

Ecological restoration in French Polynesia & Pacific Islands: from theory... to practice



Jean-Yves Hiro MEYER (Dr.)

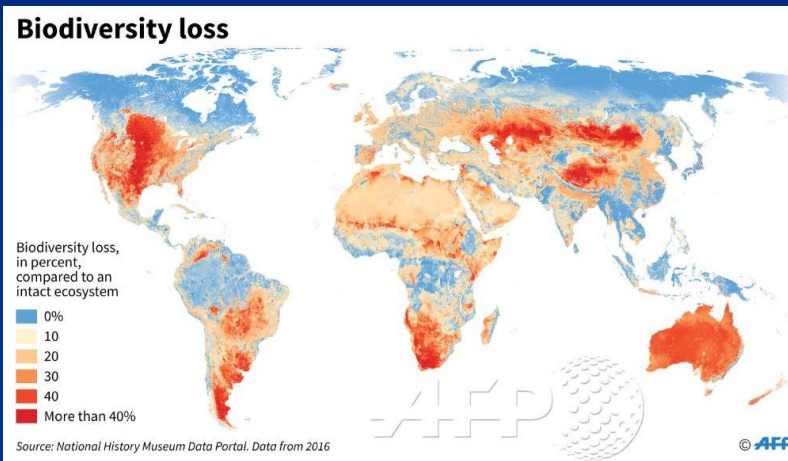
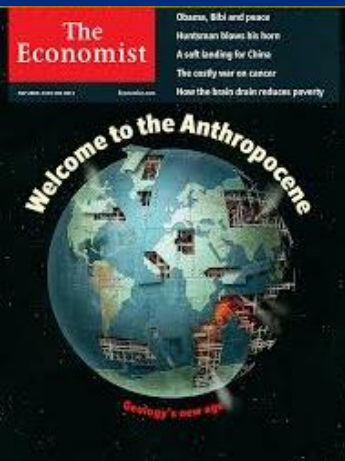
Délégation à la Recherche, Gouvernement de la
Polynésie française & UMR SECOPOL

Email : jean-yves.meyer@recherche.gov.pf



Why restoration ?

Conserving what is left *vs.* Restoring what once was !



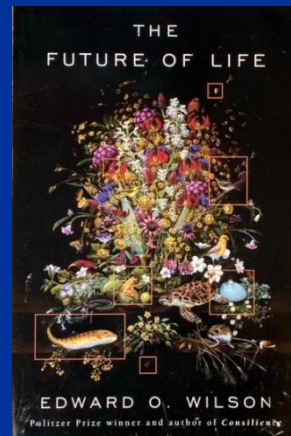
www.sciencemag.org • SCIENCE • VOL. 277 • 25 JULY 1997

Hopes for the Future: Restoration Ecology and Conservation Biology

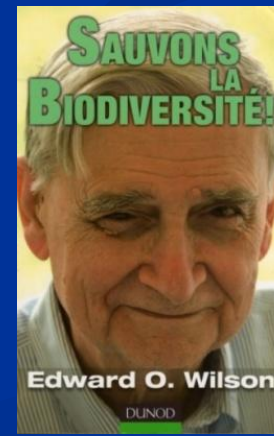
Andy P. Dobson, A. D. Bradshaw, A. J. M. Baker



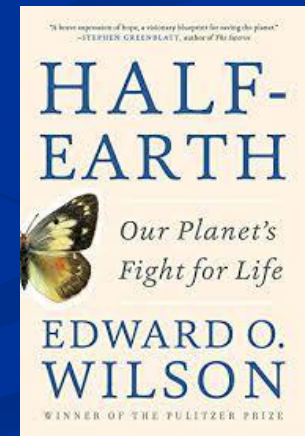
1988



2002



2007



2016

*“The next century will, I believe, be the era of restoration in ecology”
(E. O. Wilson, 1992)*

The World Agenda

- **COP 15 (2022)** : Kunming-Montreal Global Biodiversity Framework, Target 2 : *“ensure that by 2030 at least 30 per cent of areas of degraded terrestrial, inland water, and marine and coastal ecosystems are under effective restoration”*
- **Loi Européenne sur la Restauration de la Nature (2024)** : *“les pays de l’UE doivent restaurer au moins 30% des habitats en mauvais état d’ici 2030, 60% d’ici 2040 et 90% d’ici 2050”*
- **UN Decade on Ecosystem Restoration (2021-2030)**

