"Colloque pluridisciplinaire Espèces introduites", Fort-de-France, Martinique, 22 nov. 2017

L'invasion par des plantes introduites dans les îles du Pacifique : de la connaissance et la compréhension à une gestion intégrée et durable

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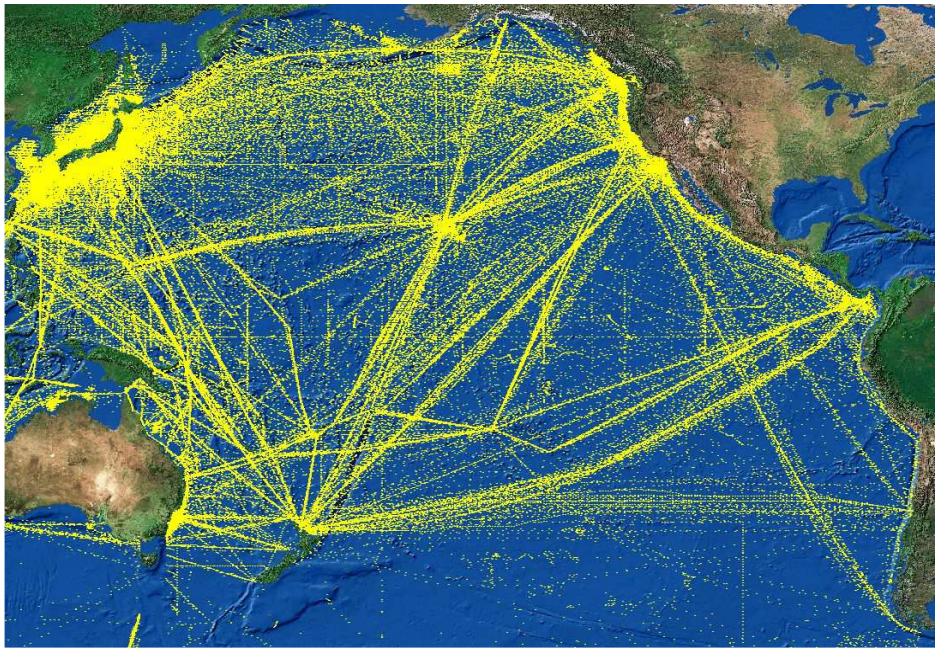
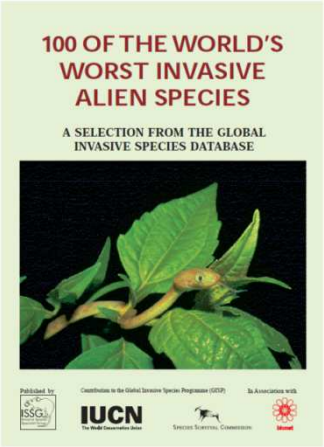
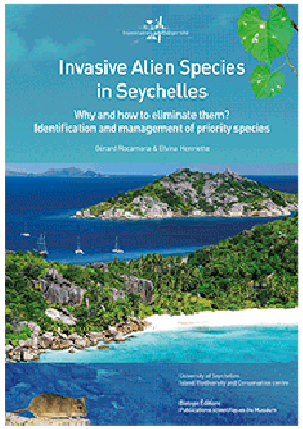
Introduction : contexte et enjeux

- Pression démographique
- Globalisation
- Changements globaux
- Invasions biologiques
- Crise d'extinction



Espèces envahissantes dans les îles





Environmental Conservation: page 1 of 12. © Foundation for Environmental Conservation 2017.

Invasive alien species on islands: impacts, distribution, interactions and management

JAMES C. RUSSELL*[1,2,3], JEAN-YVES MEYER[4], NICK D. HOLMES[5] AND SHYAMA PAGAD[6]

Table 1 Fifteen of the invasive alien species most globally prevalent on islands (source: Global Register of Introduced and Invasive Species). SIDS = small-island developing state.

Species	*Name*	*Type*	*SIDSs*	*Origin*
Leucaena leucocephala	White leadtree	Tree	33	Central America
Casuarina equisetifolia	Ironwood	Tree	32	Southeast Asia to Australia
Paratrechina longicornis	Longhorn crazy ant	Ant	32	Tropical Africa
Rattus rattus	Black rat	Rodent	31	India to Southeast Asia
Adenanthera pavonina	Red bead tree	Tree	28	India to South China
Psidium guajava	Common guava	Tree	28	Central America
Gliricidia sepium	Quick stick	Tree	27	Central America
Kalanchoe pinnata	Air plant	Herb	27	Madagascar
Tapinoma melanocephalum	Ghost ant	Ant	27	Tropical Africa and Asia
Culex quinquefasciatus	Southern house mosquito	Mosquito	26	Tropical Americas
Cyanthillium cinereum	Little ironweed	Herb	26	Tropical Africa and Asia
Jatropha curcas	Barbados nut	Shrub	26	Central America
Mus musculus	House mouse	Rodent	26	Central Asia
Oreochromis mossambicus	Tilapia	Fish	26	Southern Africa
Portulaca oleracea	Purslane	Herb	26	Africa and Asia

Homogénéisation biotique

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]GISD, [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, [m]Florence *et al.* 2007, [n]Fourdrigniez and Meyer 2008, [o]McCormack 2007, [p]Space and Flynn 2002, [q]Meyer 2004, [r]Dubois *et al.* 2013, [s]Meyer 2008, [t]Morat *et al.*, [u]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.

Espèces invasives « dormantes »

Twelfth Australian Weeds Conference

SLEEPER WEEDS

Richard Groves
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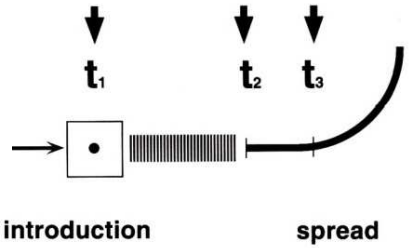

Fig. 1. The process of biological invasions including two kinds of lag phases: *(a)* the period between the first introduction to an area and the first spread (t2-t1), *(b)* the period preceding the switch to a significantly higher rate of population growth (t3-t2).

Diversity and Distributions, (Diversity Distrib.) (2004) 10, 333–347

BIODIVERSITY RESEARCH

Beautés fatales: Acanthaceae species as invasive alien plants on tropical Indo-Pacific Islands

Jean-Yves Meyer* and Christophe Lavergne†

Invasive Species Specialist Group of the IUCN Species Survival Commission

ALIENS

Double issue Numbers 24/25 2007

ISSG Invasive Species Specialist Group

The snake-like climber *Anodendron paniculatum* (Apocynaceae), a "new" invasive liana in the rainforests of Tahiti (Pacific Ocean)

Anodendron paniculatum A. DC. (syn. *A. manubriatum* Merr., *Echites paniculata* Roxb. Apocynaceae) is a large climbing and twining liana, native to India, Bangladesh, Burma, Sri Lanka, Southeast Asia (Thailand, Cambodia, Vietnam, Laos, Philippines) and Malesia (Indonesia, Malaysia). The species is characterized by terminal or axillary panicles up to 15cm long, each bearing small white or yellowish tubular flowers; and by large fruits (paired follicles or "pods" up to 16cm long, 3cm wide, black when ripe) containing small flattened seeds (1-2cm long, 0.6-0.8mm wide), each attached to a long white silky coma (or "tuft") 5-9cm long. In its native range, this huge twiner is often more than 20m tall and is found in evergreen or secondary forests up to 1700m elevation.

