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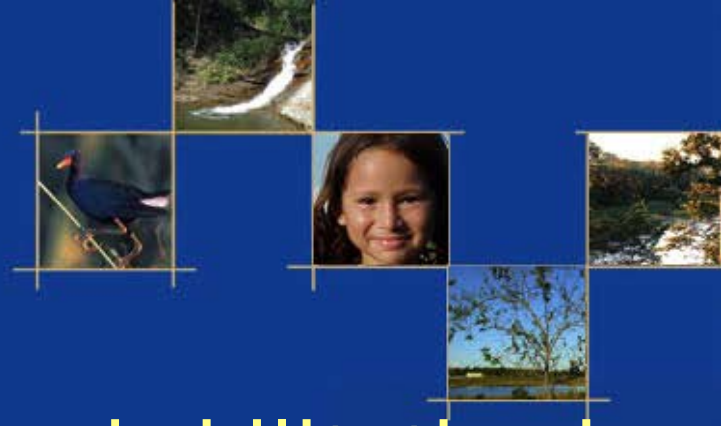


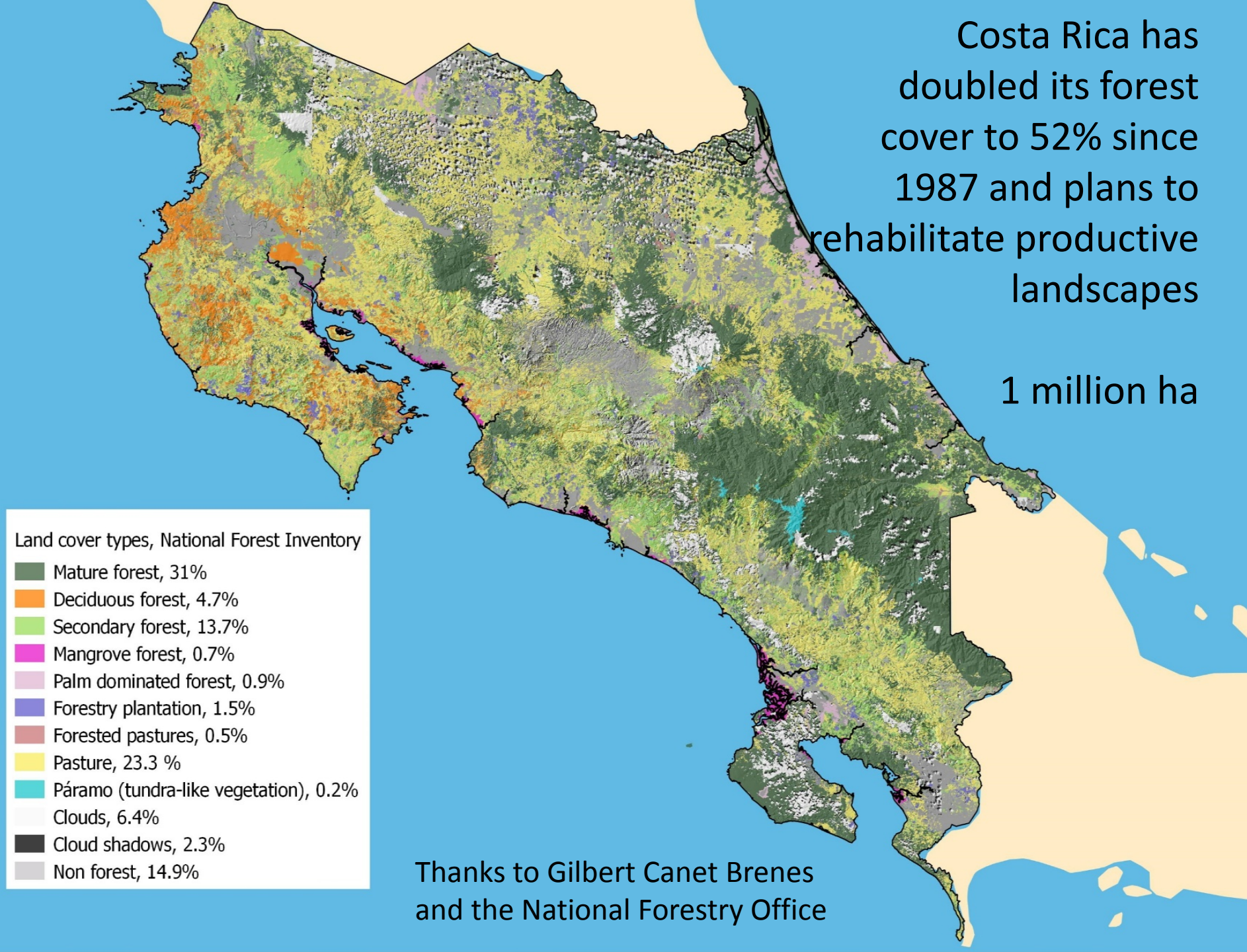
# Forest and ecosystem service rehabilitation in the Anthropocene : lessons from contrasting Costa Rican landscapes

