)

Ducula galeata (Nuku Hiva)

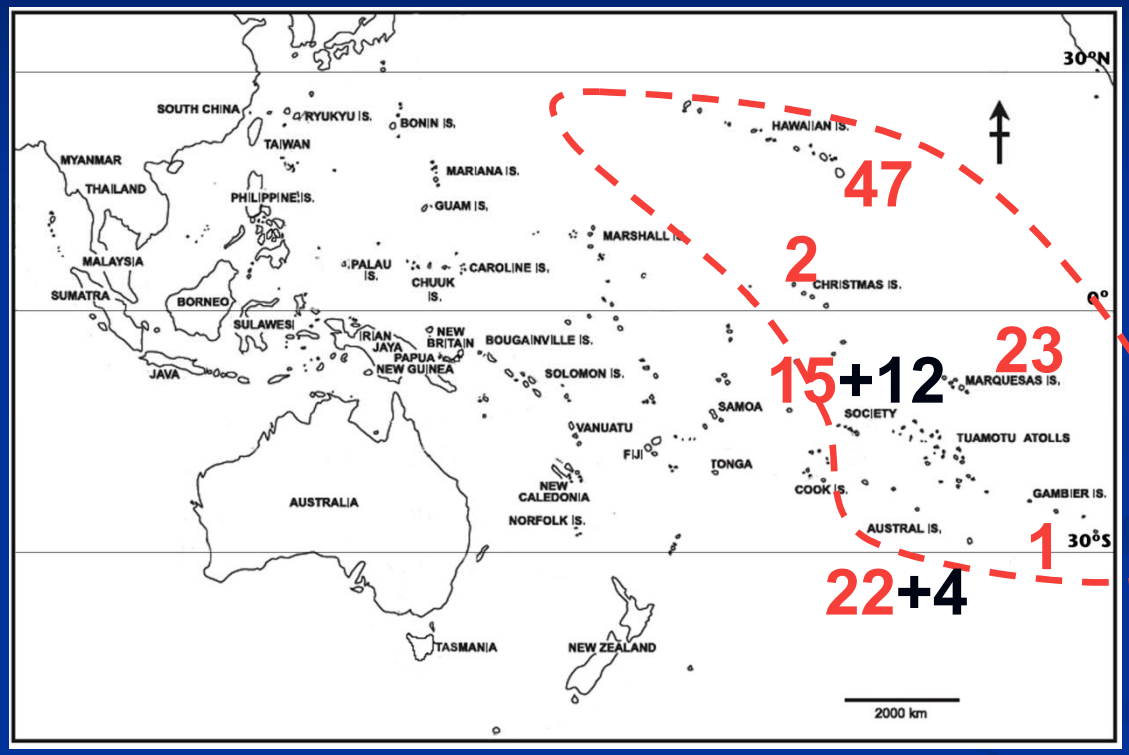
Vini kuhlii (Rimatara)

The high diversity and endemism of weevils and beetles

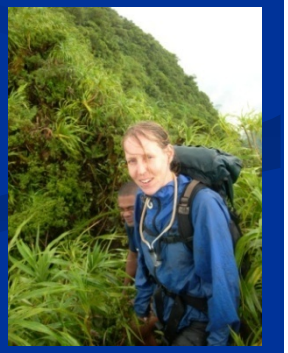
Rhyncogonus planatus (Ua Huka)



Mecyclothorax spp. (101 species)

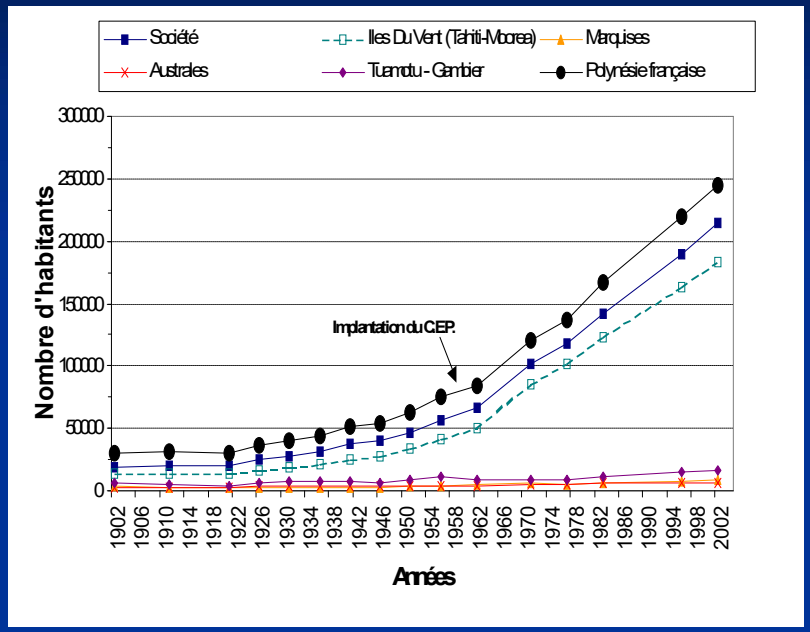


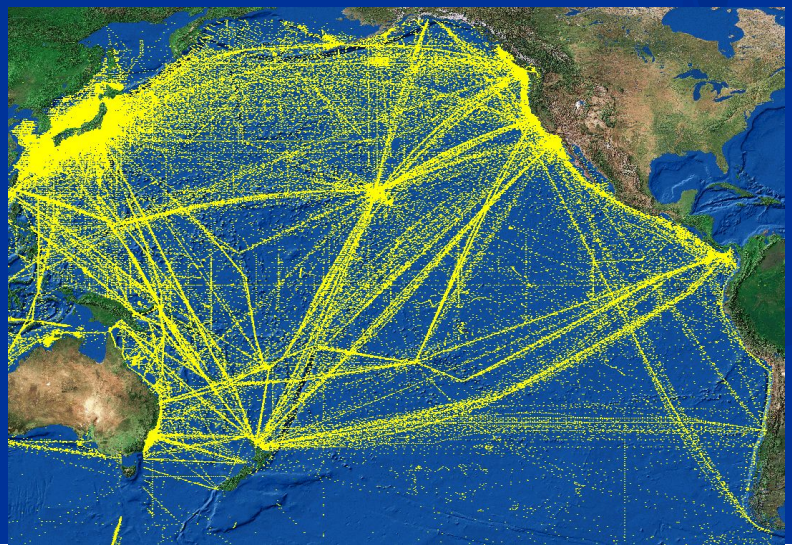
(Claridge 2006. The Systematics and Diversification of *Rhyncogonus* (Curculionidae: Coleoptera), PhD thesis, UC Berkeley)



(Raiatea, 2006)

Pressions anthropiques

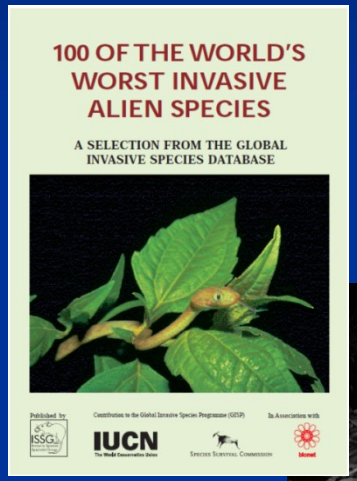


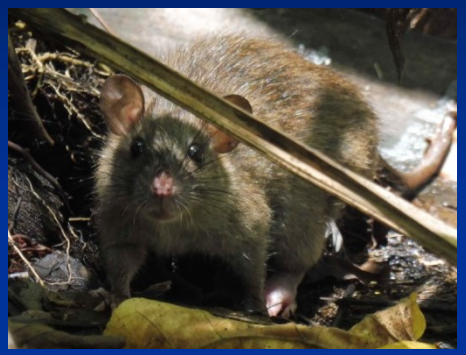


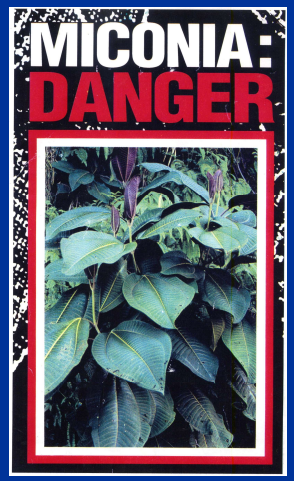
- Destruction et fragmentation des habitats naturels (« land use changes »)
  - déforestation pour l'agriculture, l'urbanisation et grandes infrastructures
  - feux
  - plantations forestières
- Sur-exploitation
- Pollutions

Invasions

- Impacts écologiques
- Impacts économiques
- Impacts sanitaires
- Impacts socio-culturels







Impacts des ongulés

- Goats, sheep, cattle, pigs…

Rapa Iti

Mt Manureva (Rurutu)

Sophora sp. nov.

Mohotani (Marquesas)

Eiao (Marquesas)

Impacts des rats

Meryta (Araliaceae)

Apocynaceae

Sapotaceae

Serianthes (Fabaceae)

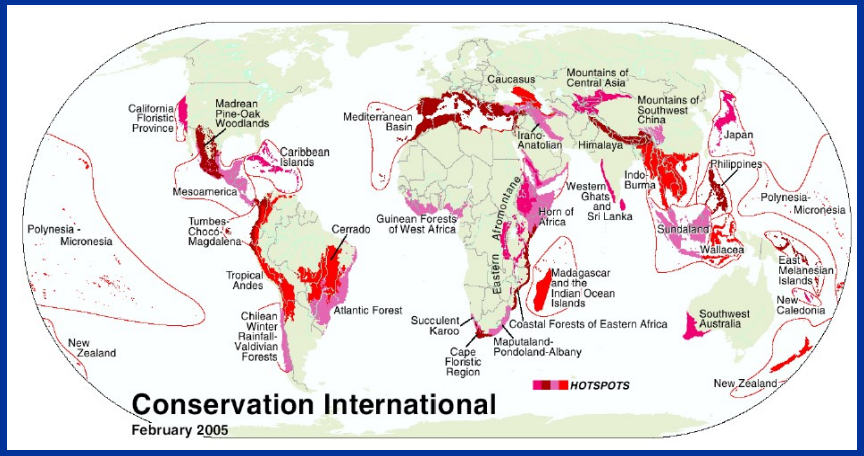
Santalum (Santalaceae)

Pelagodoxa (Arecaceae)

(Meyer & Butaud, 2009)

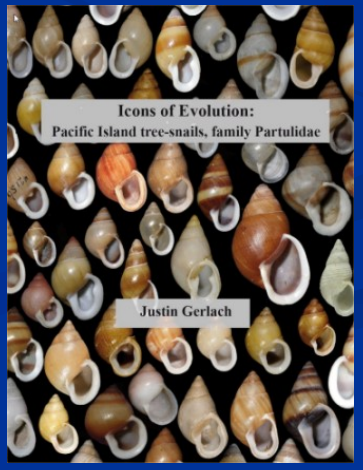
Vulnérabilité

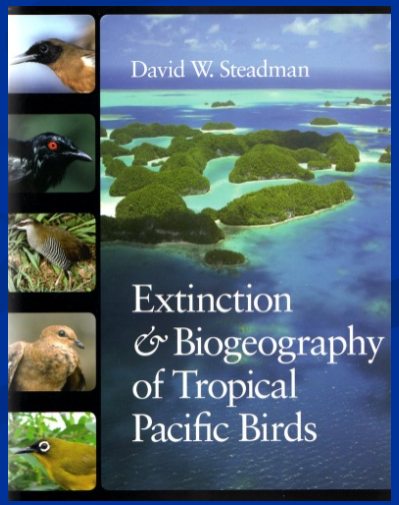
- Oiseaux : 11 CR, 17 EN, 13 VU
- Plantes : 118 CR, 134 EN, 50 VU
- Mollusques : EX, EW, CR