A.paniculatum seed Photo: Jean-Yves Meyer

Known as a medicinal plant in India and used for making fishing nets in Sri Lanka, *Anodendron paniculatum* was introduced to the botanical garden of Tahiti located on the south-east coast, at sea level in 1934 by its founder, Harrison W. Smith, from the Peradenya Botanical Garden in Sri Lanka. The "liane parachute" as it is locally called in Tahiti, was first seen naturalized outside the garden around 1968 (M. Guérin, former director of the garden, now called Harrison Smith Botanical Garden, pers. comm.). During our 2005-2006 plant surveys, we found *A. paniculatum* locally naturalized in the secondary and primary rainforests of Tahiti from 50-600m elevation in the center of the island (Lake Vaihiria and Mataiea Valley to the south, Papenoo Valley to the north, more than 12km from the garden), on roadsides, riverbanks, steep slopes and small plateaus, smothering the canopy of non-native and native trees. The liana was in flower in February 2006 and in ripe fruit in September 2006. Its

The occurrence of this "new" plant invader illustrates the role of botanical gardens as a significant source of invasive plants. Historically, H.W. Smith also introduced to Tahiti some of what have since become some of Tahiti's worst invasive species, such as *Cecropia peltata* in 1926, *Schinus terebinthifolius* in 1927, *Rhodomyrtus tomentosa* in 1928, *Spathodea campanulata* in 1932, *Miconia calvescens* in 1937, and *Ardisia elliptica* in 1939. According to herbarium specimens, the species was cultivated in Hilo in the Big Island of Hawaii (USA) back in 1958 (C. Imada, Bishop Museum, Honolulu, pers. comm), and has been grown in the past in botanical gardens in the Mascarene Islands (Leeuwenberg & Rudjiman, 2005).

Sanchezia speciosa (Atiu, îles Cook)

Time Bombs in Gardens: Invasive Ornamental Palms in Tropical Islands, with Emphasis on French Polynesia (Pacific Ocean) and the Mascarenes (Indian Ocean)

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« Transformateurs » écologiques

OIKOS 57: 7–13. Copenhagen 1990

Biological invasions and ecosystem processes: towards an integration of population biology and ecosystem studies

Peter M. Vitousek

Diversity and Distributions (2000) 6, 93–107

BIODIVERSITY RESEARCH

Naturalization and invasion of alien plants: concepts and definitions

DAVID M. RICHARDSON[1], PETR PYŠEK[2], MARCEL REJMÁNEK[3], MICHAEL G. BARBOUR[4], F. DANE PANETTA[5] and CAROL J. WEST[6]


Melinis minutiflora (Rapa Nui)


Miconia calvescens (Tahiti)


Psidium cattleianum (Tubuai)


Falcataria mollucana (Moorea)


Pinus caribaea (Nouvelle-Calédonie)


Spathodea campanulata (Fidji)

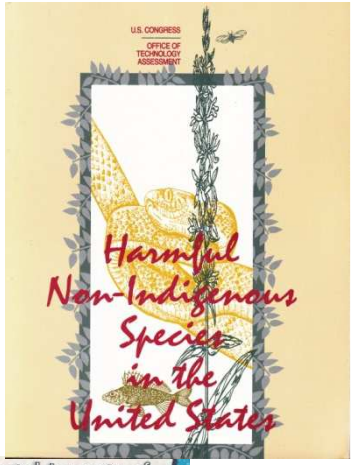
Coûts économiques

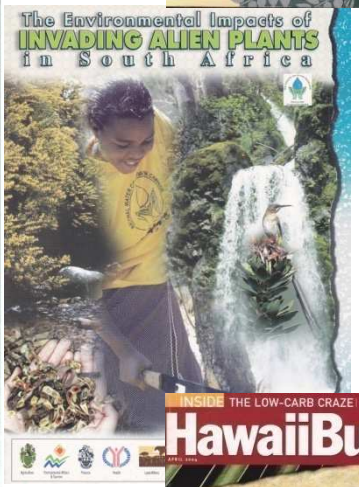
BOX 5

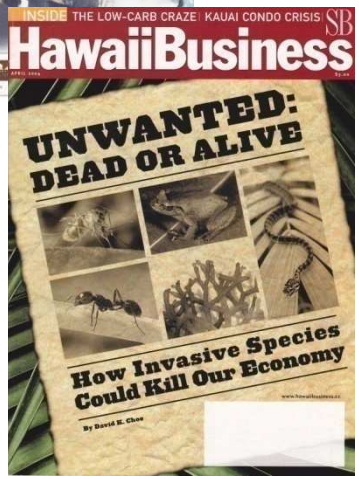
INDICATIVE COSTS OF SOME INVASIVE ALIEN SPECIES (COSTS IN US$)

SPECIES	ECONOMIC VARIABLE	ECONOMIC IMPACT	REFERENCE
Introduced disease organisms	Annual cost to human, plant, animal health in USA	$41 billion per year	Daszak et al., 2000
A sample of alien species of plants and animals	Economic costs of damage in USA	$137 billion per year	Pimentel et al., 2000
Salt Cedar	Value of ecosystem services l ost in western USA	$7-16 billion over 55 years	Zavaleta, 2000
Knapweed and Leafy spurge	Impact on economy in three US states	$40.5 million per year direct costs $89 million indirect	Bangsund, 1999; Hirsch and Leitch, 1996
Zebra mussel	Damages to US and European industrial plants	Cumulative costs 1988-2000 =$750 million to 1 billion	National Aquatic Nuisances Species Clearinghouse, 2000
Most serious invasive alien plant species	Costs 1983-92 of herbicide control in Britain	344 million/year for 12 species	Williamson, 1998
Six weed species	Costs in Australia agroecosystems	$105 million/year	CSIRO, 1997 cited in Watkinson, Freckleton and Dowling 2000
Pinus, *Hakeas*, and *Acacia*	Costs on South African Floral Kingdom to restore to pristine state	$2 billion	Turpie and Heydenrych, 2000
Water hyacinth	Costs in 7 African countries	$20-50 million/year	Joffe-Cooke, cited in Kasulo, 2000
Rabbits	Costs in Australia	$373 million/year (agricultural losses)	Wilson, 1995 cited in White and Newton-Cross, 2000
		$267-602 million	Wittenberg et al,, 2001

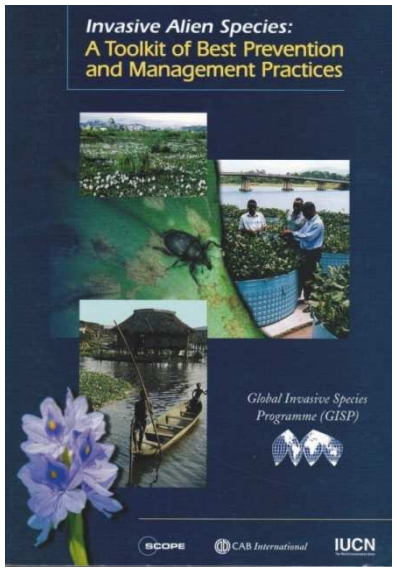
Eichhornia crassipes (Tahiti)

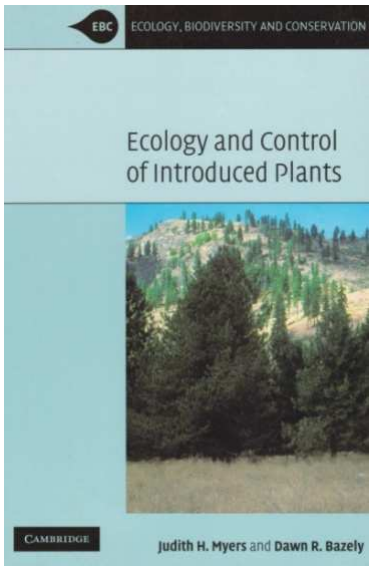






Stratégies de gestion





TREE-1578; No. of Pages 9 ARTICLE IN PRESS
Review
Cell PRESS

Impacts of biological invasions: what's what and the way forward

Daniel Simberloff[1], Jean-Louis Martin[2], Piero Genovesi[3], Virginie Maris[2], David A. Wardle[4], James Aronson[2,5], Franck Courchamp[6], Bella Galil[7], Emili García-Berthou[8], Michel Pascal[9], Petr Pyšek[10,11], Ronaldo Sousa[12,13], Eric Tabacchi[14] and Montserrat Vilà[15*]