**Bryan Finegan, June 2017**

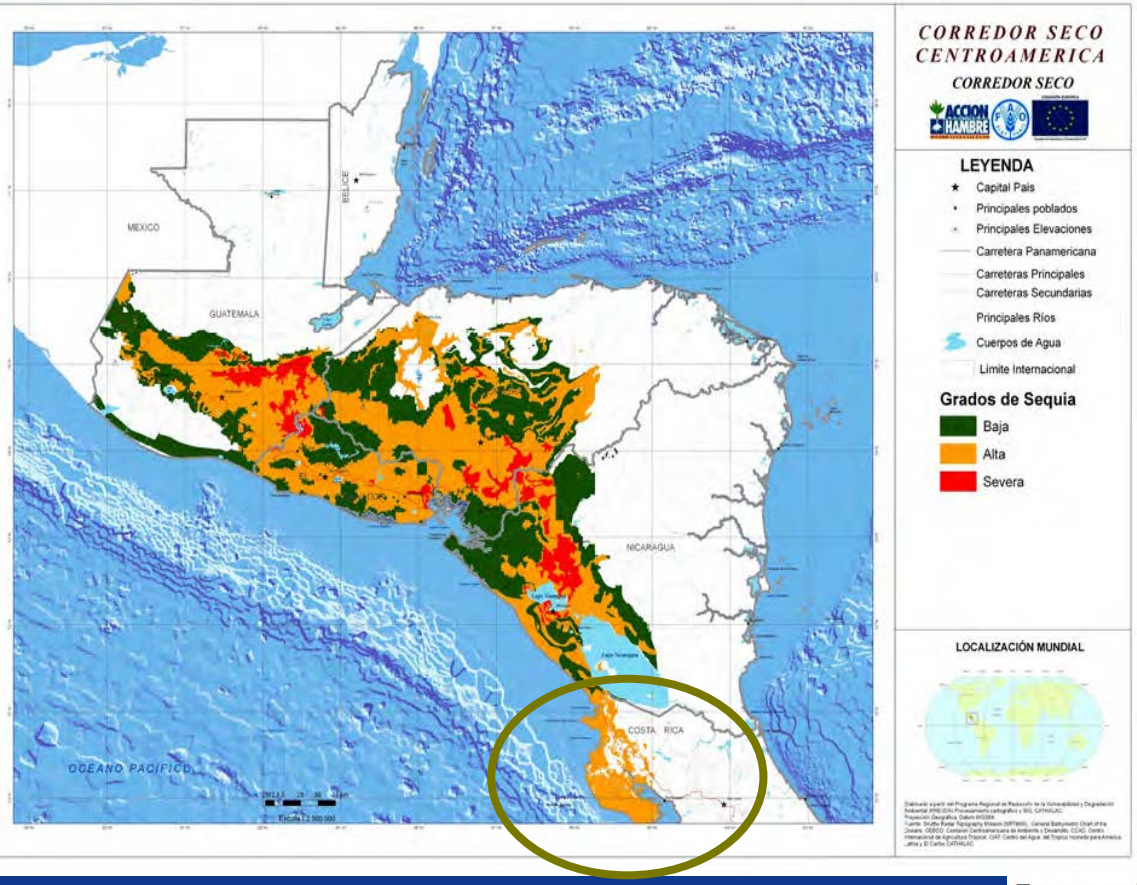
*FLR needs to be conceptualised as a long-term undertaking, in order to yield sustainable outcomes*

Costa Rica has doubled its forest cover to 52% since 1987 and plans to rehabilitate productive landscapes