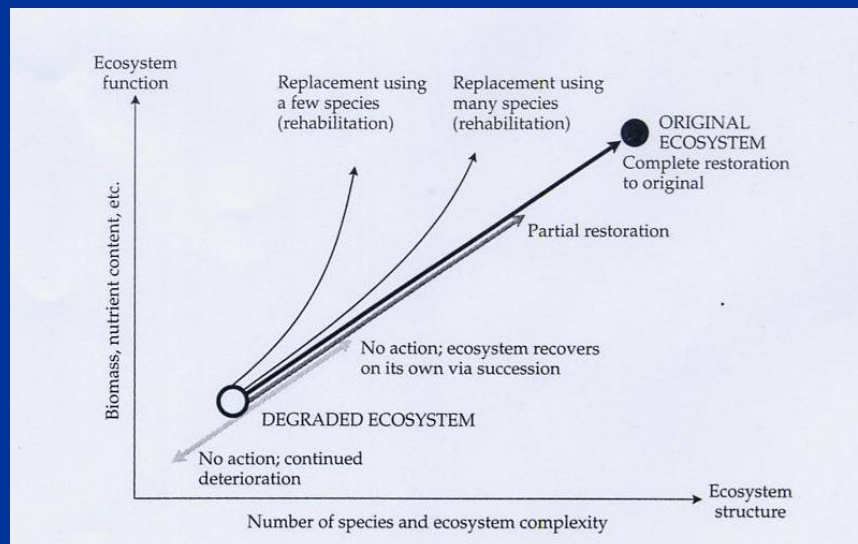


30 Oct. 2024



What is ecological restoration ?

- “the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed” (SER, 2004)
- “to achieve sustainable, resilient and inter-connected ecosystems that provide ecosystems services and habitats for humans and other organisms ” (van Andel & Aronson, 2006)
- “the process of reversing the degradation of ecosystems to regain their ecological functionality, and to improve their productivity and capacity to meet the needs of society” (IUCN)



(after Bradshaw, 1990)

What Recovery Goals ?

- Physico-chemical parameters
- Species/communities
- Natural ecosystems/socio-ecosystems
- Ecological functions/ecosystem services
- Biotic interactions/trophic networks
- Ecosystems/habitats connectivity
- Bio-cultural values

Restoration Ecology
THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION

2016

RESEARCH ARTICLE

Key biocultural values to guide restoration action and planning in New Zealand

Phil O'B. Lyver^{1,2}, Ashli Akins³, Hilary Phipps¹, Viktoria Kahui⁴, David R. Towns^{5,6}, Henrik Moller³

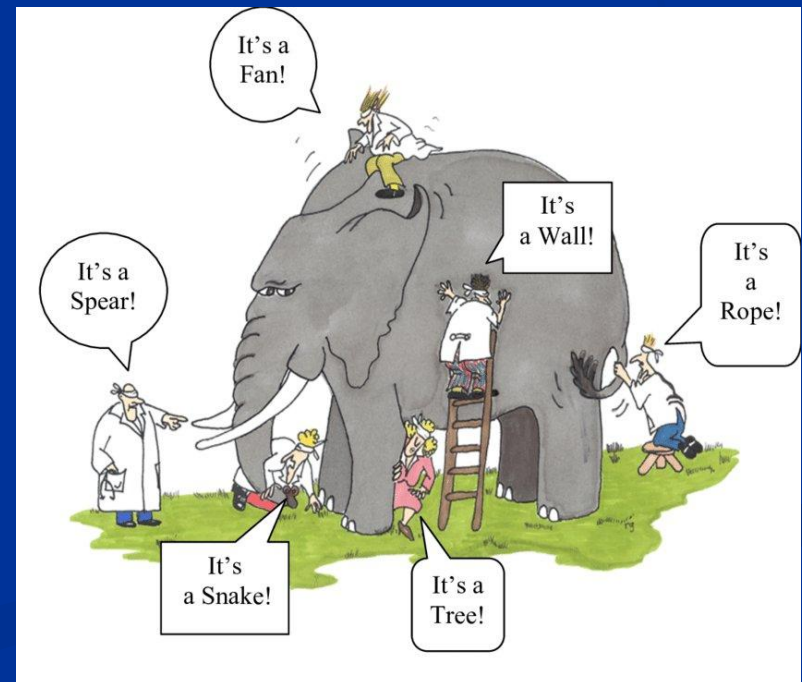
RESEARCH

Bastin *et al.*, *Science* **365**, 76–79 (2019)