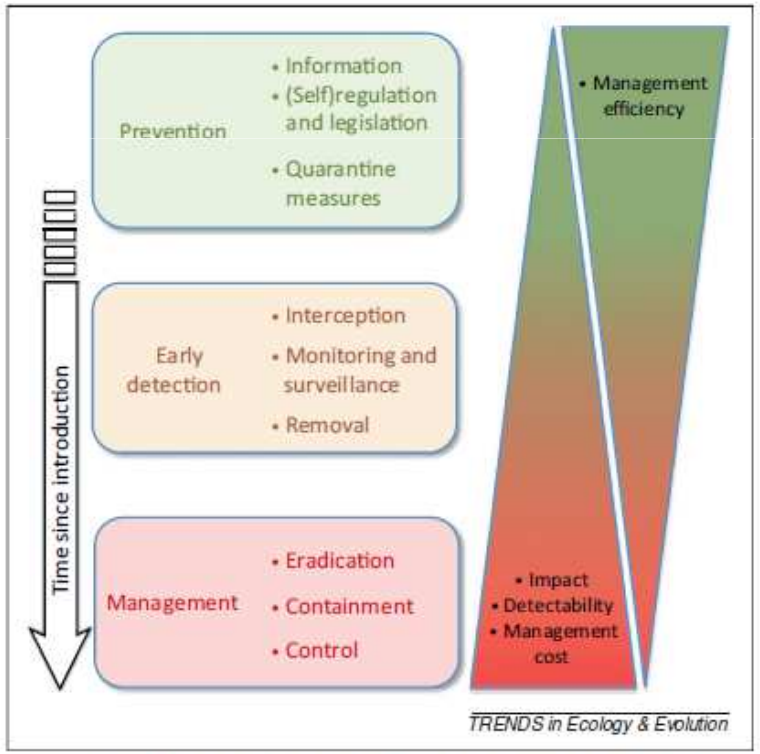
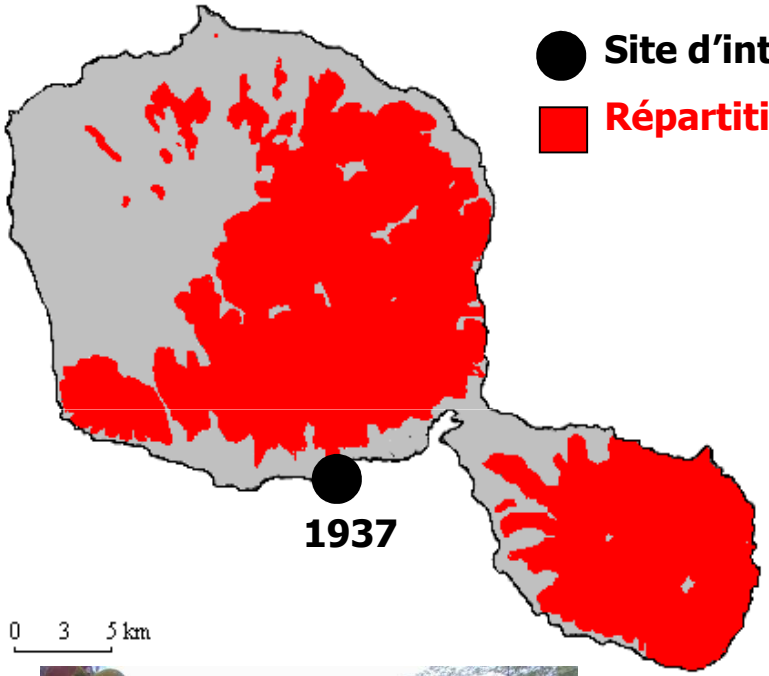


Figure 1. Management strategy against invasive species. The optimal strategy evolves with time since introduction, with management efficiency decreasing and management costs increasing with time since introduction.

Gestion intégrée : l'exemple du miconia



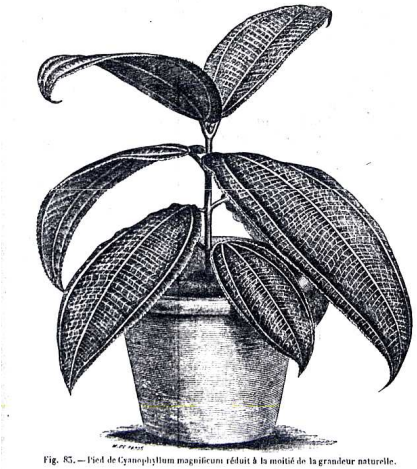
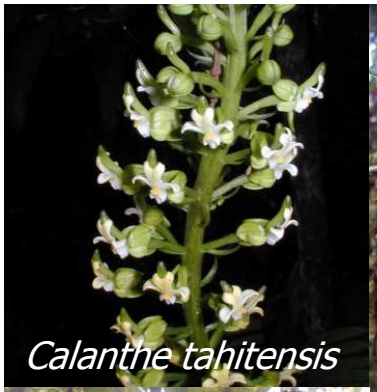


Fig. 85. — Pied de Cyanophyllum magnificum réduit à la moitié de la grandeur naturelle.

Cyanophyllum magnificum (Rev. Hort. 1859)

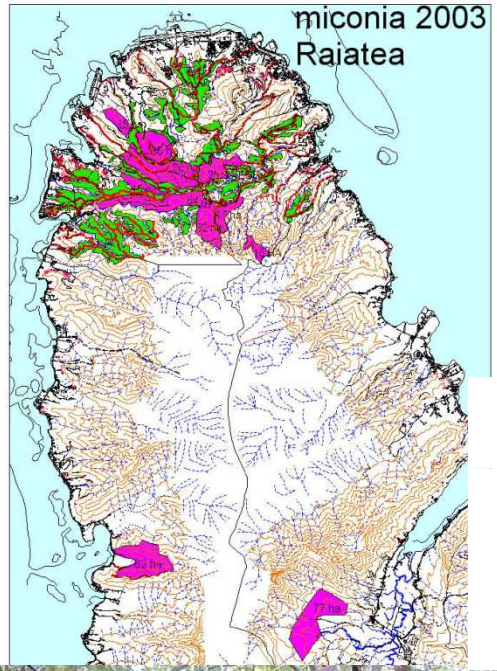
(Meyer 1994. *Thèse de doctorat, Univ. Montpellier* ; Meyer 1996. *Pacific Science*)

Impacts écologiques



(Meyer & Florence 1996. *Journal of Biogeography*)

Lutte manuelle et chimique



La Dépêche
Vendredi 10 juillet 2006

RAIATEA - Militaires, associations de protection de l'environnement et agents du développement rural, unis pendant deux semaines sur les hauteurs de l'île Sacrée

Les commandos anti-miconia luttent contre l'invasion verte

De notre correspondant
Jean-Pierre Besse

La lutte contre le miconia, sur les hauteurs de Raiatea, est toujours aussi exemplaire. Elle a débuté en juin 1992 et ne s'est jamais arrêtée. Le plus redoutable ennemi naturel des forêts des îles rassemble une fois de plus les bonnes volontés. La 16e campagne d'arrachage du miconia commence aujourd'hui. Elle se poursuit sur deux semaines, et le travail ne manque pas. Le champignon pathogène, installé en mars 2004, se répand lentement et infecte les jeunes pousses. Il reste encore de nombreux plants mûrs, on ne peut pas abandonner la lutte sur le terrain.

Des chiffres

Le détachement interarmes de 35 militaires, terre-air-mer, constitue les commandos anti-miconia

Sixteenth Australian Weeds Conference

Is eradication of the invasive tree miconia feasible? Lessons from 15 years of active management in French Polynesia (Pacific Islands)