1 million ha




Thanks to Gilbert Canet Brenes and the National Forestry Office




A seasonally dry landscape with high exposure to drought and fire

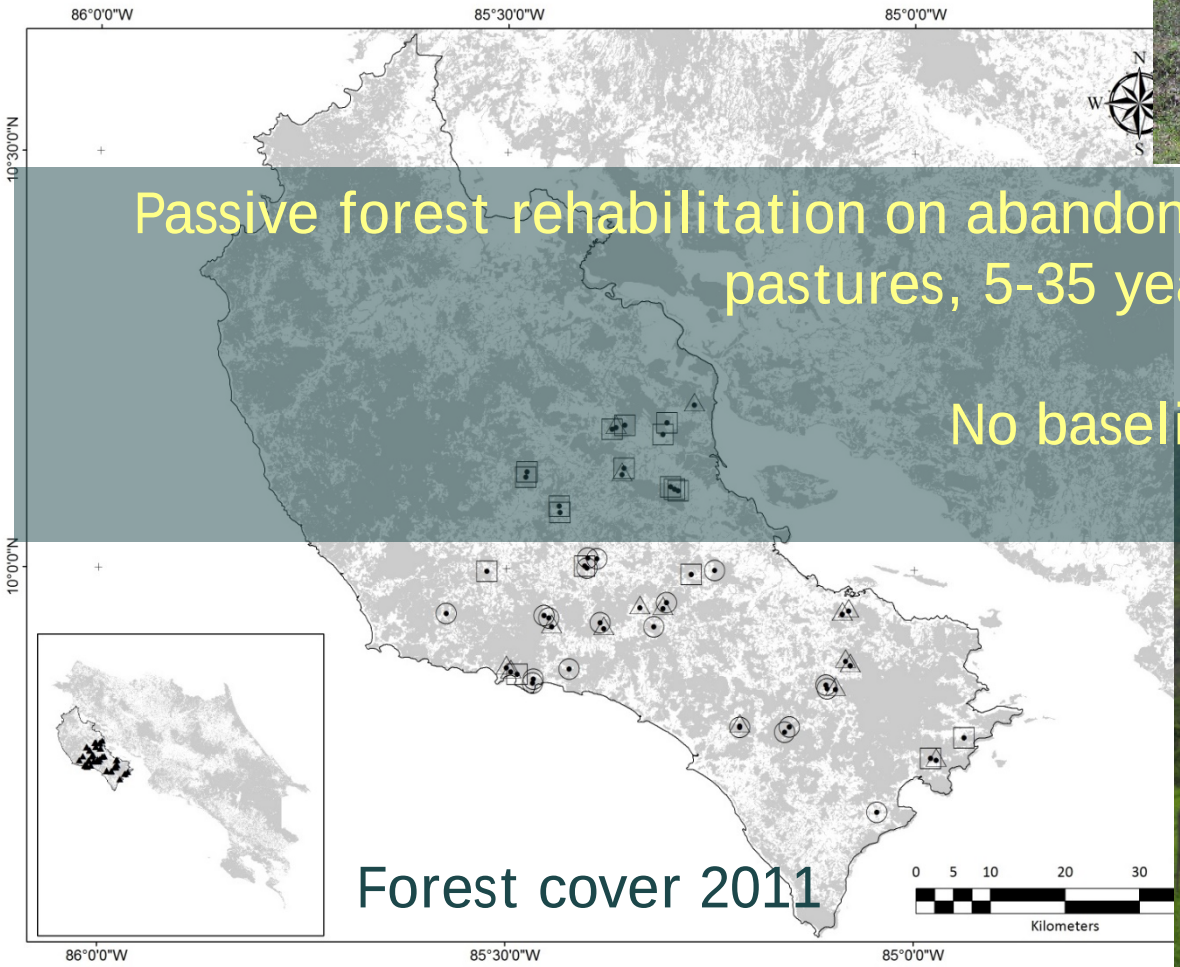
Central America´s Dry Corridor; FAO 2012