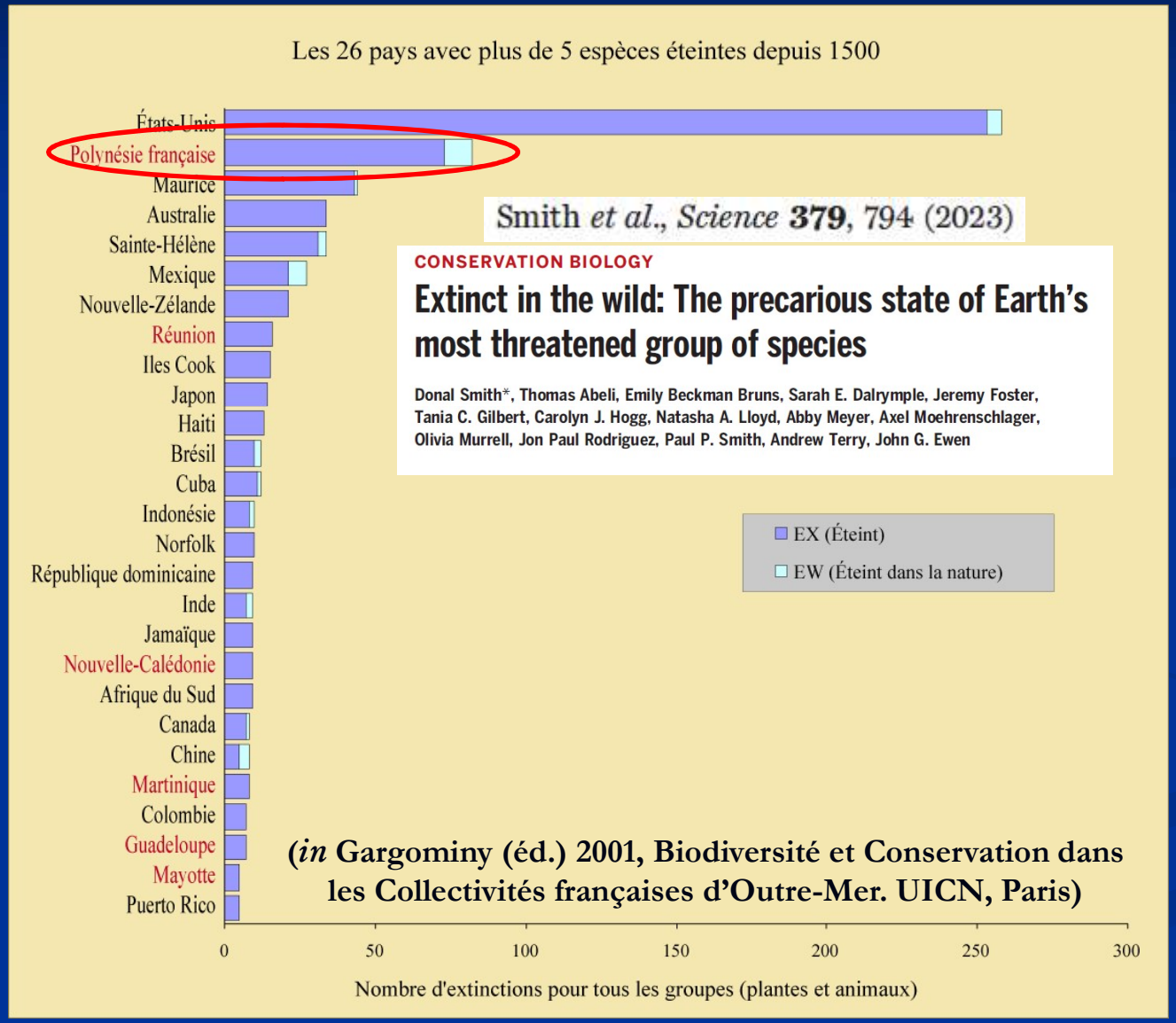
Erythrina tahitensis (CR)

2021



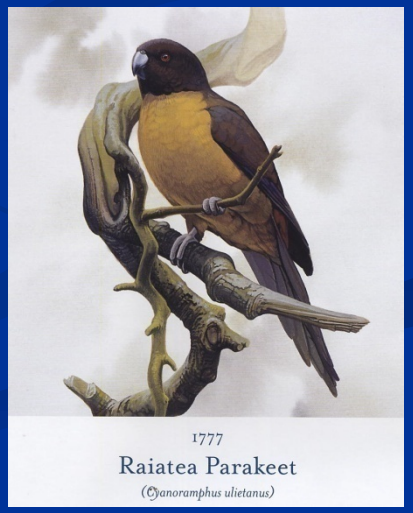


Extinctions



(*in* Gargominy (éd.) 2001, Biodiversité et Conservation dans les Collectivités françaises d'Outre-Mer. UICN, Paris)

Sesbania coccinea subsp. atollensis var. parkinsonii (Sydney Parkinson, 1773)



Cyanoramphus ulietanus

The impacts of the Carnivorous snail *Euglandina rosea*

Achatina fulica 1967

Euglandina rosea 1975

Partula taeniata (Moorea)

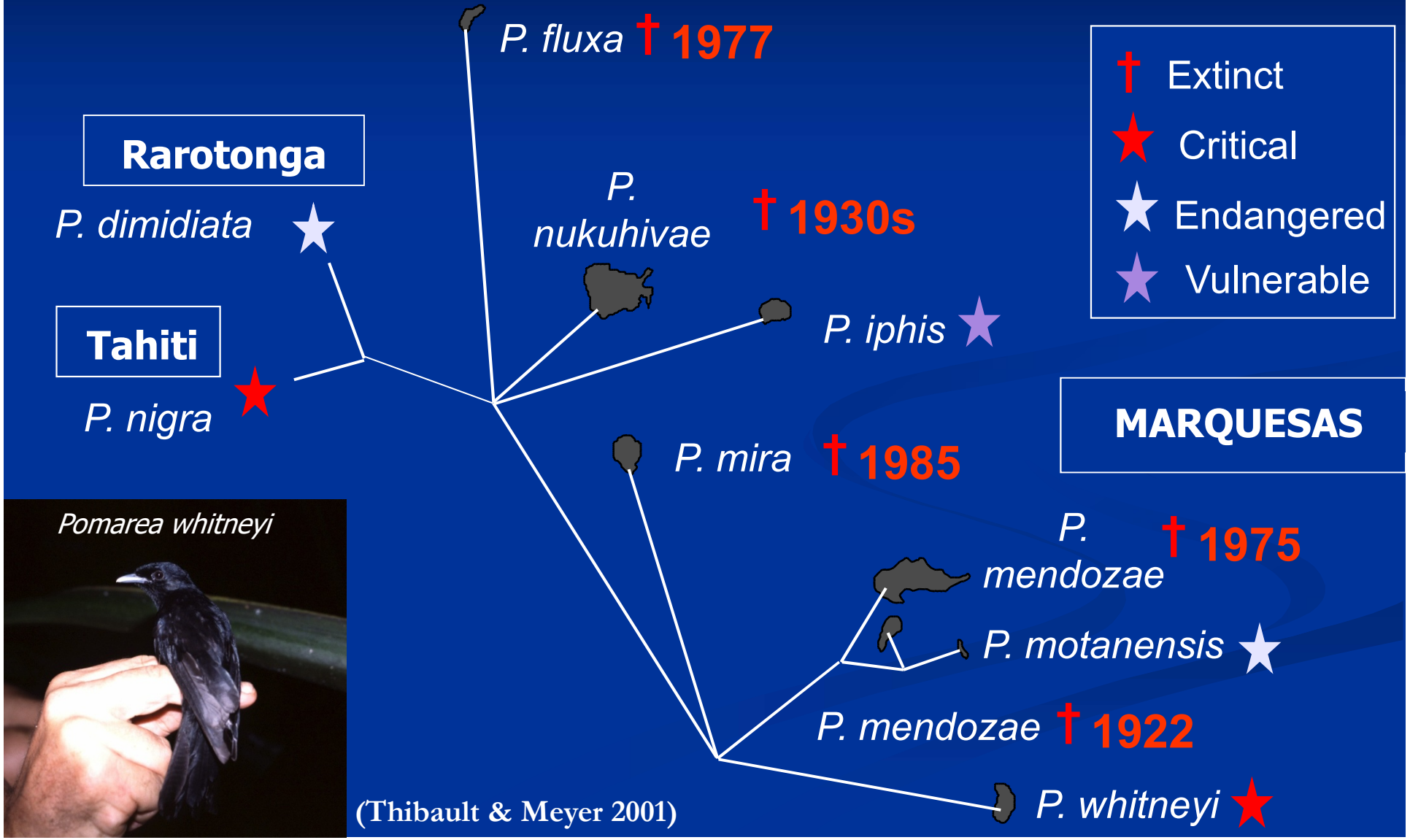
Microcystis saintjohni (Tubuai)

Partula otaheitana (Tahiti)

Samoana ganymedes (Tahuata)

- **Extinction of 56 of the 61 endemic *Partula* species in the Society Islands !**

Contemporary extinction or decline of monarchs (flycatchers) *Pomarea* spp. in Eastern Polynesia



Flore vasculaire

	Total	Indigènes	Endémiques	Taux d'endémisme
Flore primaire	881	335	546	62%

Metrosideros collina

Weinmannia parviflora

Endémiques Pol. orientale	Endémique Pol. française	Endémiques archipélaires	Endémiques insulaires
32	39	189	286

(Base de données botaniques « Nadeaud », Florence *et al.* 2007; www.herbier-tahiti.pf)

	Cultivées	Naturalisées	Invasives
Flore secondaire/introduite	> 2000	> 590	> 70

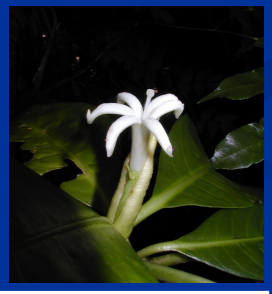
(Fourdrigniez & Meyer, 2008)

Comparaison avec d'autres îles du Pacifique

Archipels	Surface (km^2)	Plantes à fleurs	Endémiques (%)	Densité des endémiques
Hawai'i	16,880	966	859 (89%)	0.051
Nouvelle-Calédonie	19,060	3,063	2,448 (80%)	0.128
Fidji	18,270	1,302	799 (61%)	0.050
Galápagos	7,900	434	139 (32%)	0.017
Polynésie française	**3,520**	**659**	**478 (72%)**	**0.136**

Psychotria speciosa
(Tahiti)

Psychotria paulae
(Tahiti)



Cyrtandra feaniana
(Marquises)

(Meyer, 2007)

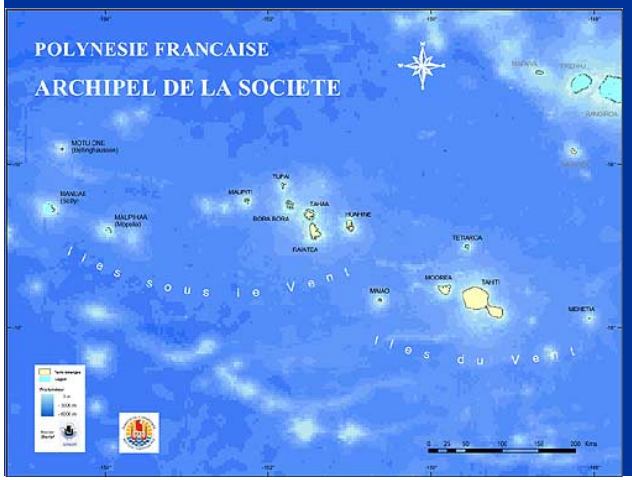
Cyrtandra induta
(Tahiti)

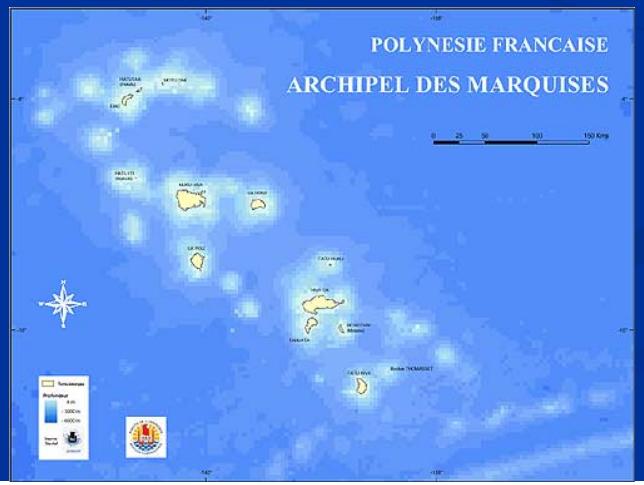
Archipels	*Cyrtandra* (Gesneriaceae)	*Psychotria* (Rubiaceae)
Hawai'i	53	11
Fidji	37	76
Polynésie française	**25+**	**27+**