RESTORATION ECOLOGY

The global tree restoration potential

Jean-Francois Bastin^{1*}, Yelena Finegold², Claude Garcia^{3,4}, Danilo Mollicone², Marcelo Rezende², Devin Routh¹, Constantin M. Zohner¹, Thomas W. Crowther¹



Remediation, Rehabilitation and Restoration

THE RESTORATIVE CONTINUUM

Improving biodiversity, ecological health, and ecosystem services

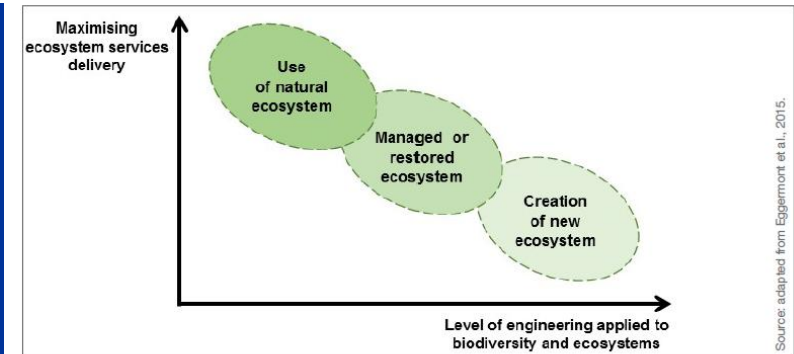
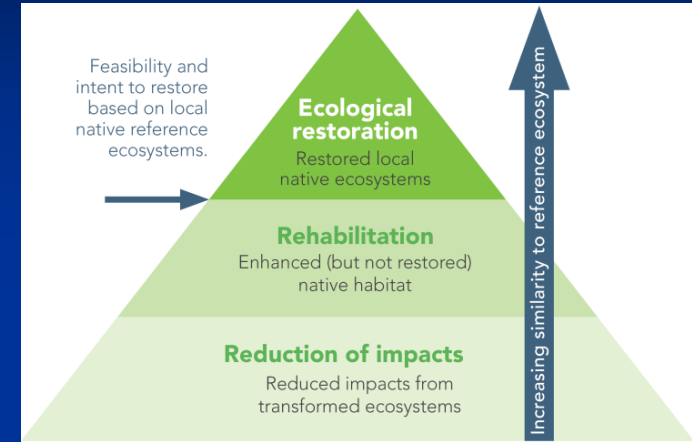
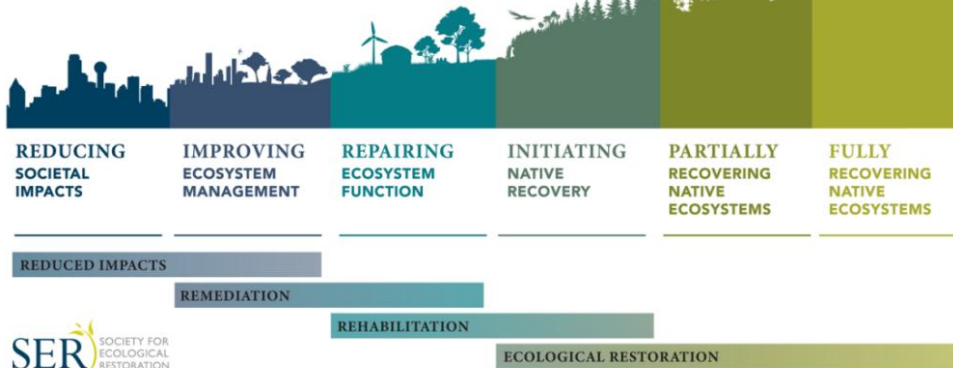


Figure 5. A typology of NbS showing three main categories of solutions based on natural, restored and new ecosystems

■ *“Restoration can happen in many ways so that nature can recover on its own. It is not always possible –or desirable– to return an ecosystem to its original state” (UNEP)*

Passive and Active Restoration

- **“passive restoration”**: removal or reduction of the threats/disturbances (e.g. fencing)
- **“active restoration”**: with human interventions (e.g. invasive alien species control, species reintroduction, population reinforcement, introduction of native or alien ecological surrogates/analogues, “rewilding”)