Elpais.cr

**Incendio destruyó en un 75 % parque Diriá en Santa Cruz**

Por Henry Morales Navarro, Vozdeguanacaste.com - 23 Abril, 2015 - EnNacionales 0

Arroyo-Mora *et al.* 2005



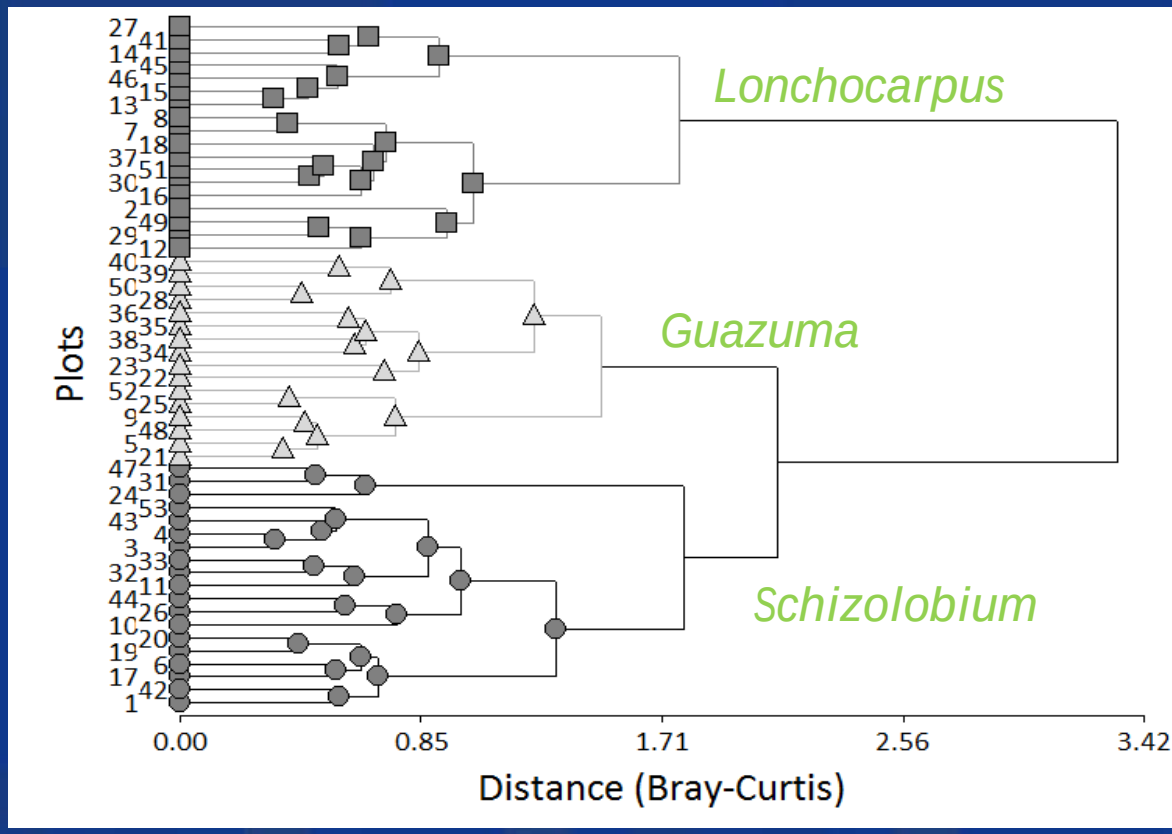

Passive forest rehabilitation on abandoned pastures, 5-35 years

No baseline

Forest cover 2011

# Compositional variation in no-analog rehabilitated forests


All stems ≥5 cm dbh in 53 plots of 0.12 ha



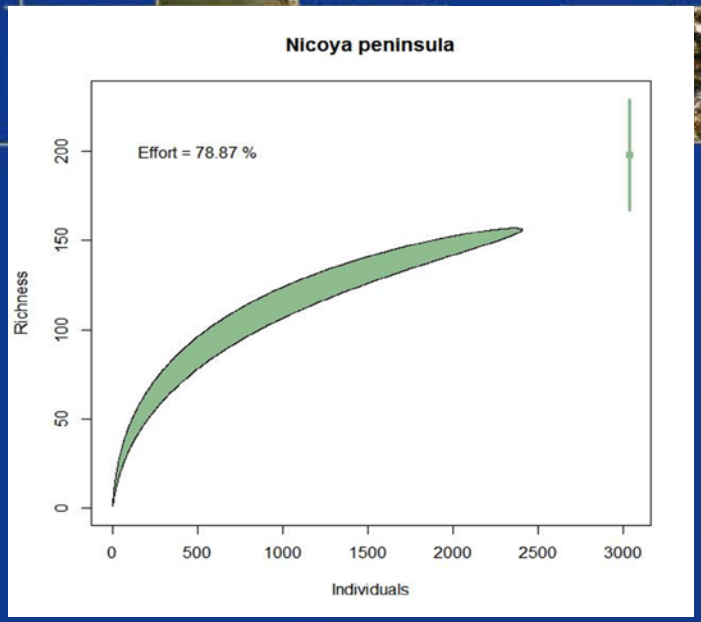
# low species diversity in no-analog rehabilitated forests

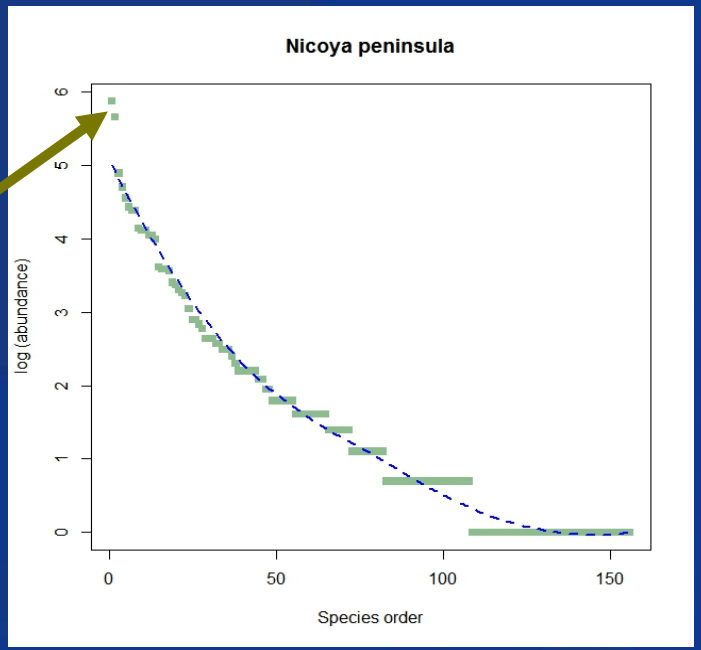
150 tree and palm species observed, ≥ 5 cm dbh