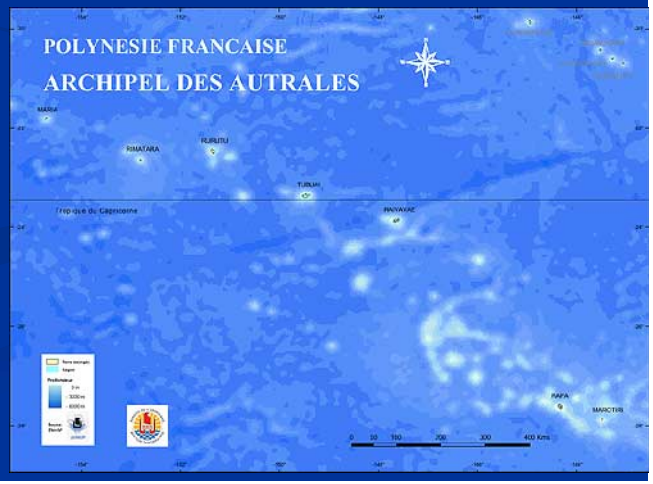
Comparaison entre archipels

Archipel	Flore vasculaire	Indigènes	Endémiques PO et PF	Endémiques archipélaires	Endémiques insulaires	% endémisme
Society	581	285	71	91	134	**51**
Marquesas	315	142	21	80	72	**55**
Tuamotu	102	80	16	2	4	**22**
Gambier	85	69	7	1	6	**19**
Austral	228	171	34	11	12	**25**
Rapa Iti	**193**	**109**	**22**	**2**	**58**	**43**

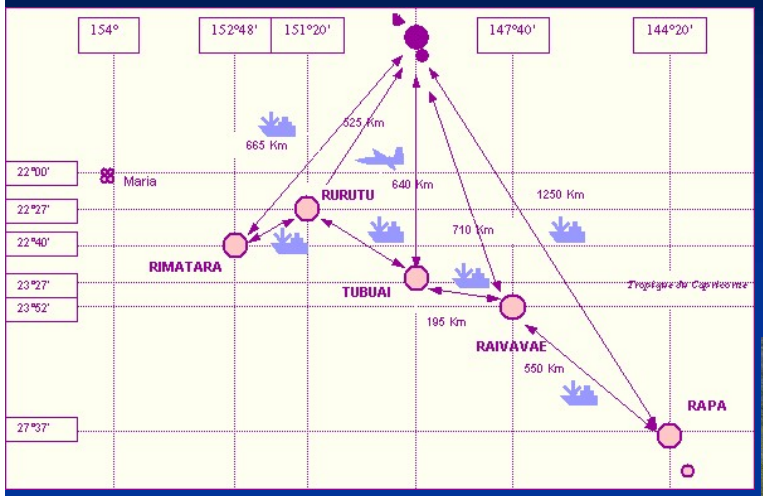
(Florence *et al.* , 2007)





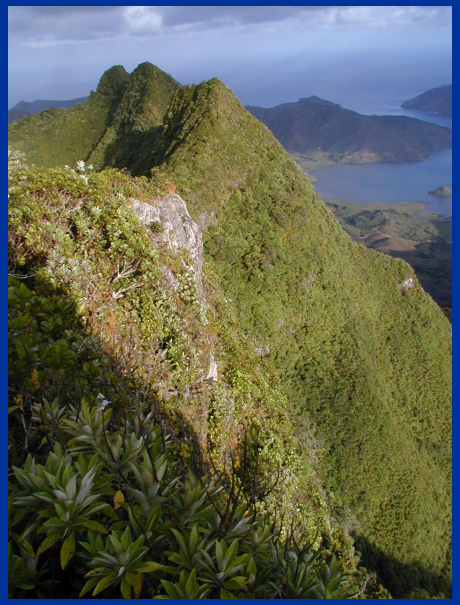


Le « point chaud » de Rapa Iti (Australes)



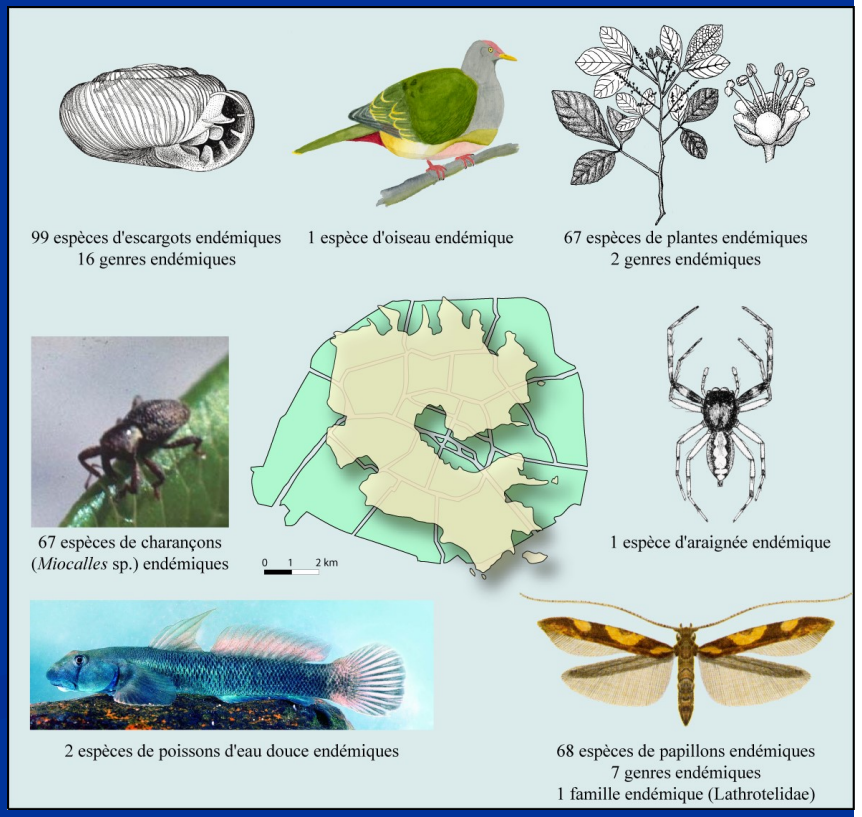
Corokia collenettei

Plantago rupicola



Mt Perau (650 m)

Pacifigeron rapensis



(*in* Gargominy, coord., 2001)

Principaux types de végétation

- Coastal low vegetation
- Wetlands (marshes, lakes)
- Littoral & Supra-littoral forests
- Lowland semi-dry forests (< 1 500 mm/yr)
- Mid-elevation mesic forests (1500-3000 mm/yr)
- Lowland and valley rainforests (> 3000 mm/an)
- Montane cloud forests (> 3 000 mm/yr and > 600-800 m asl)
- Sub-alpine vegetation (> 1800 m)

Wetland (Maiao)

Niau (Tuamotu)

Mt Temetiu (Hiva Oa)

Te Pari (Tahiti Iti)

Dry-Mesic forest (Rapa)

Mt Orohena (Tahiti Nui)

Montane cloud forests

ARCHIPELAGO Island	Island area (km²)	Summit (m)	MCF area (ha)	Elevation range (m)
SOCIETY				
Tahiti	1 045	2 241	> 5 000	300-1 800
Raiatea	171	1 017	< 200	400-1 000
Moorea	142	1 207	< 100	800-1 200
MARQUESAS				
Hiva Oa	315	1 276	< 1,000	800-1 200
Nuku Hiva	340	1 224	< 1,000	900-1 200
Ua Pou	105	1 203	< 200	800-1 200
Fatu Hiva	85	1 125	< 200	650-1 000
Ua Huka	83	884	< 50	750-880
Tahuata	61	1 050	< 100	800-1 000
AUSTRAL				
Rapa	40	650	< 20	550-650
FRENCH POL.	**2 387**	**2 241**	**< 8 000**	**300-1 800**

(Meyer, 2010)

Scaevola tahitensis

Trimenia marquesensis

Mt Aorai vers 1,700 m (Tahiti Nui)

Mt Mounanui (Fatu Hiva)

« Island Syndrome »

- Taxonomic disharmony
- Loss of dispersal capacities
- Woodiness
- Dioecy

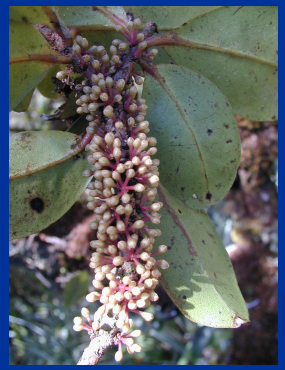
Famille	Monde	Polynésie
Total	240 000 (0,0)	912 (0,0)
Rubiacées	10 000 (4,2)	82 (9,0)
Euphorbiacées	8 000 (3,3)	47 (5,2)
Composées	20 000 (8,4)	38 (4,2)
Gesneriacées	2 400 (1,0)	30 (3,3)
Orchidacées	17 000 (7,1)	30 (3,3)
Myrsinacées	1 250 (0,5)	24 (2,9)
Urticacées	1 200 (0,4)	24 (2,9)

(Florence 1997)

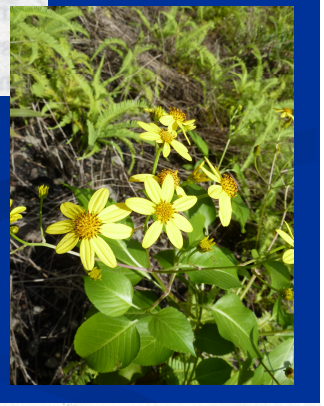
Fitchia nutans
(Asteraceae)

Oparanthus
(Asteraceae)

Coprosma meyeri
(Rubiaceae)



Myrsine
(Myrsinaceae)



Bidens henryana
(Asteraceae)

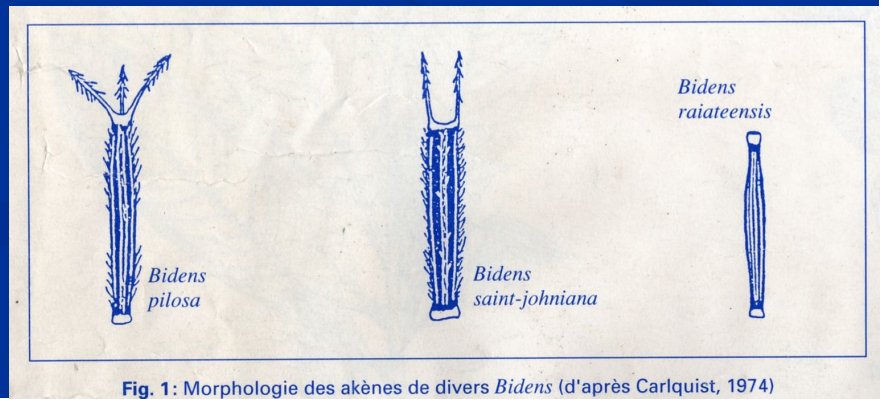


Fig. 1: Morphologie des akènes de divers *Bidens* (d'après Carlquist, 1974)