Jean-Yves Meyer
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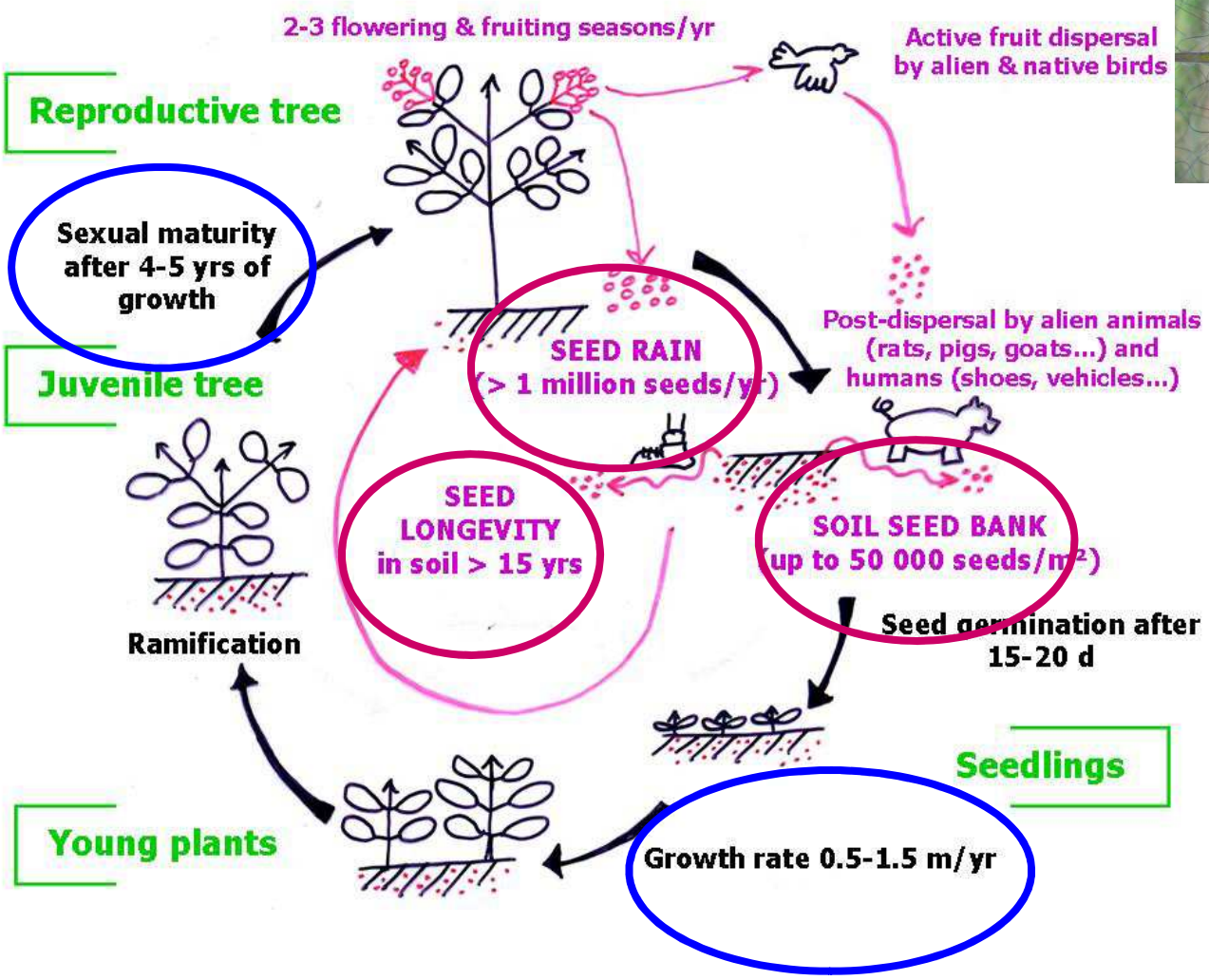
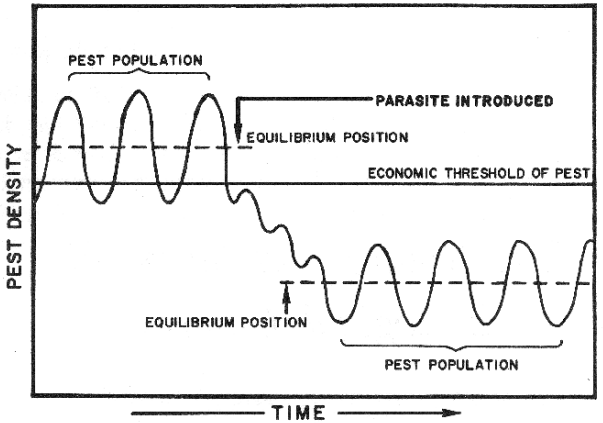
(Meyer & Malet 1997. *University Hawaii Coop. Nat. Park. Res. Studies Technical Report*)

« Invasivité » et « Facilitation »



(Meyer et al. 2010. *Proceedings of the 16th Australian Weeds Conference*)

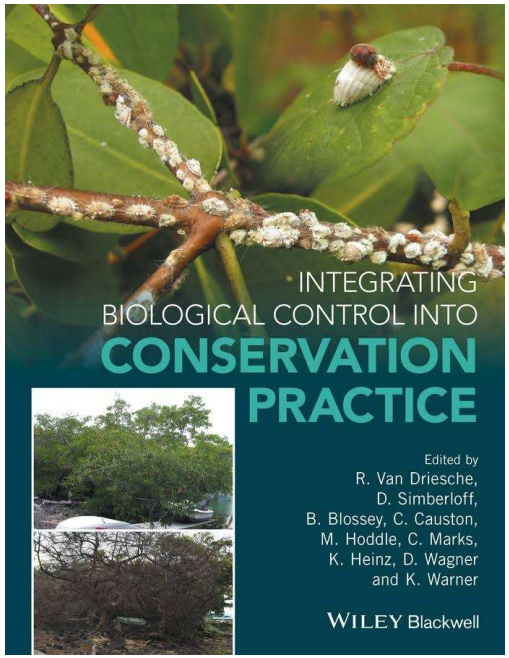
Méthode de lutte biologique

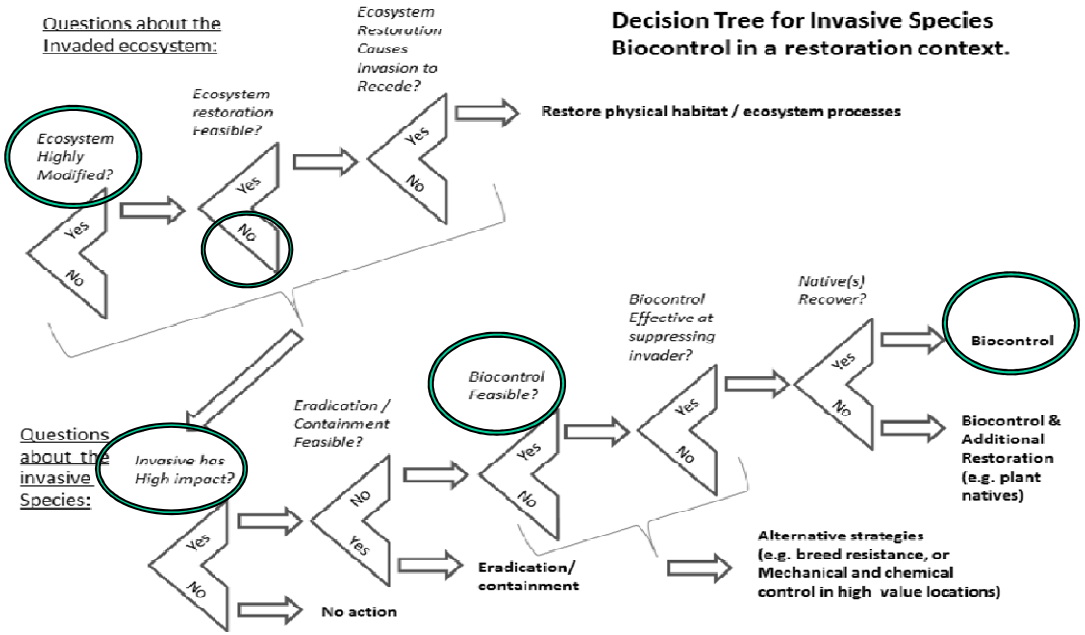


BioControl
DOI 10.1007/s10526-011-9419-x

Fighting pathophobia: how to construct constructive public engagement with biocontrol for nature without augmenting public fears