ca. 200 estimated


*Guazuma ulmifolia*
*Cordia alliodora*
*Gmelina arborea*

*30% of stems*

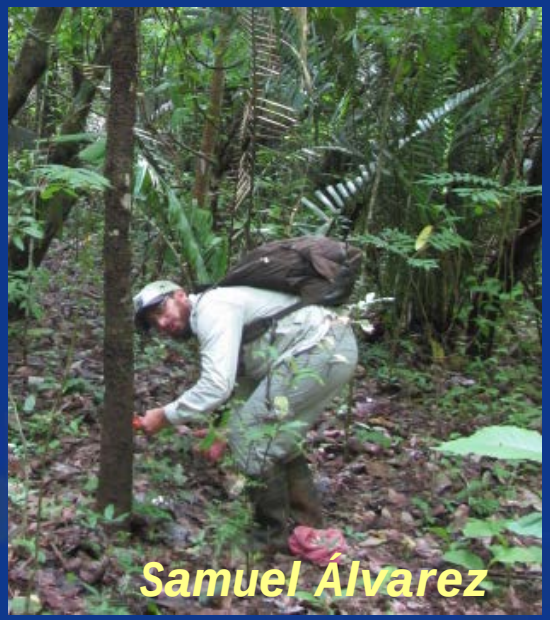


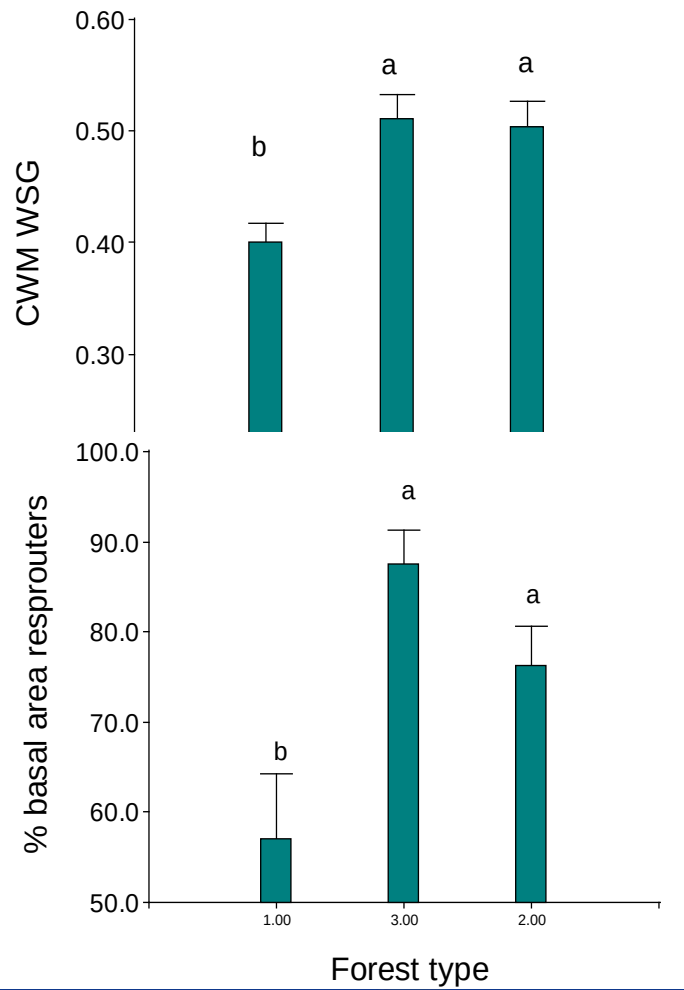



# Forest functional properties linked to fire tolerance differ among forest types (Álvarez et al. in prep.)

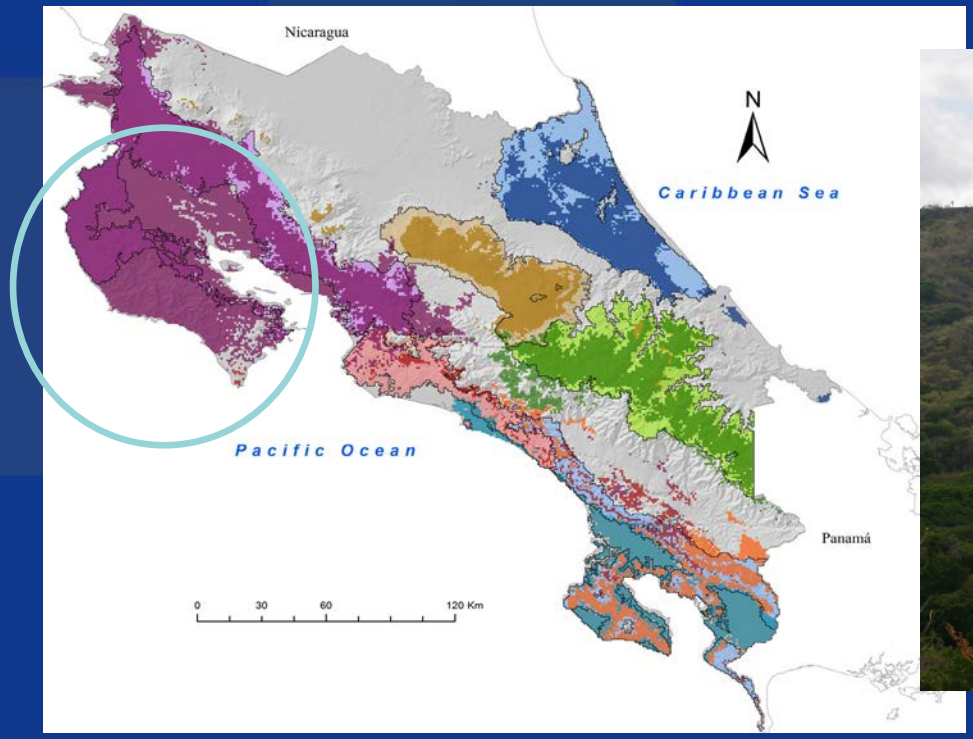
WSG and resprouting (0/1) are strong correlates of local perception of fire tolerance

(64 species measured for 17 functional traits)