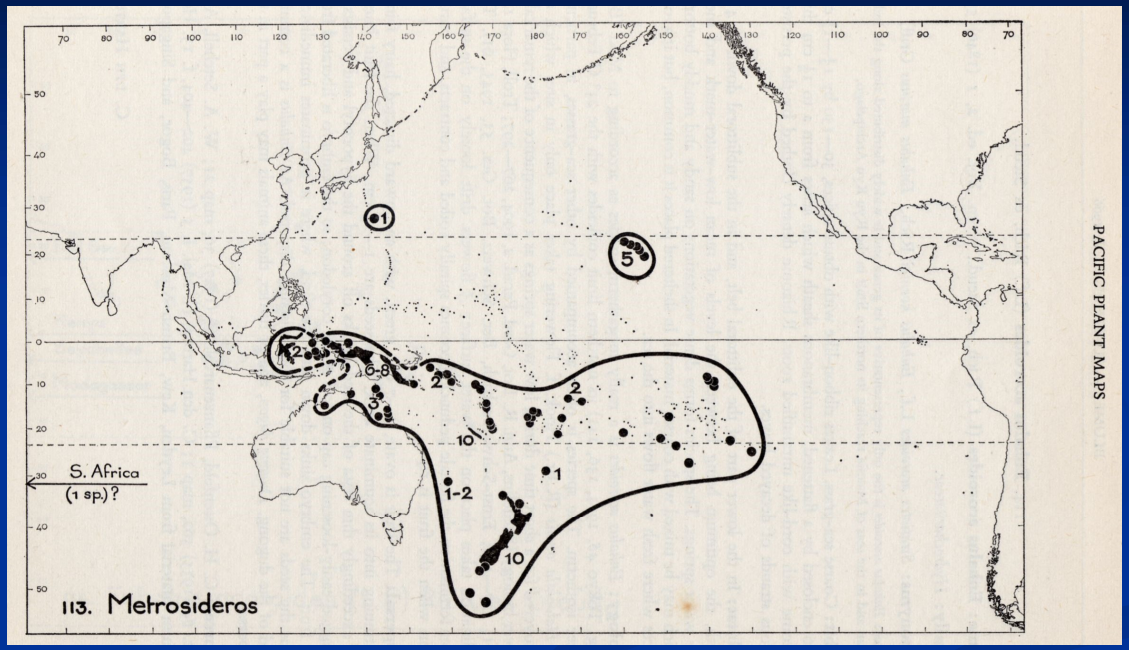
Gradients of floristic richness

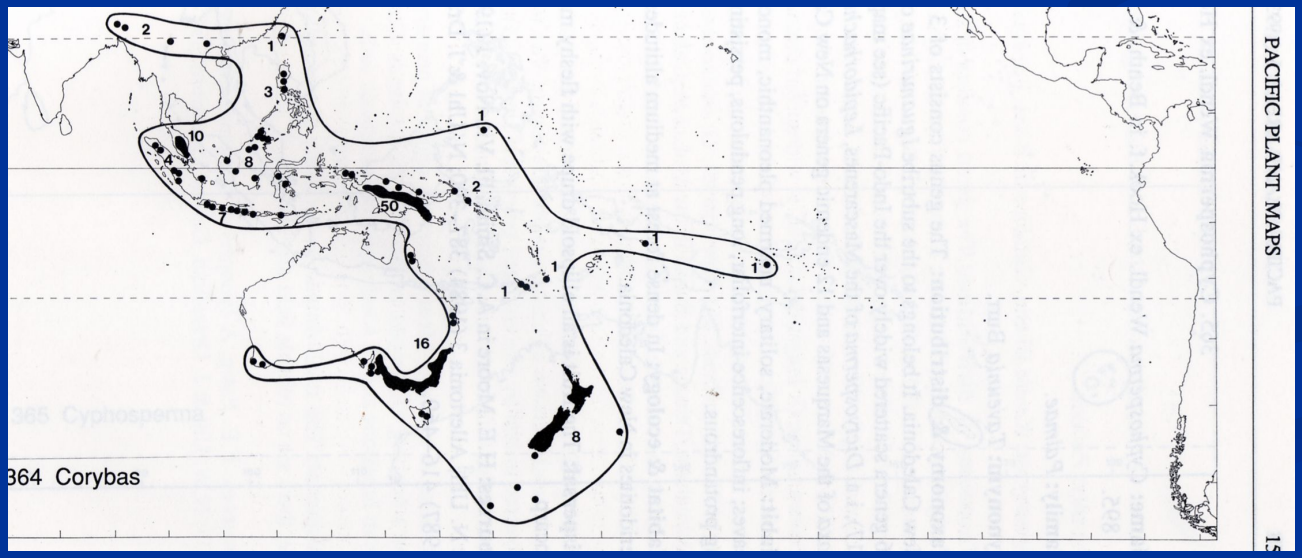
Ducula, *Ptilinopus* (Columbidae) and other frugivorous birds

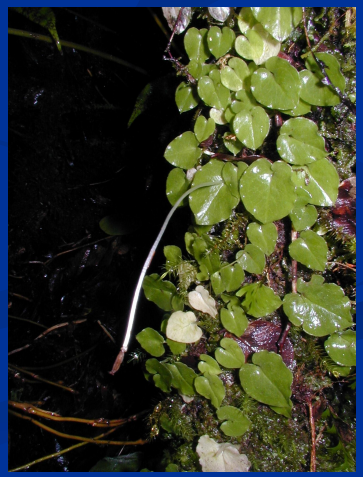
(Van Steenis & Van Balgooy, 1966. Pacific Plant Areas)

Centers of diversification

Metrosideros collina var. collina (Myrtaceae)

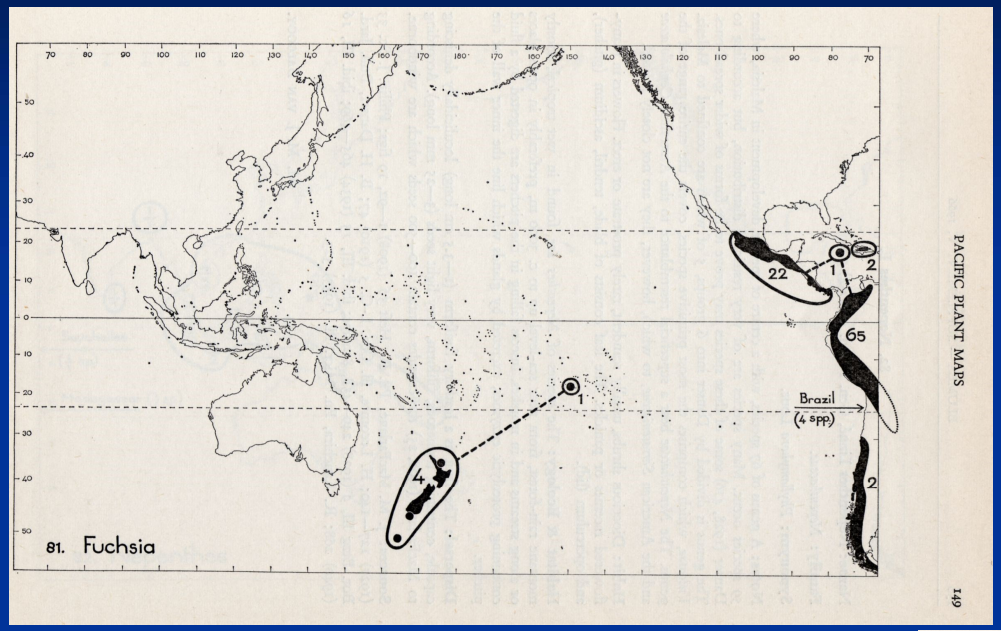


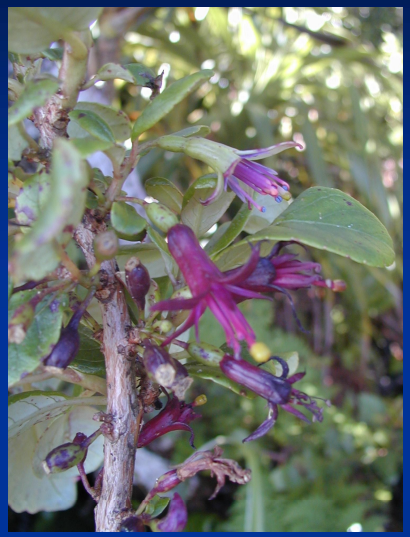




Corybas minutus (Orchidaceae)

Taxa with peculiar distributions

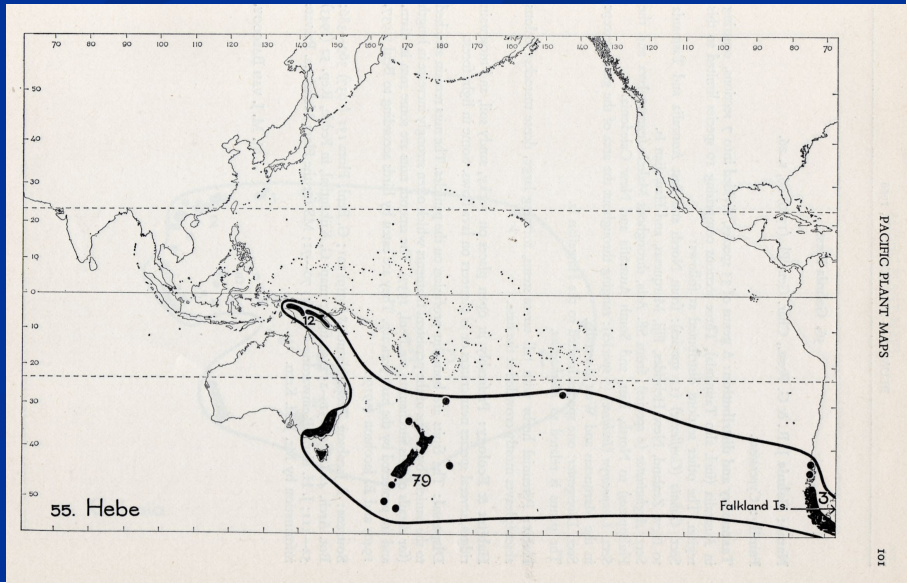




Fuchsia cyrtandroides (Tahiti)

Hebe rapensis (Rapa)

Hebe stricta (New Zealand)

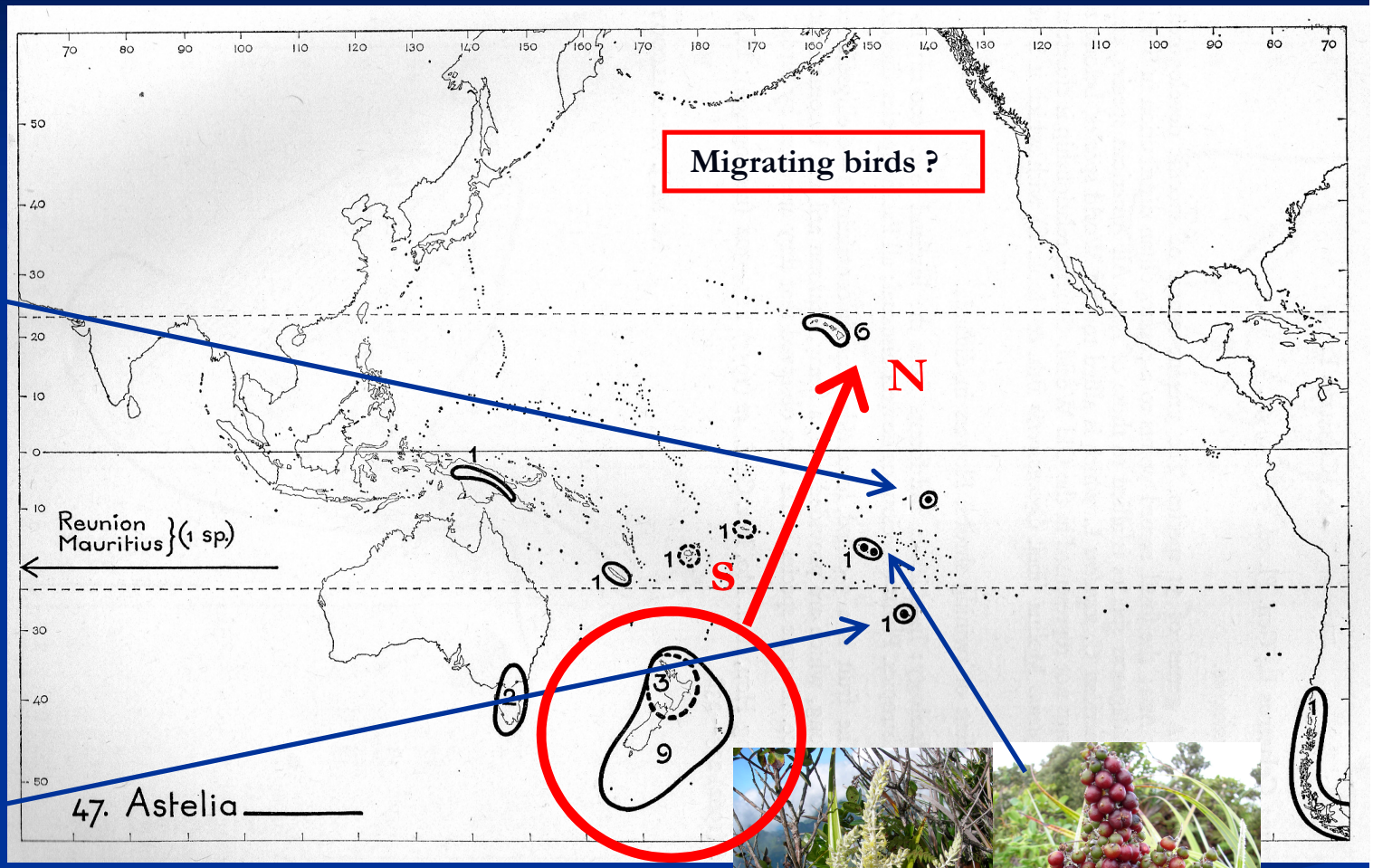


Taxa with disjunct areas

Astelia tovii (Marquesas)