Keith Douglass Warner



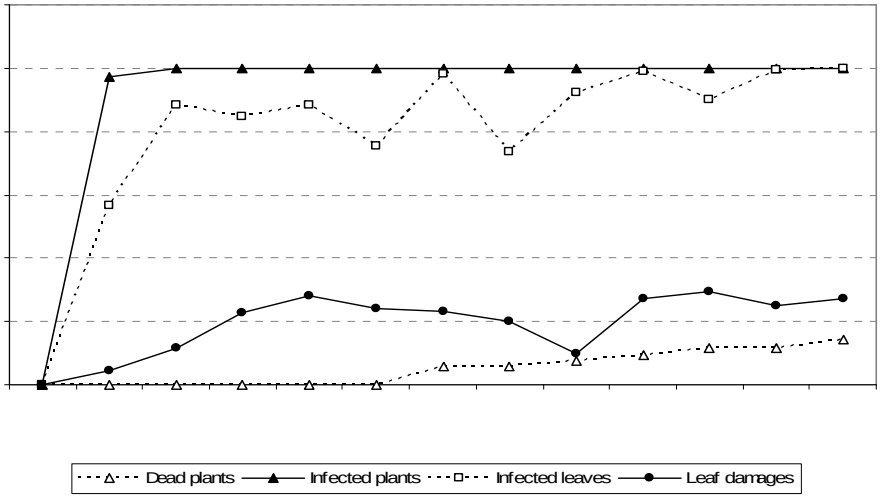


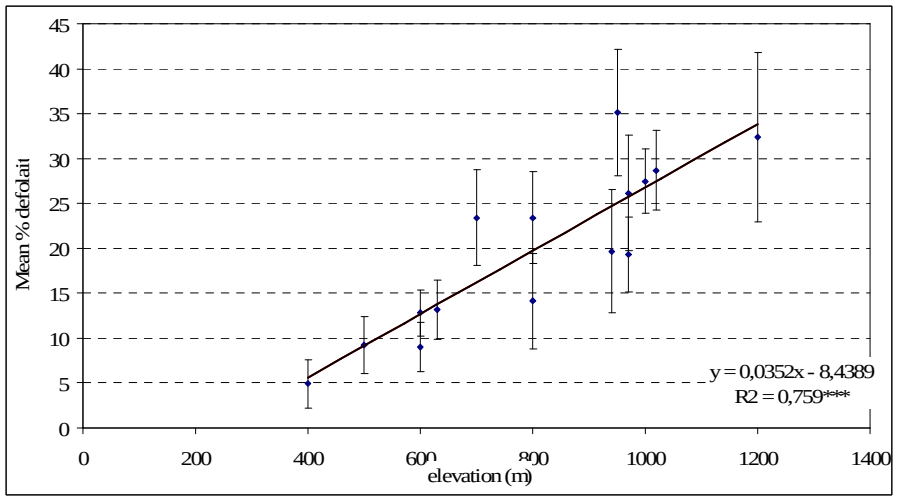
- Champignon pathogène *Colletotrichum gloeosporioides* forma specialis *miconiae* (Melanconiales, Coelomycetes)
- Découvert et isolé au Brésil en 1997
- Cultivé à Hawaii et testé pour sa spécificité (host-specificity)
- Introduit avec succès à Tahiti en 2000

La Dépêche de Tahiti

(Killgore et al. 1999. *Plant Disease*)

- 75% de mortalité des graines à la germination (en laboratoire)
- 100% d'infection (*in situ*)
- 30% de mortalité des plantules (< 50 cm hauteur)
- Défoliation partielle (>25-30%) des arbres en fonction de l'altitude





(Meyer, Taputuarai & Killgore 2008, *Proceedings XII International Symposium on Biological Control of Weeds*) ; Meyer, Fourdrigniez & Taputuarai 2010. *Biological Control for Nature Conference*, Northampton, USA)

➢ Etude de l'impact positif sur les plantes endémiques menacées

Ophiorrhiza subumbellata (Rubiaceae)

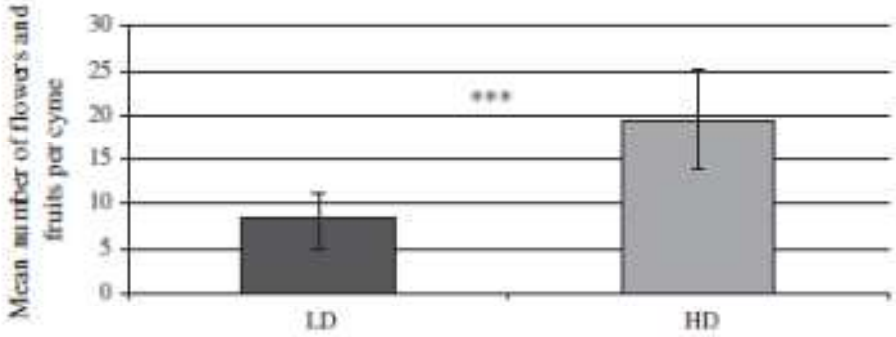


Fig. 5a. Fertility of adult *Ophiorrhiza* in low (LD) and high (HD) defoliation sites (***$P < 0.001$).

(Meyer & Fourdrigniez 2011, *Biological Conservation*)

Myrsine longifolia (Myrsinaceae)

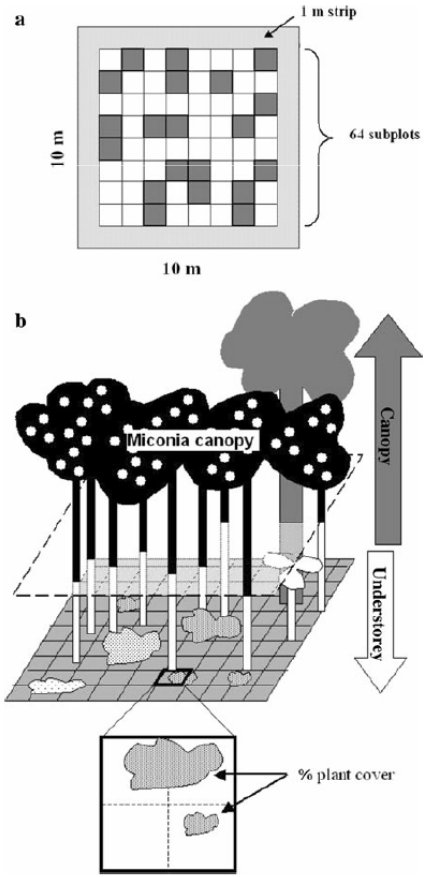
(Meyer, Duplouy & Taputuarai 2007, *Revue d'Ecologie*)

➢ Etude de l'impact positif sur la régénération naturelle des forêts

BioControl
DOI 10.1007/s10526-011-9402-6

Restoring habitat for native and endemic plants through the introduction of a fungal pathogen to control the alien invasive tree *Miconia calvescens* in the island of Tahiti

Jean-Yves Meyer · Marie Fourdrigniez · Ravahere Taputuarai



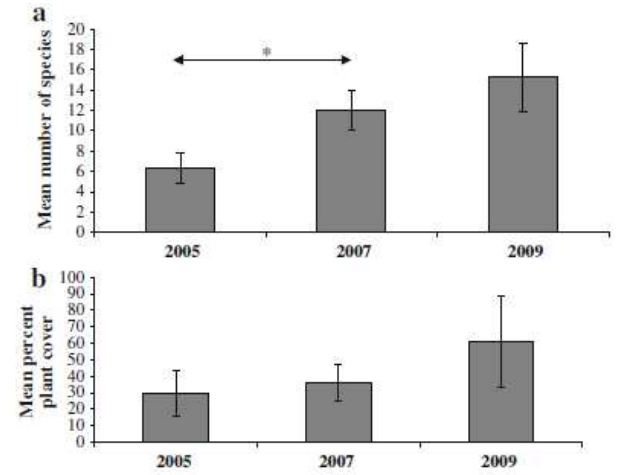


Fig. 3 Changes in species diversity (a) and plant cover (b) in all plots with time. Friedman test followed by a Wilcoxon signed rank test with Bonferroni correction (*$P < 0.016$): species diversity ($n = 7$; $\chi^2 = 12.074$; df = 2; $P < 0.01$); plant cover ($n = 7$; $\chi^2 = 4.571$; df = 2; $P = 0.102$); error bars represent SE

SUPRESSING OVER-ABUNDANT INVASIVE PLANTS AND INSECTS IN NATURAL AREAS BY USE OF THEIR SPECIALIAZED NATURAL ENEMIES

Edited by Roy G. Van Driesche and Richard C. Reardon

CHAPTER 9. PARTIAL RESTORATION OF NATIVE RAINFORESTS IN THE ISLAND OF TAHITI (FRENCH POLYNESIA) AFTER INTRODUCTION OF A FUNGAL PATHOGEN TO CONTROL THE INVASIVE TREE *MICONIA CALVESCENS*

J-Y. Meyer

Délégation à la Recherche de la Polynésie française

Pittosporum tahitense
(Pittosporaceae)

Liparis clypeolum
(Orchidaceae)

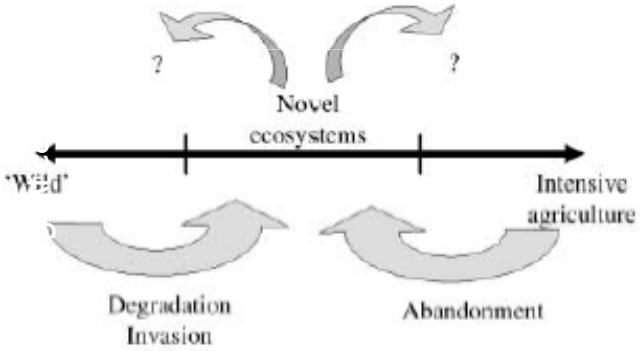
Néo-écosystèmes : un nouveau paradigme ?