# This landscape is *likely* to be tropical dry forest (purple) by 2050 (19 GCMs, RCP 4.5)

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Climatic Change
DOI 10.1007/s10584-016-1789-8

**Mapping conservation priorities and connectivity pathways under climate change for tropical ecosystems**

Emily Fung[1] · Pablo Imbach[1] · Lenin Corrales[1,2] · Sergio Vilchez[3] · Nelson Zamora[4] · Freddy Argotty[1] · Lee Hannah[5] · Zayra Ramos[6,7]

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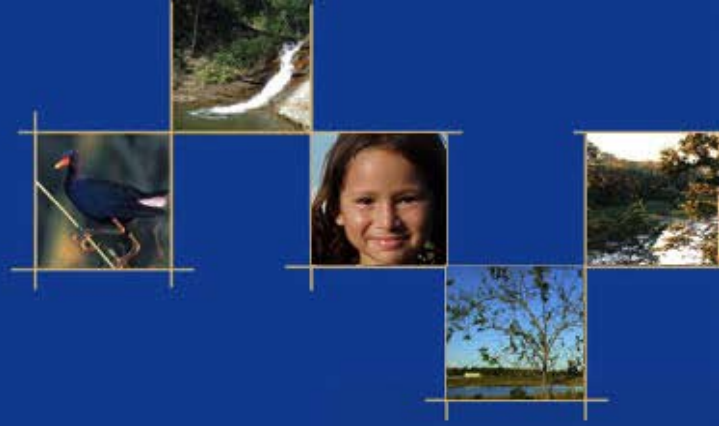


# the need to rehabilitate forest currently considered mature because of climate change: San Juan La Selva Biological Corridor

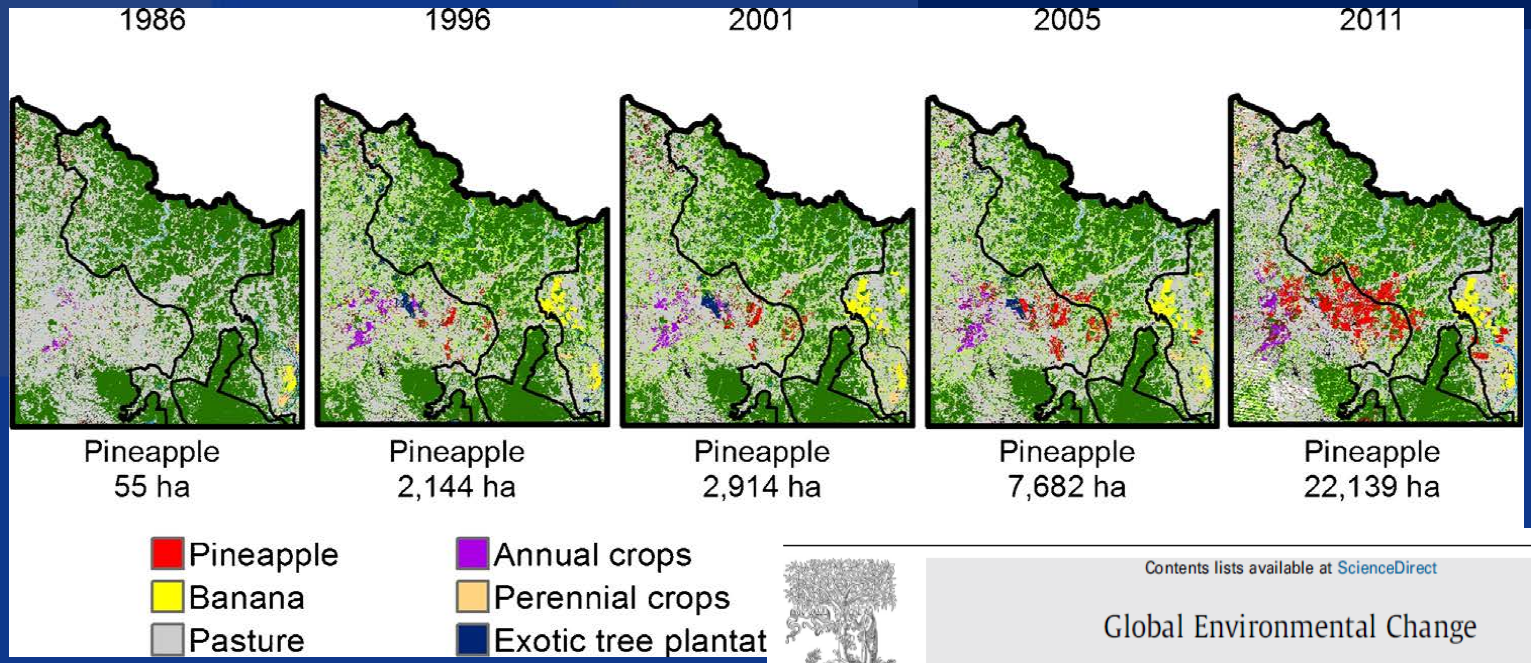
Morse, W. C., J. L. Schedlbauer, S. E. Sesnie, B. Finegan, C. A. Harvey, S. J. Hollenhorst, K. L. Kavanagh, D. Stoian, and J. D. Wulfhorst. 2009. Consequences of environmental service payments for forest retention and recruitment in a Costa Rican biological corridor. *Ecology and Society* 14(1): 23. [online] URL: http://www.ecologyandsociety.org/vol14/iss1/art23/