Annu. Rev. Ecol. Evol. Syst. 2011. 42:465–87

Toward an Era of Restoration in Ecology: Successes, Failures, and Opportunities Ahead

Katharine N. Suding

Department of Environmental Science, Policy, and Management, University of California, Berkeley, California 94720; email: suding@berkeley.edu

Restoration Ecology

THE JOURNAL OF THE SOCIETY FOR ECOLOGICAL RESTORATION

2018

STRATEGIC ISSUES ARTICLE

On principles and standards in ecological restoration

Eric Higgs^{1,2}, Jim Harris³, Stephen Murphy⁴, Keith Bowers⁵, Richard Hobbs⁶, Willis Jenkins⁷, Jeremy Kidwell⁸, Nikita Lopoukhine⁹, Bethany Sollereder¹⁰, Katherine Suding¹¹, Allen Thompson¹², Steven Whisenant¹³

2024

BIOLOGICAL
REVIEWS

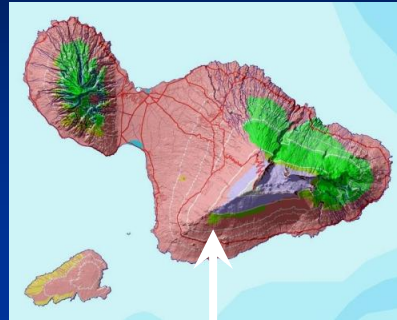
Cambridge
Philosophical Society

Biol. Rev. (2024), pp. 000–000.
doi: 10.1111/brev.13046

Ecological restoration and rewilding: two approaches with complementary goals?

Clémentine Mutillod^{1,*}, Élise Buisson¹, Gregory Mahy^{1,2}, Renaud Jaunatre³, James M. Bullock⁴, Laurent Tatin¹ and Thierry Dutoit¹

Dry forest restoration in Auwahi, Maui (Hawai’i)



1997

- 5% of the original dry forest left !
- Fencing (cattle, feral pigs) 4 ha in 1997 → 94 ha in 2008...
- Weeding & chemical control (invasive “kikuyu” grass)
- Replanting 36 native and endemic tree species



2014



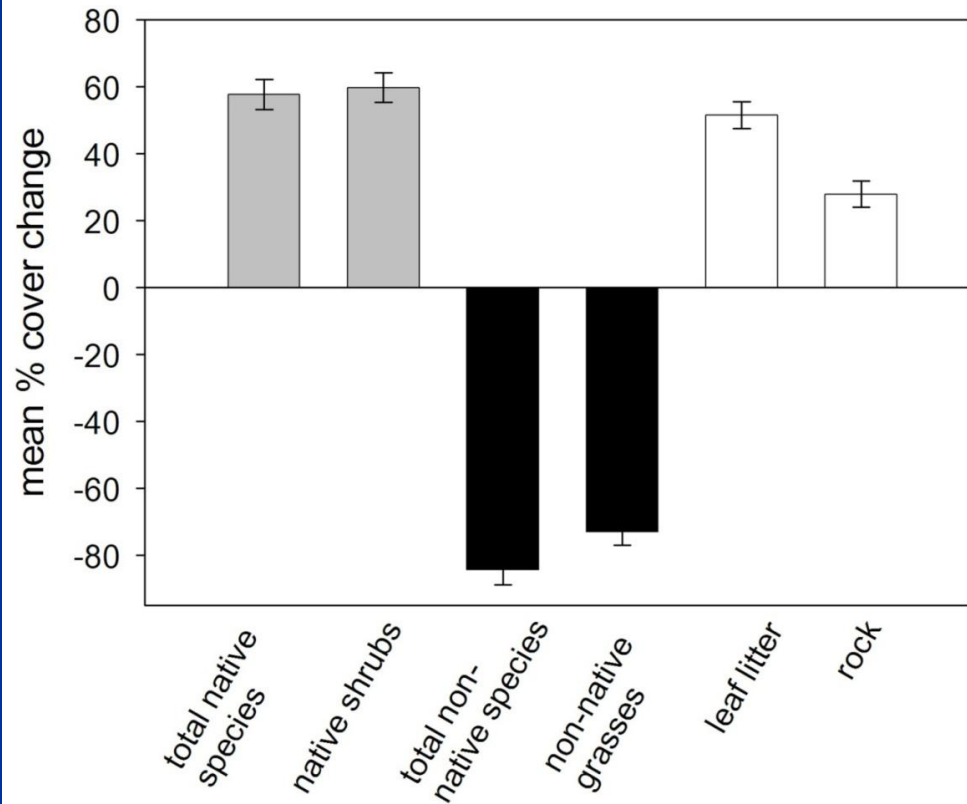
www.auwahi.org

2014

Dry Forest Restoration and Unassisted Native Tree Seedling Recruitment at Auwahi, Maui¹