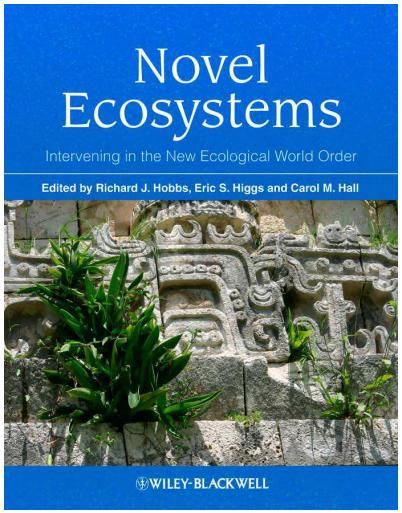
Global Ecology and Biogeography, (Global Ecol. Biogeogr.) (2006) **15**, 1–7

ECOLOGICAL SOUNDING

Novel ecosystems: theoretical and management aspects of the new ecological world order

Richard J. Hobbs[1*], Salvatore Arico[2], James Aronson[3], Jill S. Baron[4], Peter Bridgewater[5], Viki A. Cramer[1], Paul R. Epstein[6], John J. Ewel[7], Carlos A. Klink[8], Ariel E. Lugo[9], David Norton[10], Dennis Ojima[4], David M. Richardson[11], Eric W. Sanderson[12], Fernando Valladares[13], Montserrat Vilà[14], Regino Zamora[15] and Martin Zobel[16]

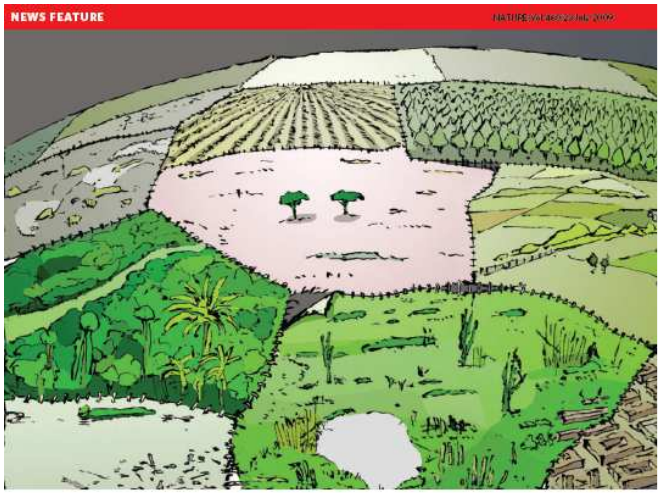




THE NEW NORMAL

As though working through the five stages of grief, more and more ecologists are reluctantly accepting that we live in a human-dominated world. And some are discovering that patchwork ecosystems might even rival their pristine counterparts.

Conservation Magazine • Vol. 11 No. 2 | April-June 2010



RAGAMUFFIN EARTH

A small group of ecologists is looking beyond the pristine to study the scrubby, feral and untended. **Emma Marris** learns to appreciate 'novel ecosystems'.

- **Doit-on lutter contre les espèces invasives et restaurer les habitats envahis… ou accepter les changements et ne rien faire ?**

Conservation Biology

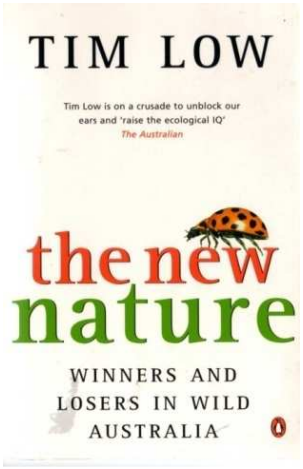
Review

The Potential Conservation Value of Non-Native Species

MARTIN A. SCHLAEPFER,*† DOV F. SAX,‡ AND JULIAN D. OLDEN§

*State University of New York, College of Environmental Science and Forestry, 1 Forestry Drive, Syracuse, NY 13210, U.S.A., email mschlaepfer@esf.edu
†INRA, Ecologie et Santé des Ecosystèmes, 35042 Rennes, France
‡Department of Ecology and Evolutionary Biology, 80 Waterman Street, Brown University, Providence, RI 02912, U.S.A.
§School of Aquatic and Fishery Sciences, University of Washington, Box 355020, Seattle, WA 98195, U.S.A.

- **Remplacement d'espèces éteintes, substituts écologiques**
- **Service écosystémiques rendus**
- **espèces « nurse » pour la restauration**



OIKOS 41: 195–199. Copenhagen 1983

Extinction of the Hawaiian avifauna resulted in a change of pollinators for the ieie, Freycinetia arborea

Paul Alan Cox

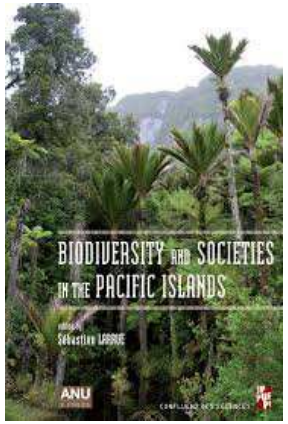
Pollinisation de plantes indigènes par l'abeille domestique *Apis mellifera*

Zosterops lateralis

Reforestation avec *Casuarina equisetifolia* à Rapa Nui

Ajonc d'Europe *Ulex europaeus* (Nouvelle-Zélande)

Exemple de l'île de Moorea



- 310 plantes indigènes *versus* 767 introduites (dont 182 naturalisées)
- Une mosaïque d'habitats naturels et anthropiques

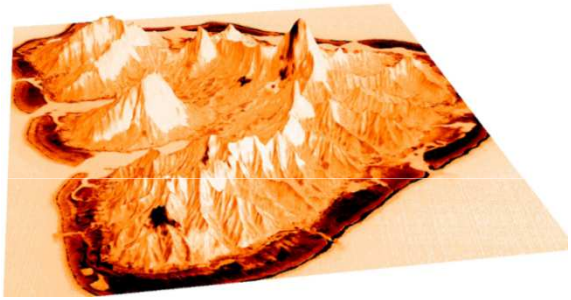
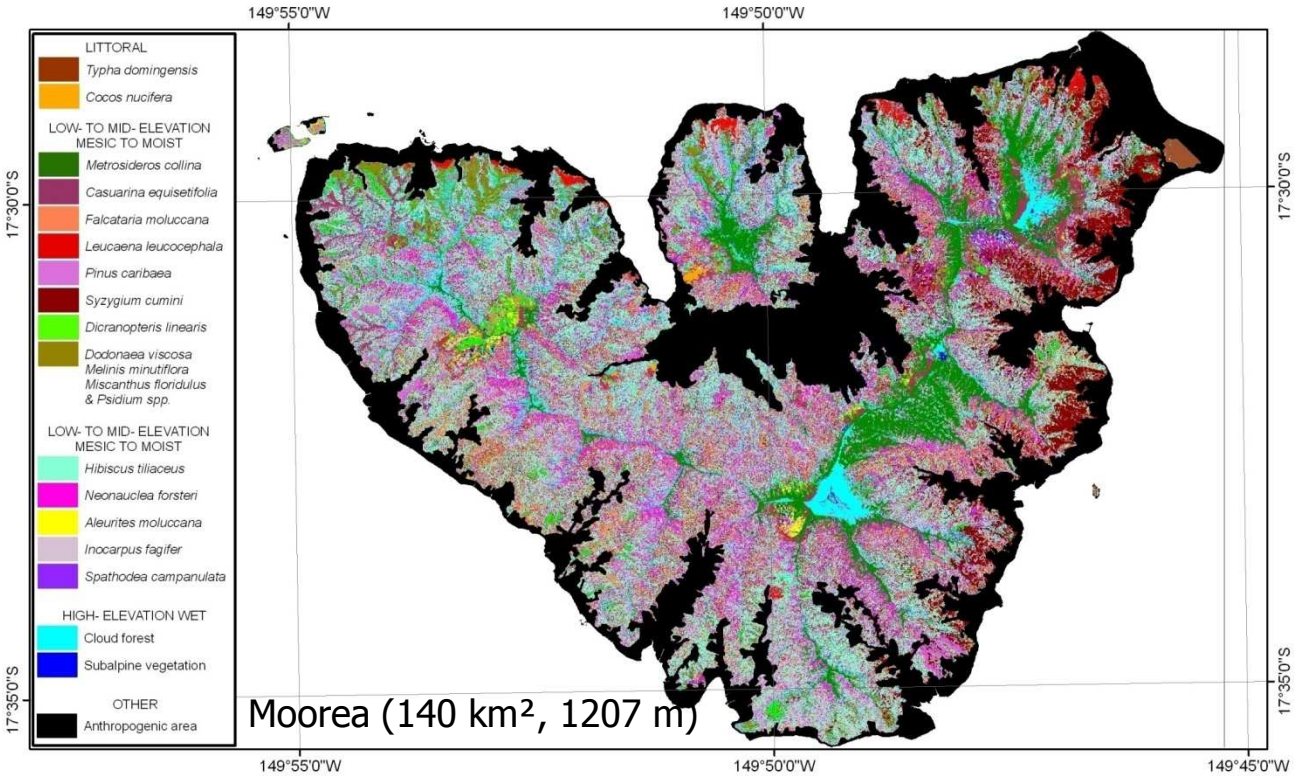