*Research*

## Consequences of Environmental Service Payments for Forest Retention and Recruitment in a Costa Rican Biological Corridor

*Wayde C. Morse*[1,2], *Jessica L. Schedlbauer*[1,2], *Steven E. Sesnie*[1,2], *Bryan Finegan*[1], *Celia A. Harvey*[1,3], *Steven J. Hollenhorst*[2], *Kathleen L. Kavanagh*[2], *Dietmar Stoian*[1], *and J. D. Wulfhorst*[2]

*Baseline*: relatively stable mature forest cover, agricultural intensification in the matrix

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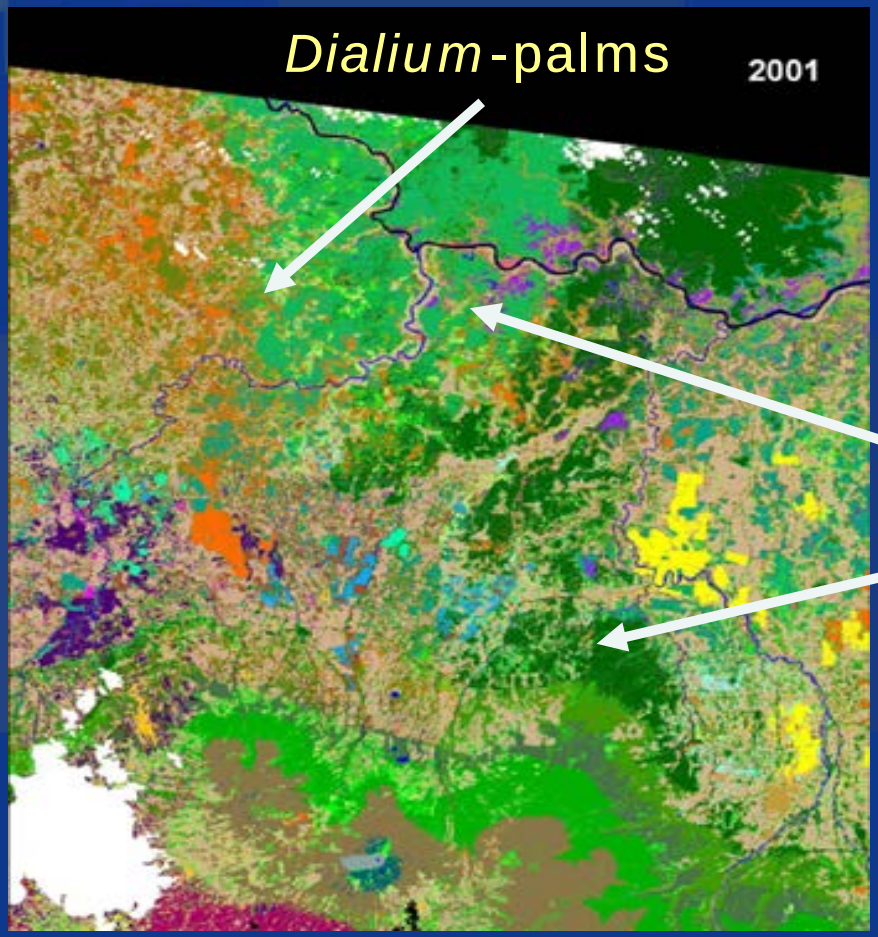
journal homepage: www.elsevier.com/locate/gloenvcha

## Coupled social and ecological outcomes of agricultural intensification in Costa Rica and the future of biodiversity conservation in tropical agricultural regions

Irene Shaver[a,c,*], Adina Chain-Guadarrama[b,c], Katherine A. Cleary[c,d], Andre Sanfiorenzo[a,c], Ricardo J. Santiago-García[a,c], Bryan Finegan[g], Leontina Hormel[h], Nicole Sibelet[i,j], Lee A. Vierling[b], Nilsa A. Bosque-Pérez[e], Fabrice DeClerck[f], Matthew E. Fagan[k], Lisette P. Waits[d]

*Baseline*: pre-Anthropocene tropical wet forest composition characterised and mapped




*International Journal of Remote Sensing*
Vol. 31, No. 11, 10 June 2010, 2885–2909
Taylor & Francis
Taylor & Francis Group