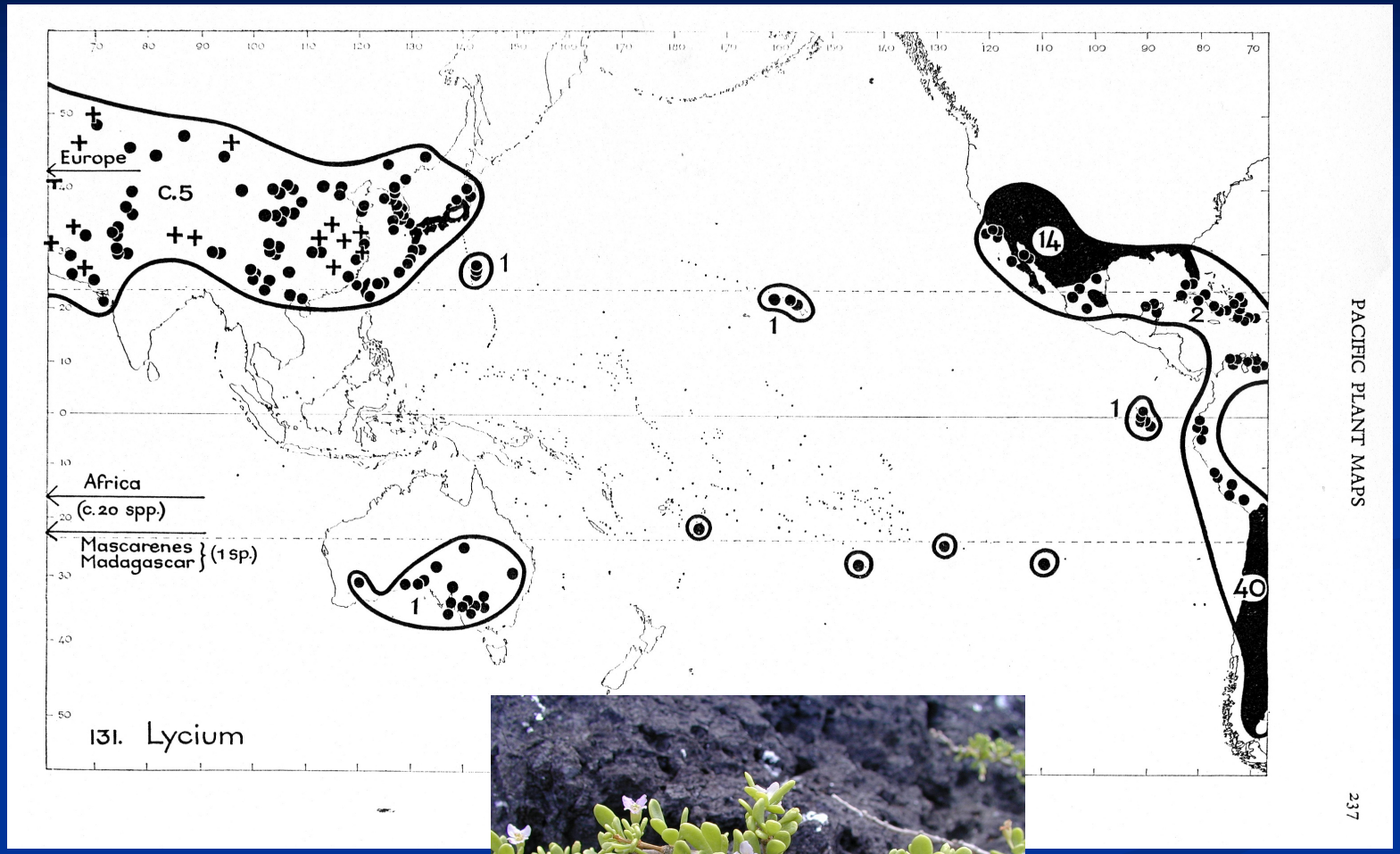
"Ananas marron"

Astelia rapensis (Rapa, Australs)



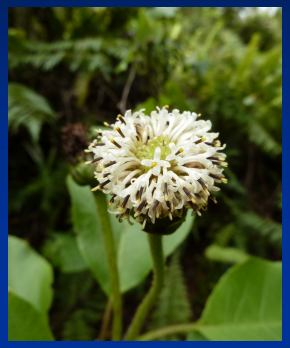
Astelia nadeaudii (Society)

Taxa with disjunct areas



Lycium sandwicense
(Cook, Rapa, Tonga, Hawaii, Rapa Nui)

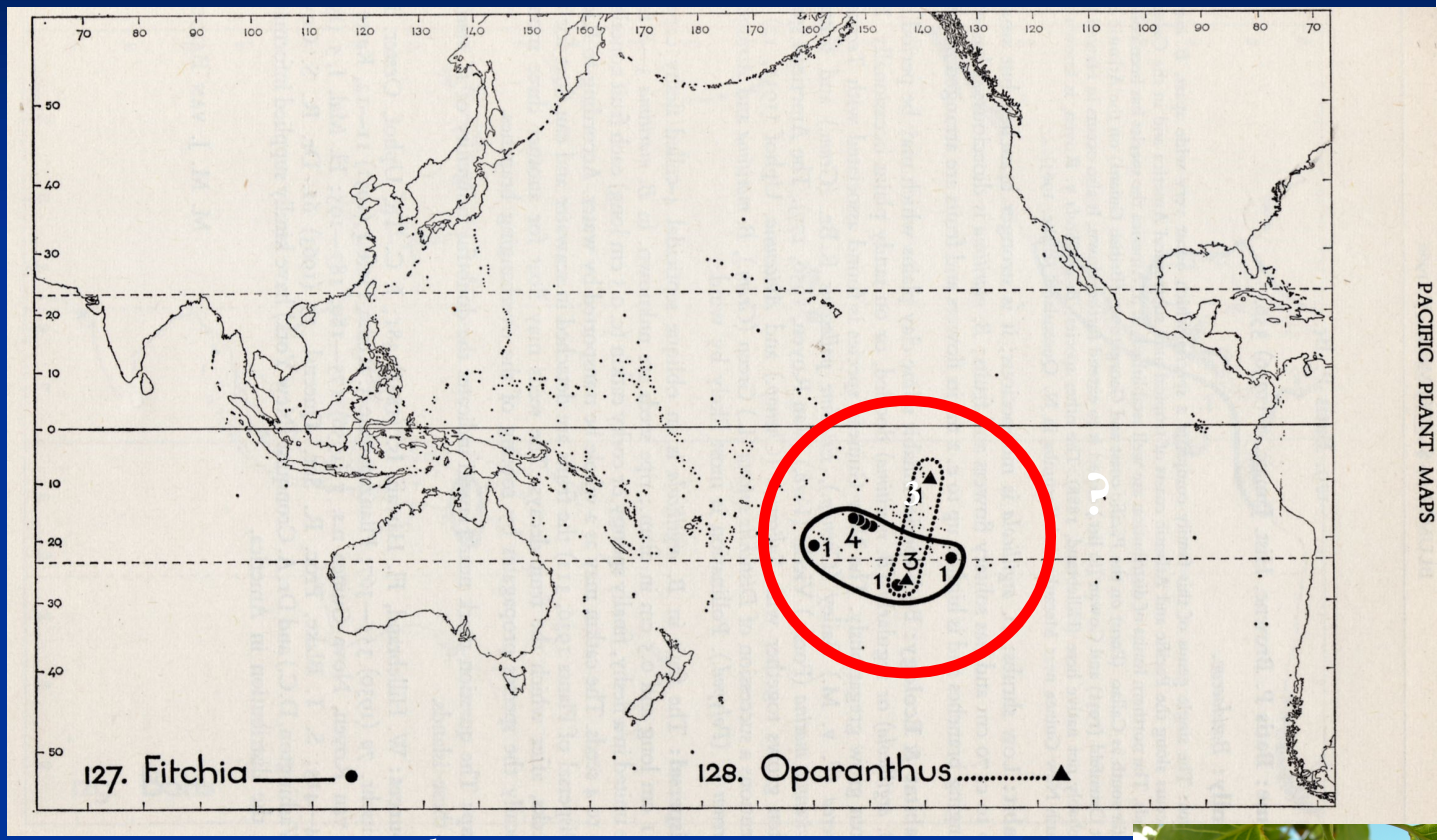
Southeastern & French Polynesian endemic genera



Oparanthus teikiteetinii (Nuku Hiva)

Oparanthus hivaoana (Hiva Oa)

Oparanthus coriaceus (Rapa)



Fitchia rapense (Rapa)

Fitchia nutans (Tahiti)

Biogeography and origins of woody Lobeliads

Asia

North America

Bonin

HAWAI'I

?

Apetahia spp.

Africa

Australia

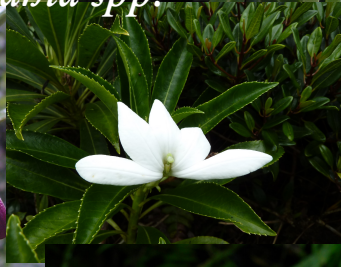
"Out of Africa scenario"

Marquesas

Society

Cook

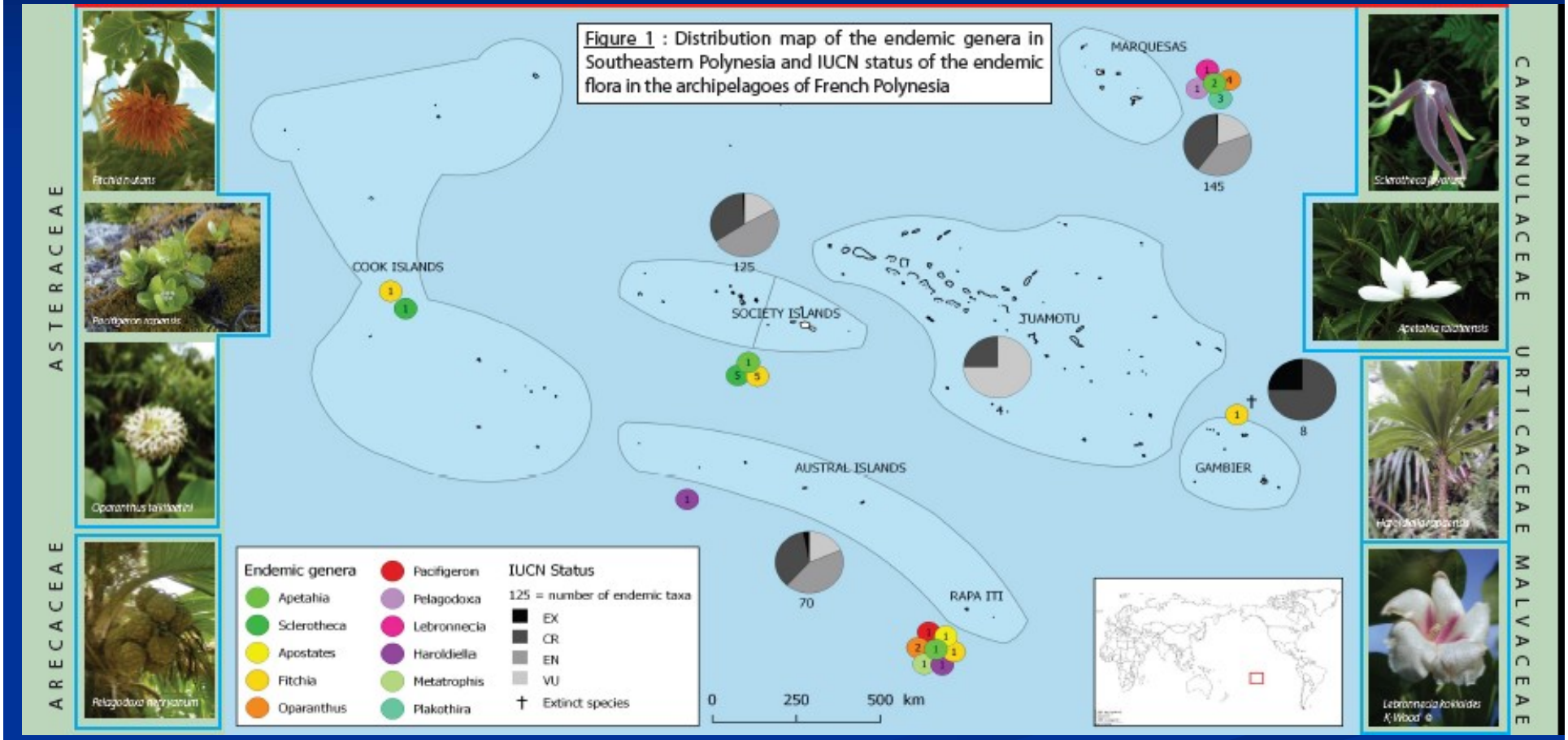
Rapa



Sclerotheca spp.