image satellite Quickbird (Near IR)



BIOCODE moorea 17 30S 149 50W

Gordon and Betty MOORE FOUNDATION

(Pouteau, 2011. *Thèse de doctorat* ; Pouteau et al. 2013)

Biodivers Conserv (2015) 24:83–101
DOI 10.1007/s10531-014-0791-6

ORIGINAL PAPER

The importance of novel and hybrid habitats for plant conservation on islands: a case study from Moorea (South Pacific)

Jean-Yves Meyer · Robin Pouteau · Erica Spotswood · Ravahere Taputuarai · Marie Fourdrigniez

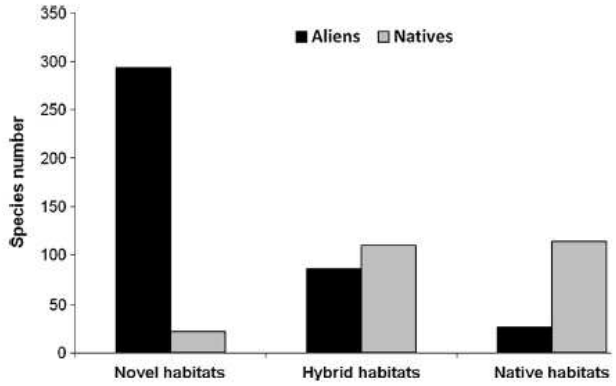
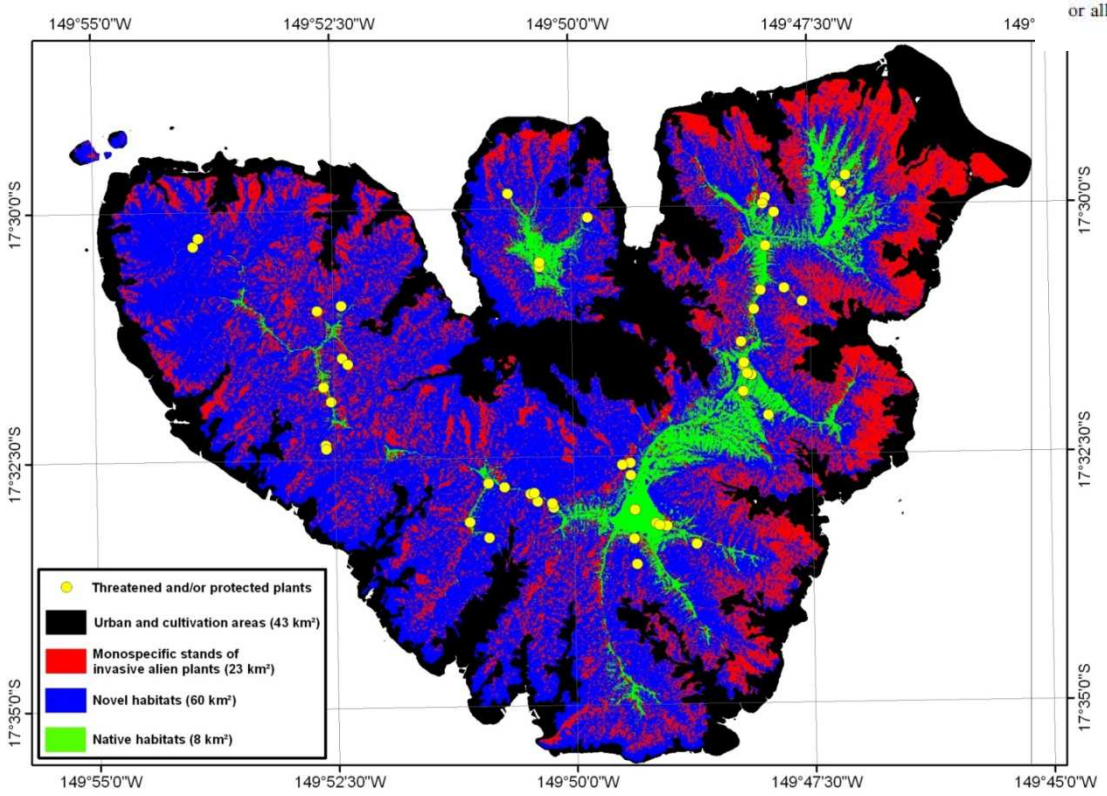


Fig. 3 Occurrence of naturalized alien plants ($N = 308$) and native and endemic plants ($N = 158$) according to habitat types on Moorea in the 32 surveyed watershed. A plant species can be found in one, two or all the three habitats



➢ Rupture des interactions interspécifiques et des mutualismes

Ptilope de la Société *Ptilinopus purpuratus*

Tarenna sambucina
(Rubiaceae)

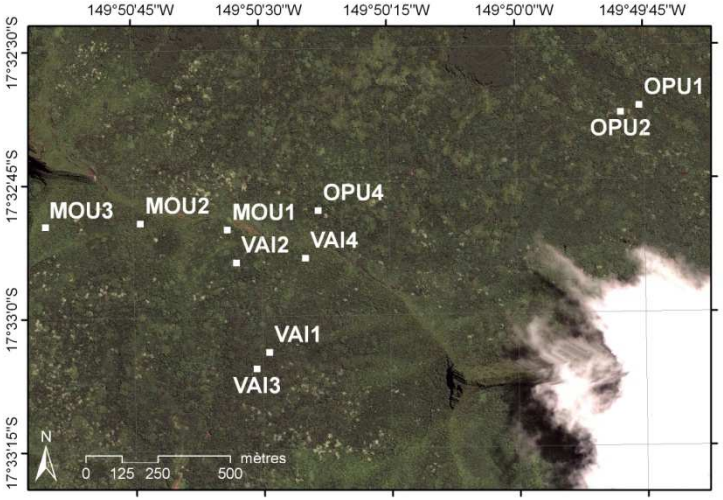
Journal of Biogeography (J. Biogeogr.) (2012)