A. C. Medeiros,^{2,4} E. I. von Allmen,³ and C. G. Chimera³

Pacific Science (2014), vol. 68, no. 1:33–45
doi:10.2984/68.1.3
© 2014 by University of Hawai‘i Press
All rights reserved



Monitoring (1997-2012)



2012

GEOPHYSICAL RESEARCH LETTERS, VOL. 39, L05405, doi:10.1029/2012GL051120, 2012

Effects of native forest restoration on soil hydraulic properties, Auwahi, Maui, Hawaiian Islands

K. S. Perkins,¹ J. R. Nimmo,¹ and A. C. Medeiros²



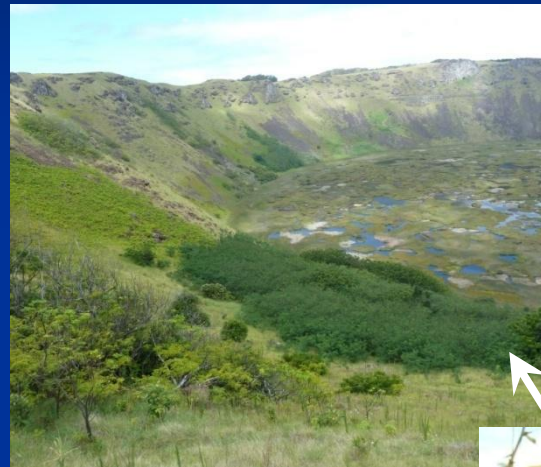
Alien grassland



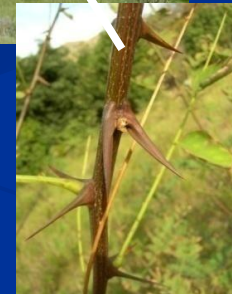
16 years old restored native forest

Vegetation restoration in Rapa Nui (Easter Island)

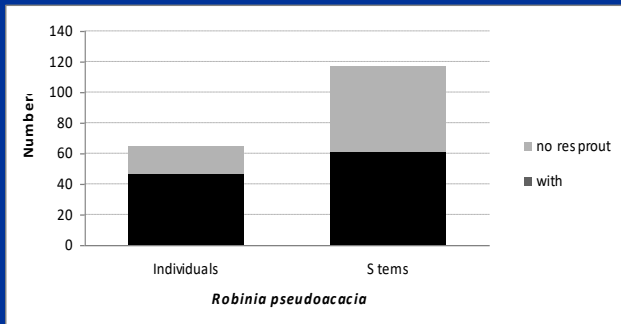
➤ Weed control (cut-stump chemical treatment)



Sophora toromiro



Robinia pseudoacacia



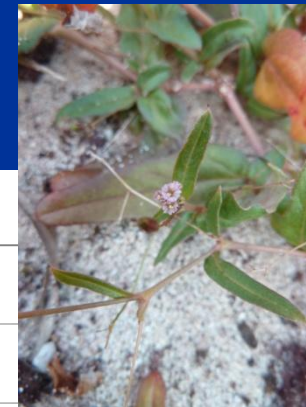
2012



2013



- Remnant of native coastal vegetation
- Manual control of alien weeds (2012-2013)



Native coastal herb
Boerhavia acutifolia

□ Before weed control (June 2012) ■ After weed control (Nov. 2012)