(after Knox *et al.* 1993; Givnish *et al.* 1995, 2009)

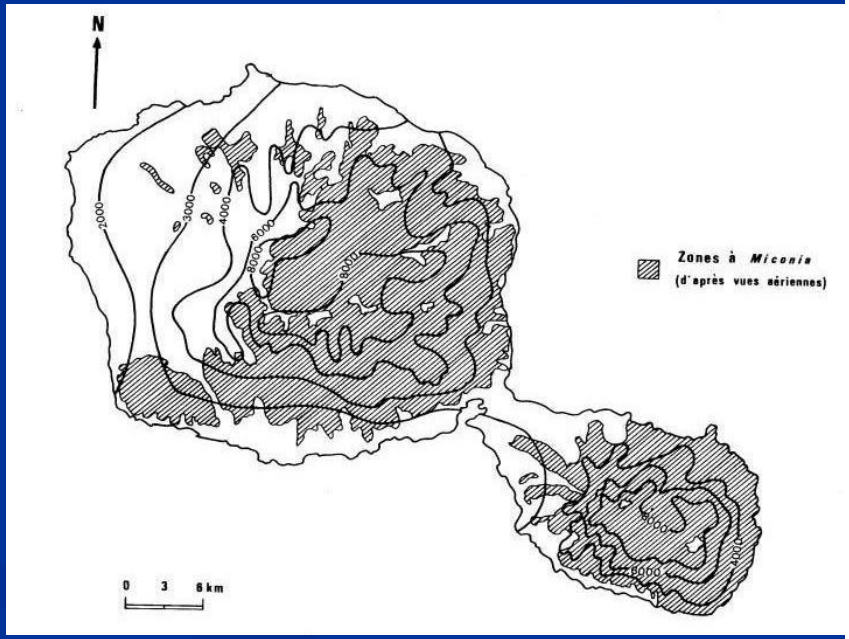
A unique but highly threatened flora



(Meyer, 2016. Island Biology Conference, Azores)

Miconia calvescens, « the green cancer »

- Introduced in 1937 as an ornamental plant
- Naturalization in the 1970s
- > 80 000 ha invaded areas in Tahiti (2/3 of the island) !
- 6 islands : Tahiti, Moorea, Raiatea, Tahaa (Society), Nuku Hiva, Fatu Hiva (Marquesas)



Papeari, Botanical Garden
Tahiti (1963)

(Meyer 1996)

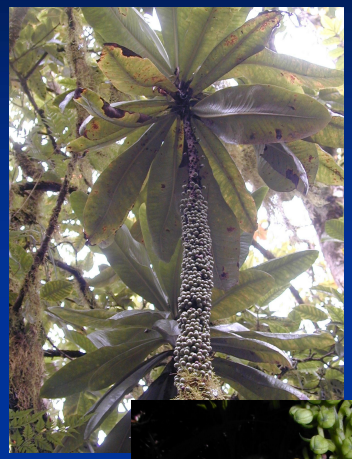
Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Impacts de *Miconia calvescens* on the native flora

Dense monotypic miconia stands in Tahiti

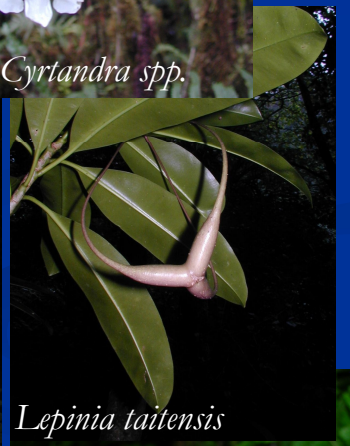
(Meyer & Florence, 1996 !)

Myrsine longifolia



Cyrtandra spp.

Calanthe tahitensis



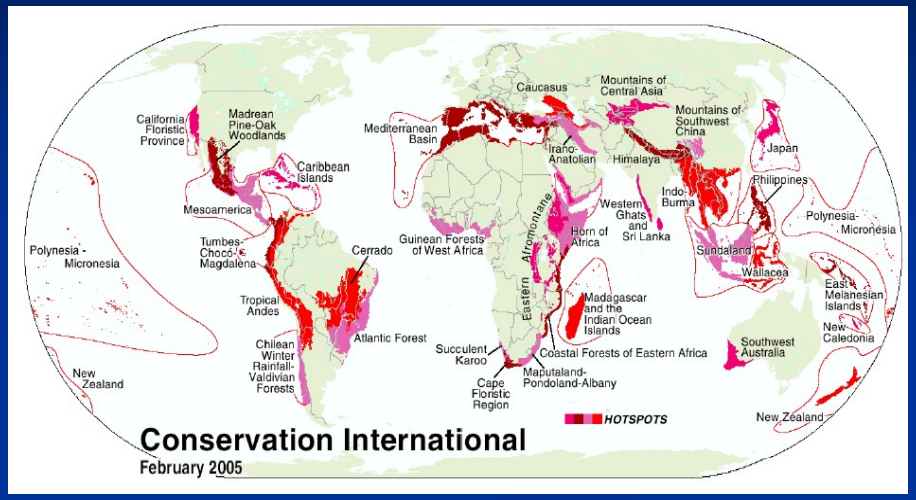
Lepinia taitensis

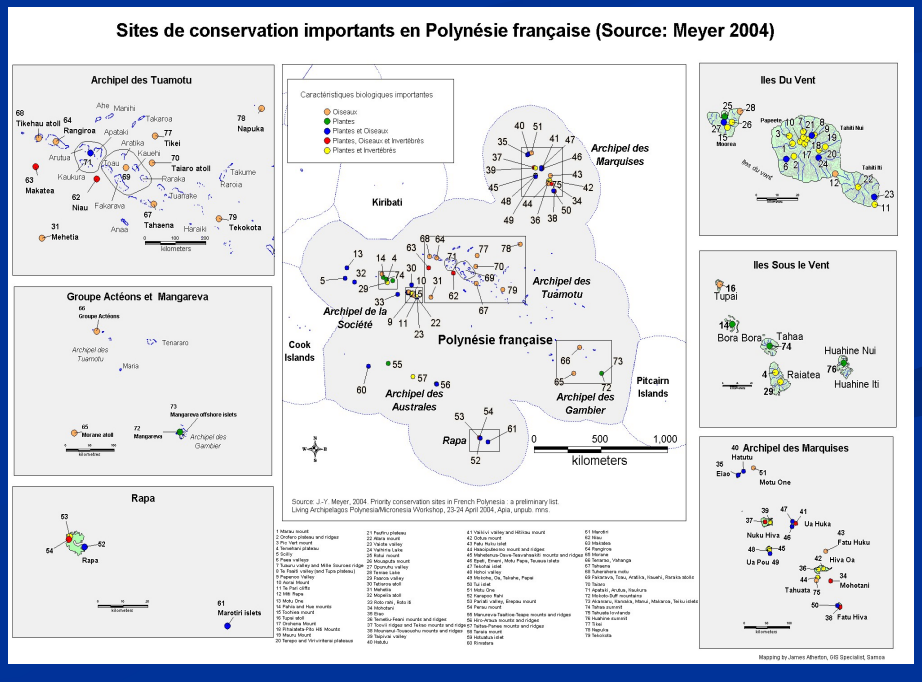
Psychotria franchetiana

Sclerotheca jayorum

Challenges for conservation

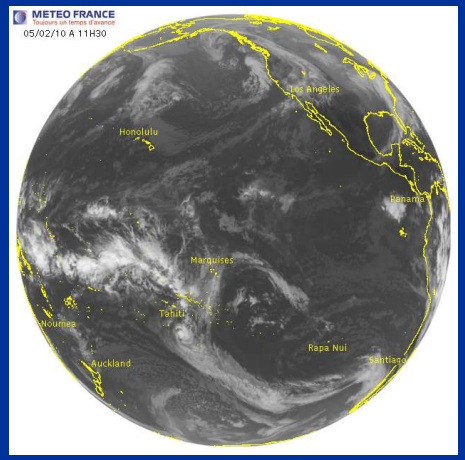
- « Polynesia-Micronesia » biodiversity hotspot
- 4/218 « Endemic Birds Areas » (BirdLife) : Marquesas, Tuamotu, Rimatara (Austral)
- 1 « Center for Plant Diversity » (IUCN/WWF) : Marquesas
- 2 Eco-Régions (WWF) : Society, Marquesas
- 10/588 « Alliance for Zero Extinction » sites
- >115 conservation areas of high importance !





Potential impacts of climate change

- **Sea level rise** ⇒ regression of coastal vegetation and forests ? loss of lowland wetlands ?
- **Decrease of rainfall on leeward sides** ⇒ increase of drough periods ⇒ loss of semi-dry forests ?
- **Increase of the frequency and intensity of cyclones (?)** ⇒ more treefall gaps ⇒ invasion of alien pioneer species ?



High elevation habitats at risk ?

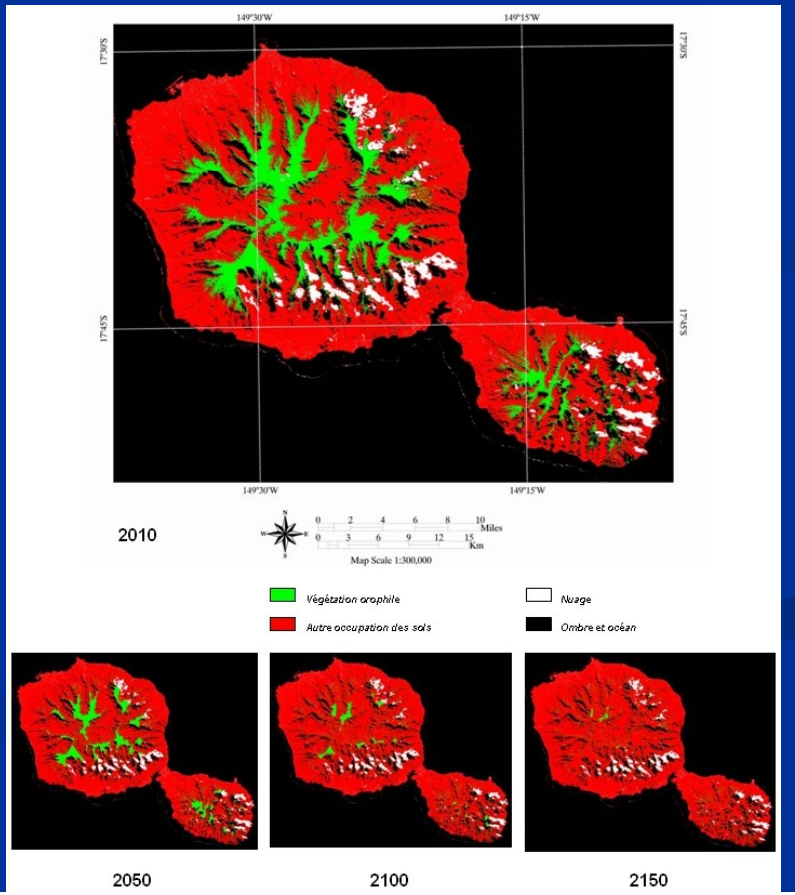
- +1,4°C max. in 2050 (+ 3,1°C max. in 2100)
- Vegetation shift +220 m in 2050 (+490 m in 2100)
- Reduction of the orophilous habitats from 14,000 ha to 1,500 ha in 2100
- Possible extinction of native and endemic plants with restricted high elevation distribution

Mt Orohena (2,241 m)

Grammitis sp. nov.