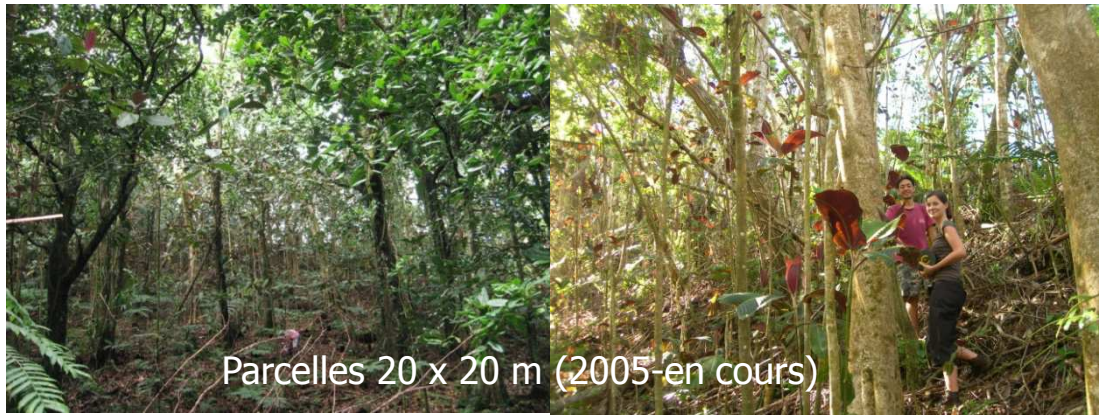
SPECIAL ISSUE

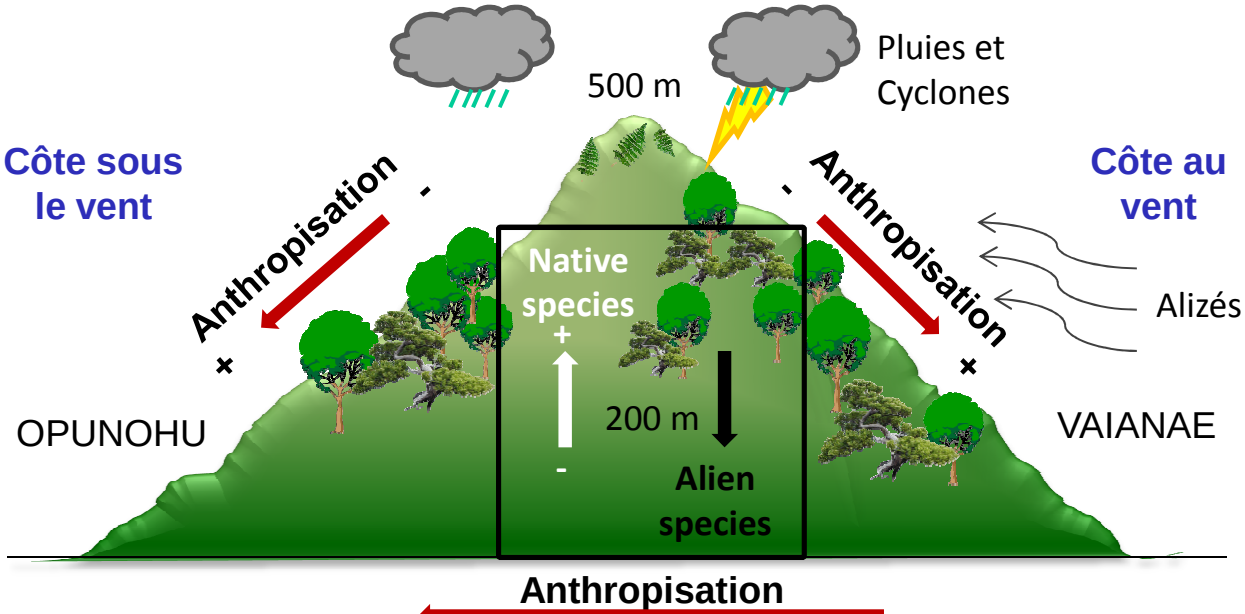
An invasive tree alters the structure of seed dispersal networks between birds and plants in French Polynesia

Erica N. Spotswood[1]*, Jean-Yves Meyer[2] and James W. Bartolome[1]

➢ Suivi sur le long-terme de la dynamique forestière en fonction de gradients environnementaux et du degré d'invasion à Moorea



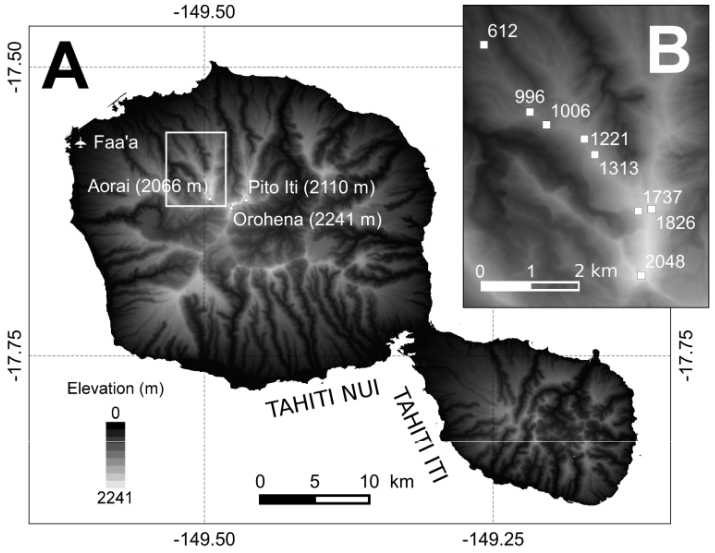




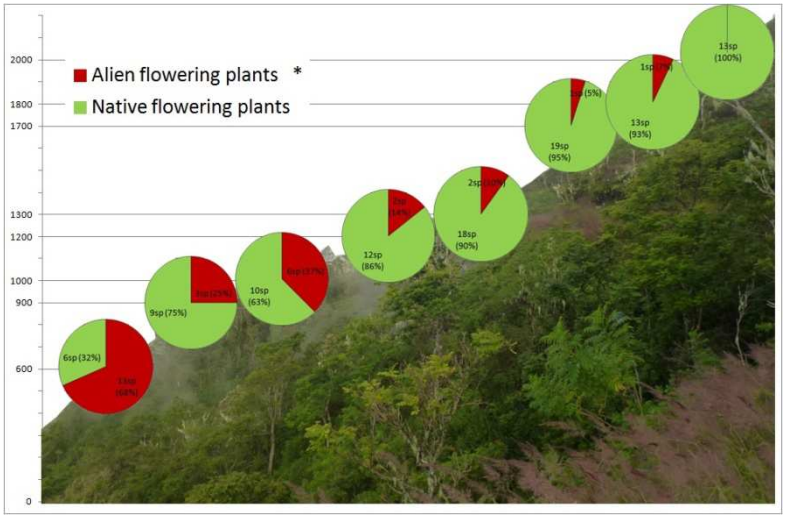
Chablis
(cyclone Oli, 2010)

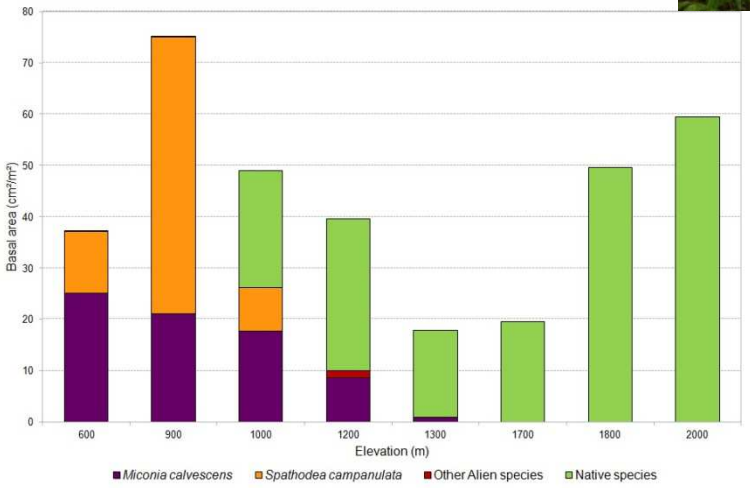
(Fraisse, 2010. *Rapport Master2, Univ. Perpignan*)

➢ Suivi sur le long-terme de la composition, structure et dynamique de la végétation en fonction d'un gradient d'altitude à Tahiti



Tahiti (1045 km², 2241 m)





(Jordan, 2014. *Rapport Master2, Univ. Montpellier 2*)

Conclusions

- Les invasions biologiques, première cause de l'érosion de la biodiversité dans les îles
- *Management must recognize the change is inevitable* (CBD 1998, COP4, SBSTTA Recommandation V/10) : nouvelles stratégies de gestion intégrant la conservation des habitats naturels et la gestion des « nouveaux » écosystèmes
- Nécessité de comprendre la composition et le fonctionnement des écosystèmes… donc de mener des études sur le long-terme !
- Importance de la collaboration régionale, nationale et internationale

- Les îles, laboratoires de l'écologie et l'évolution mais également sentinelles des changements globaux

Remerciements / *Maurururu roa* !

Délégation à la Recherche de la Polynésie française, Tahiti

« Initiative Espèces Exotiques Envahissante Outre-Mer », Comité français de l'UICN, Paris, 2008

Calvin & Hobbes (by Bill Watterson)