Boerhavia acutifolia

No weed control

+ 40%

Treated plot

Control plot

Outside area



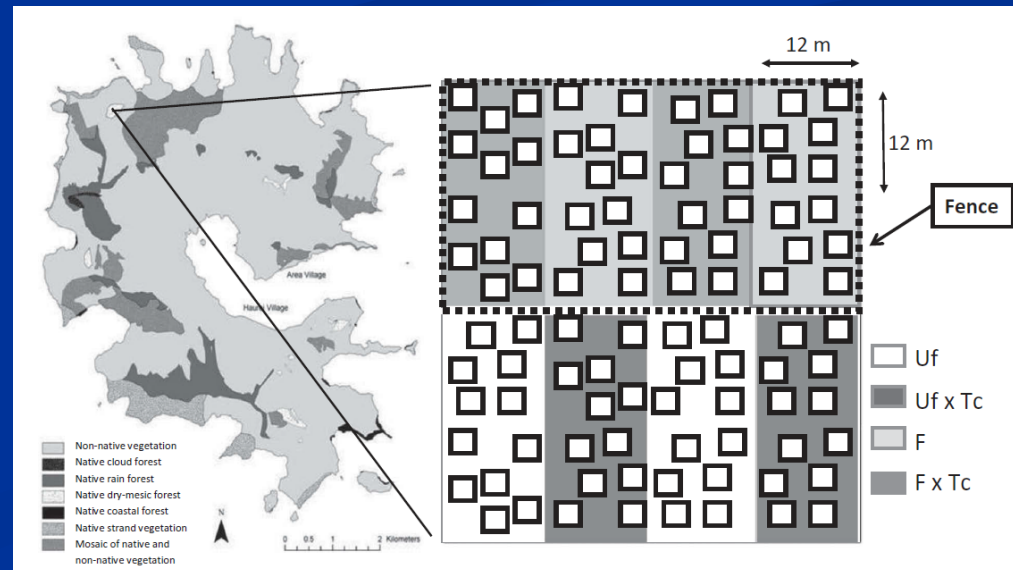
Alien grass *Cenchrus clandestinus* (syn. *Pennisetum clandestinum*, « kikuyu »)

Dry-mesic forest restoration in Rapa iti (Australis)

- Remnants of species-rich native dry-mesic forests...
- ...overgrazed (horses, feral goats) and invaded by strawberry guava *Psidium cattleianum*
- Fencing + cutting stems, but no chemical treatment



Pariati Bay, 2002



(T. Laitame©, 2011)

2019

PLANT ECOLOGY & DIVERSITY
https://doi.org/10.1080/17550874.2019.1584651



ARTICLE



Short-term recovery of native vegetation and threatened species after restoration of a remnant forest in a small oceanic island of the South Pacific

Jean-Yves Meyer , Tiffany Laitame and Jean-Claude Gaertner

^aDélégation à la Recherche, Gouvernement de la Polynésie française, Tahiti, French Polynesia; ^bUMR-241 EIO, Université de la Polynésie française, Tahiti, French Polynesia; ^cUMR-241 EIO, Institut de Recherche pour le Développement, Tahiti, French Polynesia



Monitoring (2012-2014)

6 J.-Y. MEYER ET AL.

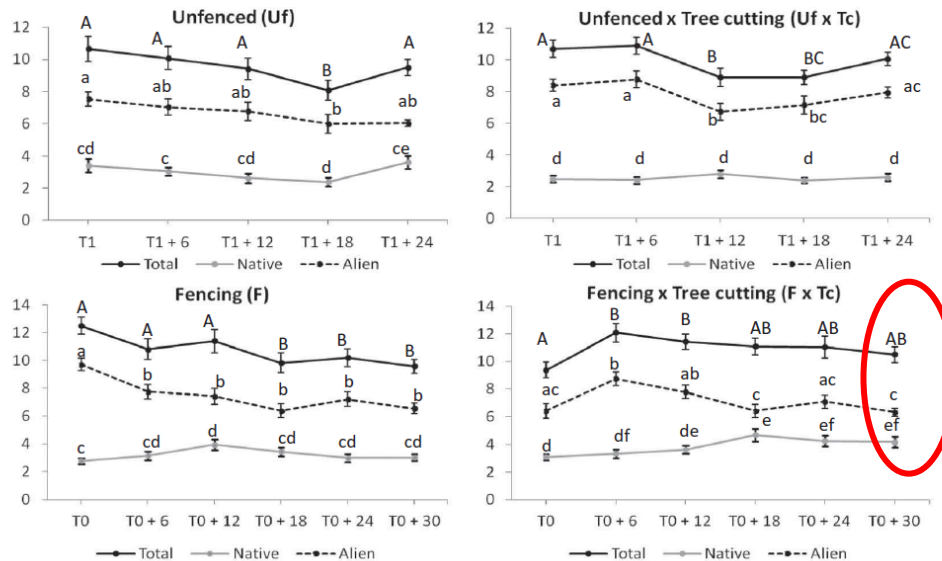


Figure 4. Comparison of species richness (mean ± SE; n = 24 quadrats) of understorey plants in the four treatments over 2 years. A different letter or group of letters indicates significant differences between surveys in a given treatment (post-hoc pair-wise Wilcoxon-test).