Oreobolus furcatus

Fuchsia cyrtandroides



(Pouteau *et al.* 2010)

Déplacement en altitude des espèces animales invasives

Euglandina rosea

JOURNAL OF CONCHOLOGY (2008), VOL.39, NO.5 517

BEYOND THE ALIEN INVASION: A RECENTLY DISCOVERED RADIATION OF NESOPUPINAE (GASTROPODA: PULMONATA: VERTIGINIDAE) FROM THE SUMMITS OF TAHITI (SOCIETY ISLANDS, FRENCH POLYNESIA)

OLIVIER GARGOMINY[1]

[1] Muséum national d'Histoire naturelle, 55, rue Buffon, 75231 Paris cedex 05

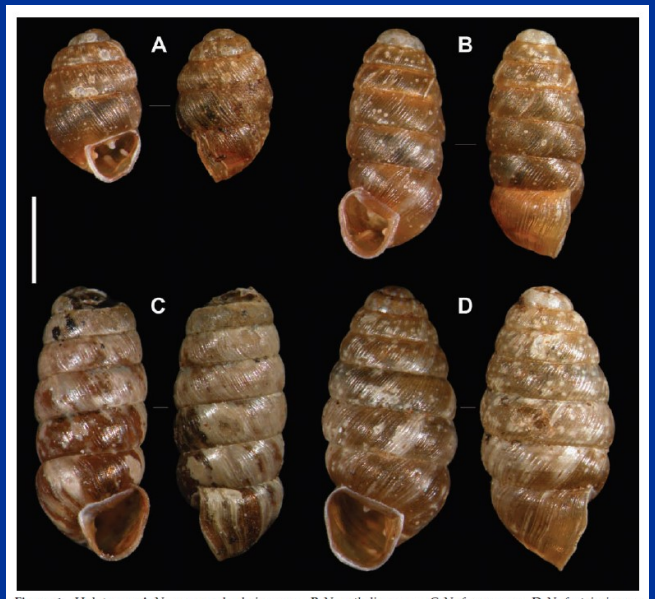


Figure 1 Holotypes. **A** *Nesoropupa duodecim* n. sp., **B** *N. nathaliae* n. sp., **C** *N. fenua* n. sp., **D** *N. fontainei* n. sp. Scale bar = 1mm.

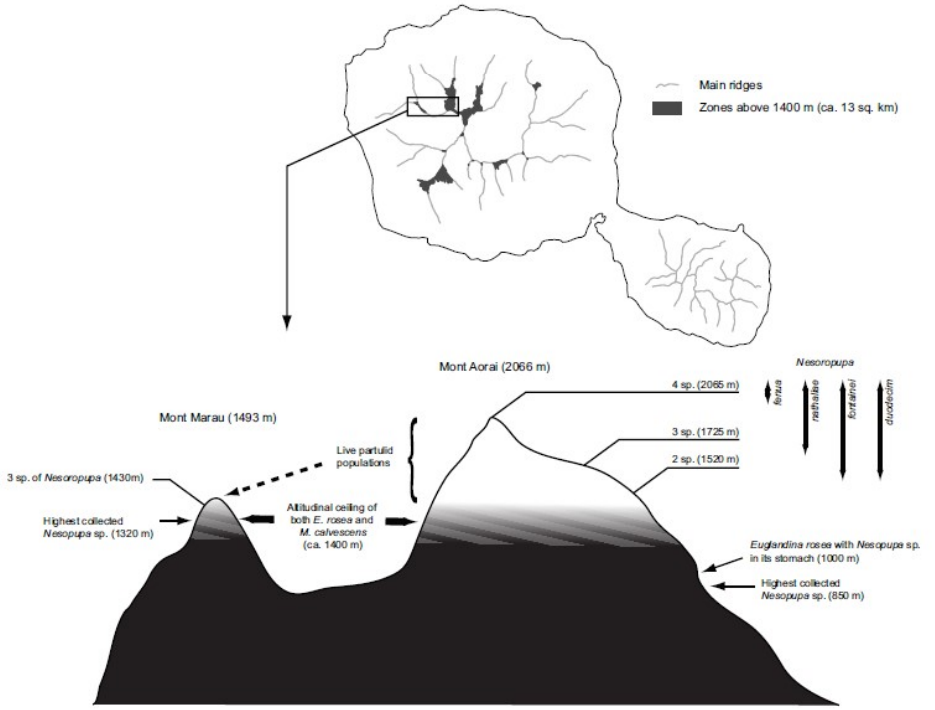
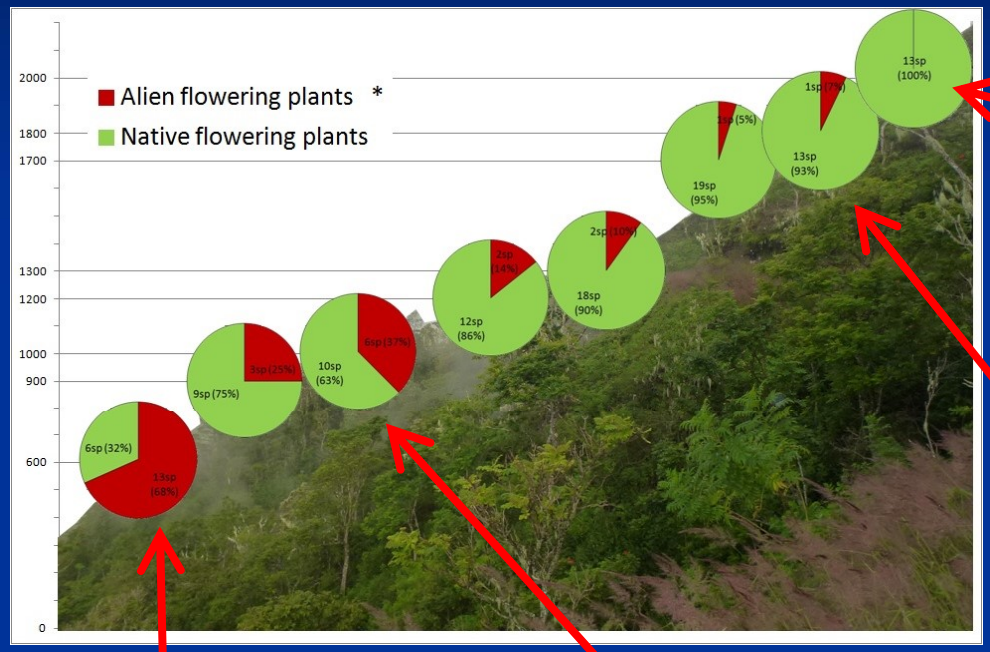


Figure 10 Potential area of occupancy of *Nesoropupa* (zones above 1400 m elevation) on Tahiti and altitudinal chart of native snails and their threats on Mt Aorai and Mt Marau on Tahiti.

Déplacement en altitude des plantes envahissantes



Mt Aorai, 2000 m

Fare Ata, 1700 m

Belvédère, 600 m

Col Hamuta, 900 m

Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Le cas des zones humides en Polynésie française

Contribution à la Biodiversité de Polynésie française N°19

Sites Naturels d'Intérêt Ecologique et Patrimonial VIII

LES ZONES HUMIDES DE POLYNESIE FRANÇAISE : UN ECOSYSTEME MECONNU, MESESTIME ET MENACE

par

Jean-Yves MEYER (Dr.)*

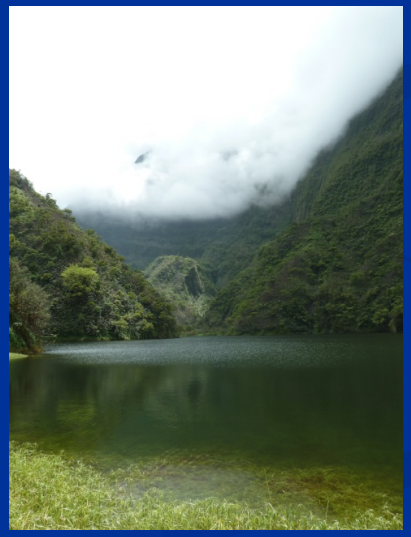
**Délégation à la Recherche, B.P. 20981, 98713 Papeete, Tahiti, Polynésie française ; E-mail : jean-yves.meyer@recherche.gov.pf*

2016

Tubuai (Australes)

Anaorii, Tahiti (Société)

Niau (Tuamotu)



Lac Vaihiria, Tahiti (Société)

Motu Horoatera, Tetiaroa (Société)

Plateau Toovii, Nuku Hiva (Marquises)

Submangroves/forêts marécageuses

- "*Ilots de submangrove*" (R. H. Papy, 1951-54 ; P. Rivals, 1952)
- "*Almost-mangrove swamps*" (Mueller-Dombois & Fosberg, 1998)

Butorides striata patruelis (« 'ao »)

Vaipoiri (Tahiti iti)

Fougère dorée *Acrostichum aureum* (« 'āoa » ou « pihaoto »)

Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Prairie/pelouse salée à *Paspalum vaginatum*

Niau (Tuamotu)

Paea, Tahiti Nui (Société)

Hatuatua (Nuku Hiva)

Rurutu (Australes)

Huahine (Société)

Pluvier fauve *Pluvialis fulva*

L'habitat naturel le plus menacé en PF ?

Lac et lagune de Temae, Site classé RAMSAR en 2008 (« Lagon de Moorea ») !

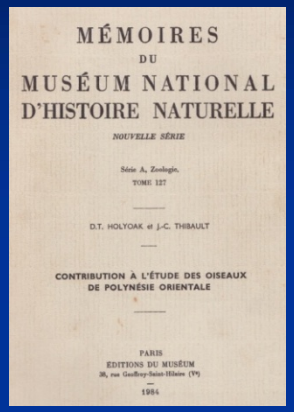
Faratea, Tahiti Iti (Société)

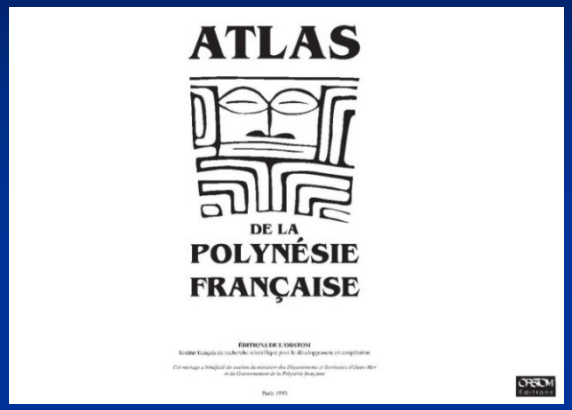
Vaihakaomeama, Nuku Hiva (Marquises)

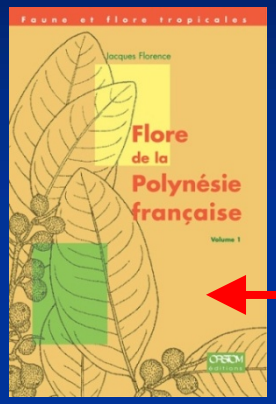
2010

Rhizophora stylosa

La contribution de la Recherche



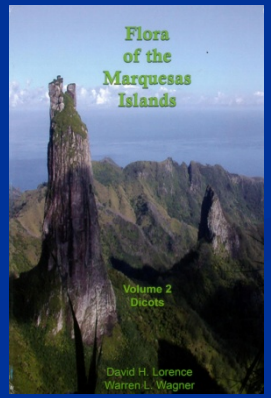




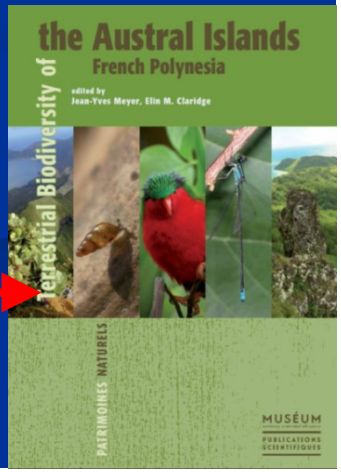
Jacques Florence (IRD/MNHN), Moorea, 2006

- « Flore de la Polynésie française » (1982-2016)
- « Vascular Flora of the Marquesas » (1988-2005)
- « Multidisciplinary scientific expenditions in the Austral Islands » (2002-2005)

Ua Pou, 2003

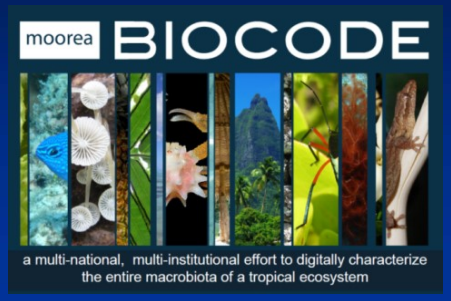


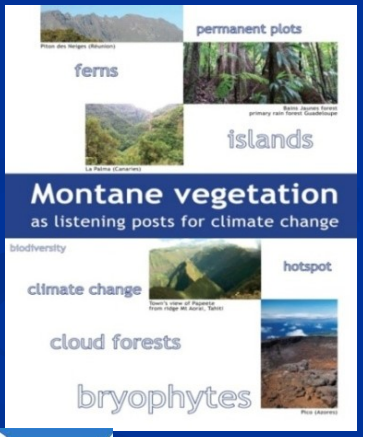
Rapa, 2002

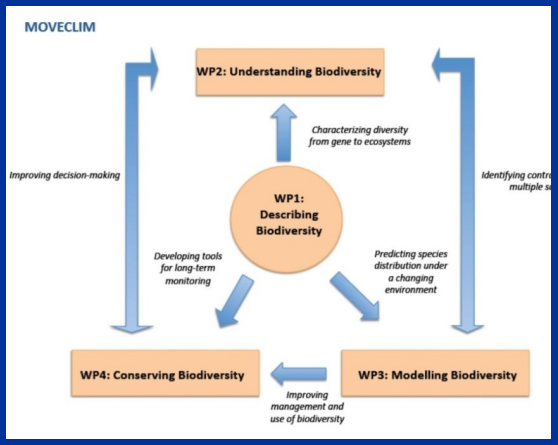


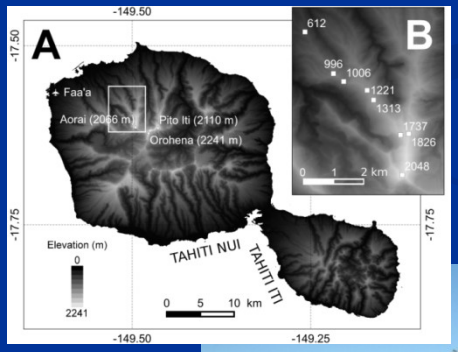
Understanding dynamics & processes

- « MOOREA BIOCODE » (2007-2011)
- « Montane Vegetation as Listening Posts for Climate Change (MOVECLIM) » (2012-2015)









Habitat restoration and conservation

- Miconia biological control program in Tahiti, Raiatea, Nuku Hiva (2000-)
- Invasive plant control on Temehani Rahi plateau in Raiatea (2012-)
- Fencing dry-mesic forest and strawberry guava control in Rapa (2013-)
- Fencing, weeding and rat control on Maraetia plateau in Tahiti (2013-)

STRATÉGIE NATIONALE POUR LA BIODIVERSITÉ
ADHÉRER ET S'ENGAGER

CRITICAL ECOSYSTEM PARTNERSHIP FUND

BEST
VOLUNTARY SCHEME FOR BIODIVERSITY AND ECOSYSTEM SERVICES IN TERRITORIES OF EUROPEAN OVERSEAS

Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Tetiaroa atoll restoration program (TARP): 2018-

"It is my hope that the island will serve as an ecological model…" **(Marlon BRANDO)**

Anous solidus

Anoplolepis gracilipes

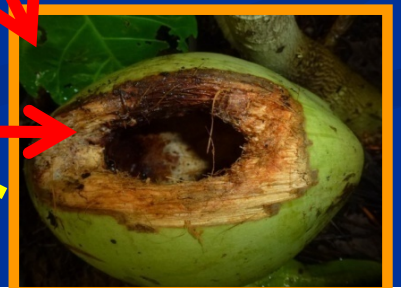
Aedes polynesiensis

Rattus exulans

Pisonia grandis

Pandanus tectorius

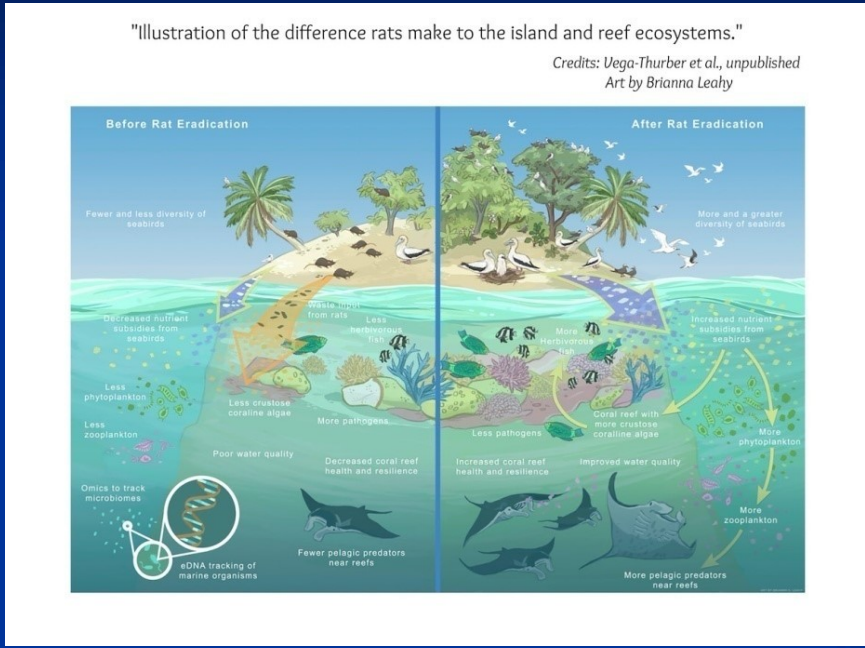
Birgus latro



Cocos nucifera

TETIAROA society
• SUSTAINABILITY IN ACTION •

Dynamique et trajectoires des écosystèmes



(VEGA-THURBER *et al.*, non publié)

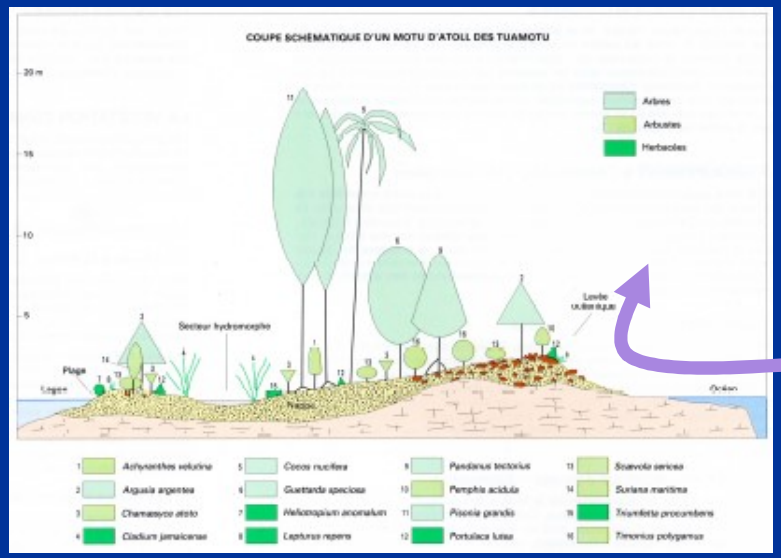
Pisonia grandis forest

Rat-free Motu ‘A’ie, Tetiaroa

Pandanus tectorius forest in rat-free atoll of Morane (Tuamotu-Gambier)

Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

Solutions fondées sur la Nature…et la Science



Paléo-écologie et paléo-climatologie

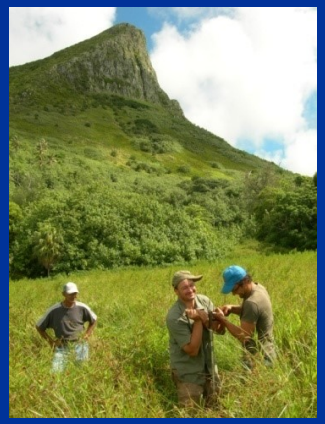
Journal of Biogeography (J. Biogeogr.) (2016)

ORIGINAL ARTICLE

Abrupt late Pleistocene ecological and climate change on Tahiti (French Polynesia)

Matthew Prebble[1]*, Rose Whitau[1], Jean-Yves Meyer[2], Llewellyn Sibley-Punnett[1], Stewart Fallon[3] and Nick Porch[4]

2016



Tubuai (Australs) - 2010

Toovii, Nuku Hiva (Marquesas) - 2022

(R. Taputuarai©)

Fitchia sp. nov. (Asteraceae)

Polynesian colonization and landscape changes on Mo'orea, French Polynesia: The Lake Temae pollen record

The Holocene
1–13
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SAGE

Janelle Stevenson,[1] Alexis Benson,[1] J. Stephen Athens,[2] Jennifer Kahn[3] and Patrick V Kirch[4]

2017

L'importance des associations et NGOs locales

- « Ia Ora Te Natura » (1973)
- Protection de la vallée de la Punaruu (1986)
- « Te Rau Atiati a Tau a Hiti Noa Tu » (1987)
- Société d'Ornithologie « Manu » (1990)
- Protection du patrimoine naturel et culturel de Raiatea « Tuihana » (2005)
- Fédération des Associations de Protection de l'Environnement « Te Ora Naho » (2006)
- Tetiaroa Society (2013)

TE RAU ATI ATI A TAU A HITI NOA TU

Manu

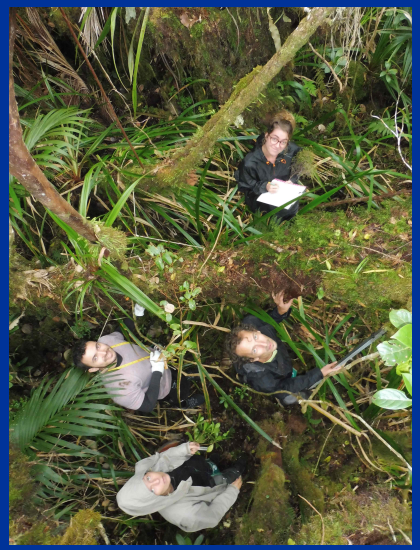
TUIHANA

TE ORA NAHO
FÉDÉRATION DES ASSOCIATIONS DE PROTECTION DE L'ENVIRONNEMENT

Défis futurs

- Vers de nouvelles stratégies et méthodes de conservation dans des écosystèmes « hybrides » / « nouveaux » face aux changements locaux et globaux…

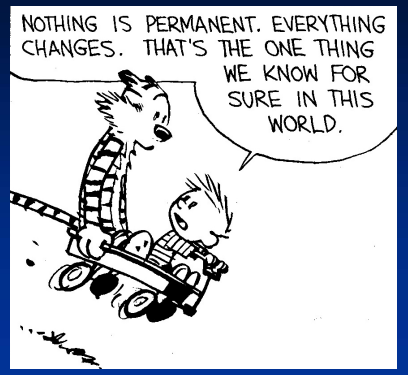
- Vers de nouveaux partenariats (« EDENE » 2023-2025)



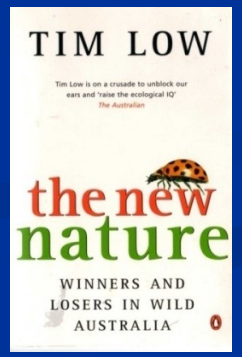
La Réunion, St Philippe, vers 1500 m (02 mars 2023)

2018

Mo'orea (oct. 2016)



Calvin & Hobbes (Watterson©)



Conservatoire et Jardin Botanique de Mascarin, île de La Réunion, 03 mars 2023

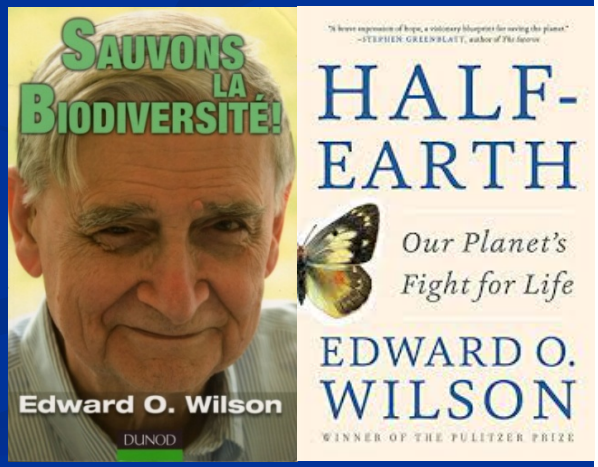
Merci pour votre attention, Maurururu roa !

Lloyd L. LOOPE (USGS, Haleakala National Park, Maui) décédé en 2017
& Betsy H. GAGNE (Hawaii Dept Land and Natural Resources) décédée en 2020

W. Arthur WHISTLER décédé en 2020 de la Covid-19

Dieter MUELLER-DOMBOIS (University of Hawaii) décédé en 2022

Vicki FUNK (Smithsonian Institution) décédée en 2019



décédé en 2022