Nesoluma polynesianum
(« karaka »)



Sophora rapaensis
(« Maiane », T. Laitame©)

Mesic-Wet forest restoration on plateau Maraetia, Tahiti

- Fencing + rat control + weeding
- Monitoring the recruitment of seedlings of rare and threatened endemic woody species



De Auwahi (Maui) à Maraeti'a (Tahiti)
L'alliance entre les scientifiques
et les communautés locales
pour la restauration
de forêts naturelles menacées

(Medeiros *et al.*, 2018. *Bull. Soc. Et. Océan.* 346)



Biocontrol as a tool to restore invaded forests

- Introduction of a highly host-specific fungal pathogen *Colletotrichum gloeosporioides* f. sp. *miconiae* (Coelomycetes)



2011



2000



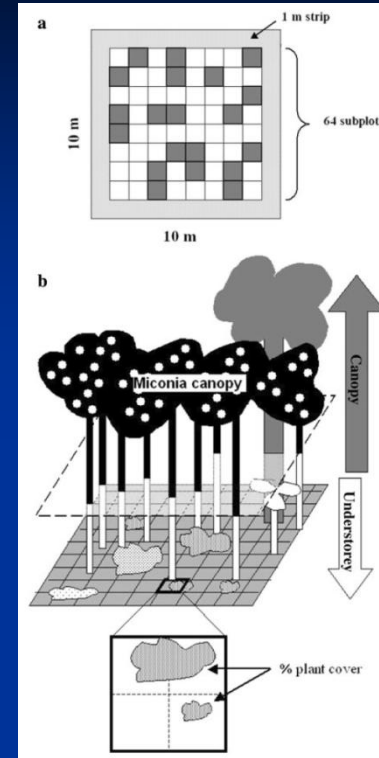
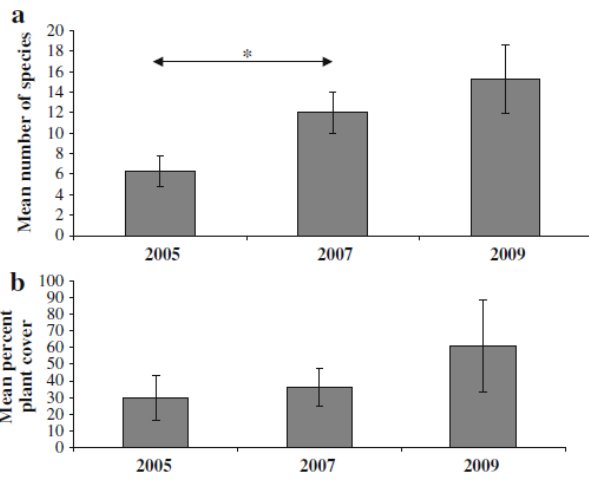
2008

2012

BioControl (2012) 57:191–198
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 calvenscens* in the island of Tahiti

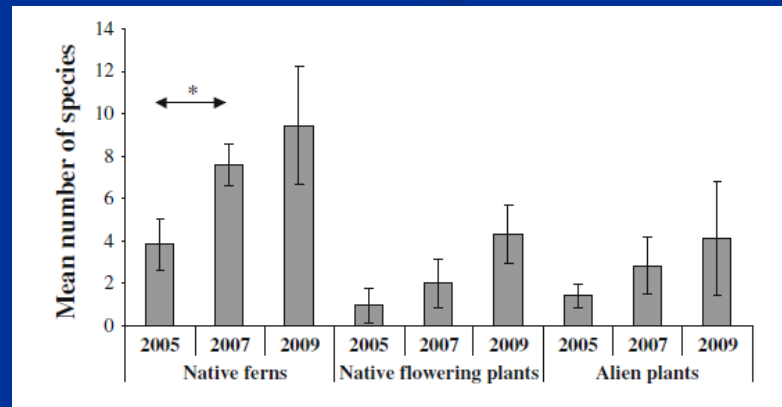
Jean-Yves Meyer · Marie Fourdrigniez ·
Ravahere Taputuarai



Liparis clypeolum



Pittosporum tabitense



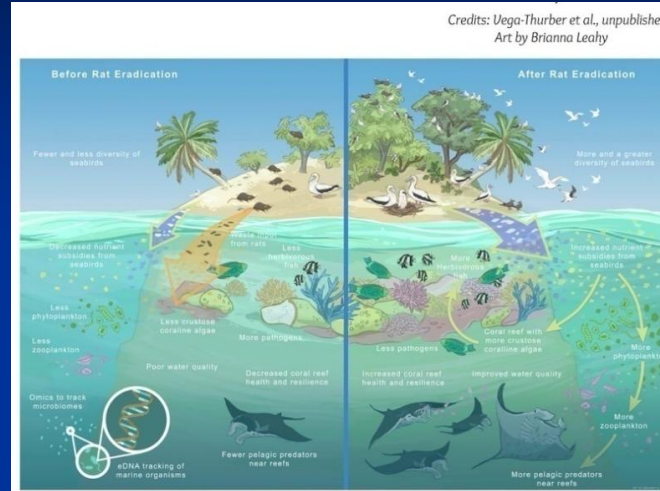
Monitoring (2005-2009)



Psychotria speciosa

Atoll forest restoration in Tetiaroa

- Rat eradication
- Vegetation dynamics (woody plant seedlings incl. coconuts and % herbaceous plant cover)



Monitoring (2018-on going !)

Littoral forest restoration in ILM-Paea, Tahiti



(2021-2023)



(2024-2026)



?

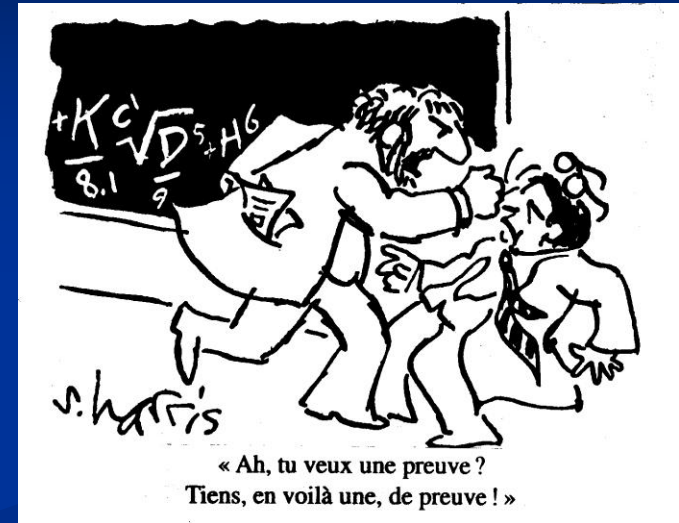


Conclusions: success and failure ?

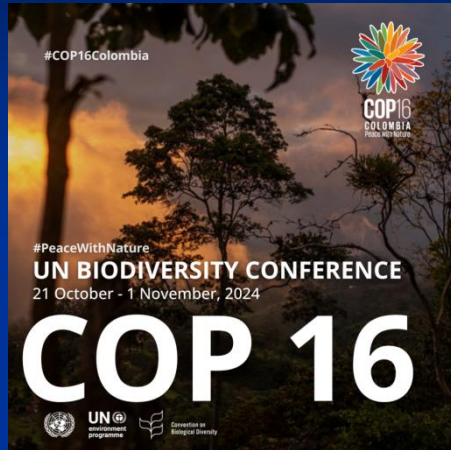
- **Current difficulties to evaluate successes or failures of restoration projects** : lack of clear goals, ecological criteria, standart protocols, monitoring rate, indicators and data...
- **The need for long-term monitoring !**
- **More collaborations and data sharing between stakeholders** (scientists, managers, NGO’s...)



- ❖ **A workshop on restoration ecology in French Polynesia in 2025 (cf. Stratégie de l’Innovation 2030) ?**



Restoring « Ecosystem Health »



“CBD Parties approved a “Global Action Plan on Biodiversity and Health” designed to help curb the emergence of zoonotic diseases, prevent non-communicable diseases, and promote sustainable ecosystems. The strategy embraces a holistic “One Health” approach that recognizes the health of ecosystems, animals, and humans as interconnected”



Ecosystem restoration is integral to humanity's recovery from COVID-19

Elsevier, The Lancet Planetary Health, Volume 6, September 2022