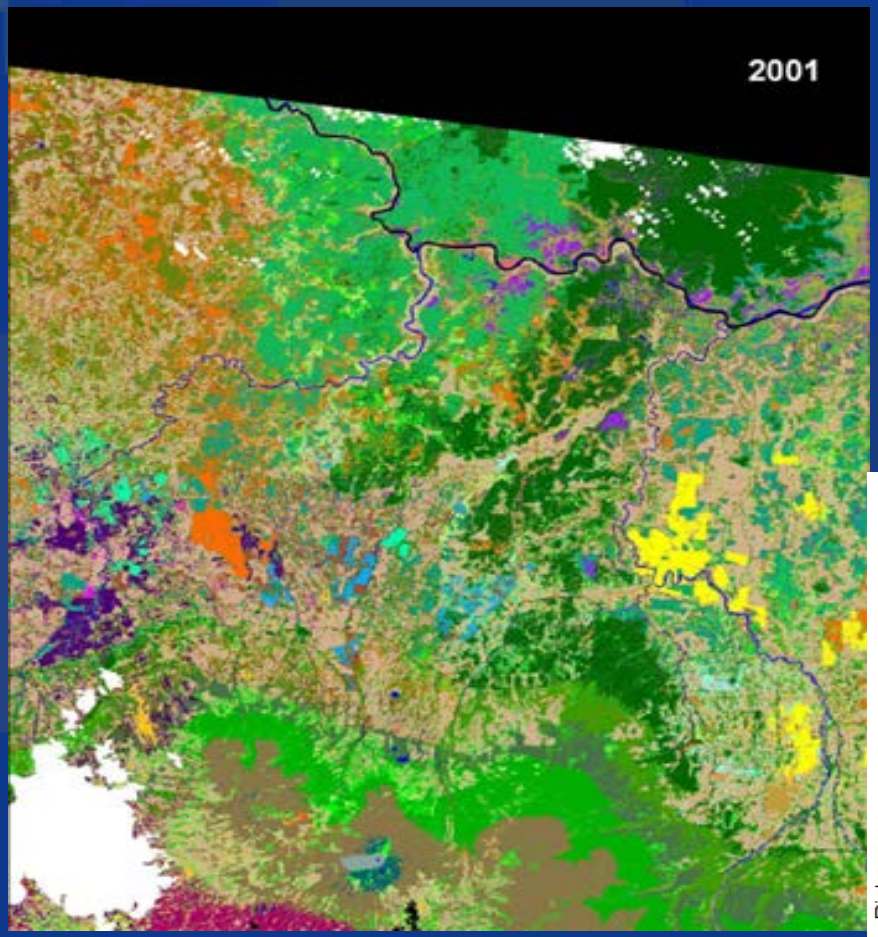
**The multispectral separability of Costa Rican rainforest types with support vector machines and Random Forest decision trees**

STEVEN E. SESNIE*†‡, BRYAN FINEGAN‡, PAUL E. GESSLER†¶, SIRPA THESSLER§, ZAYRA RAMOS BENDANA‡ and ALISTAIR M. S. SMITH†¶

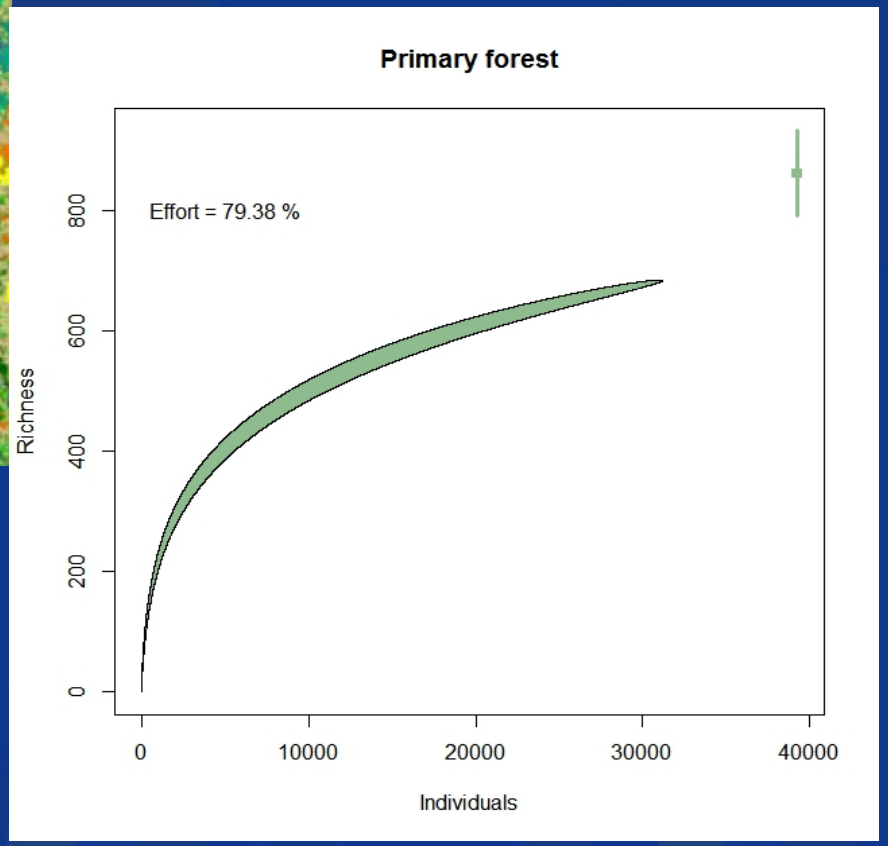
127 0.25 ha plots

trees >30 cm dbh,

palms >10 cm dbh



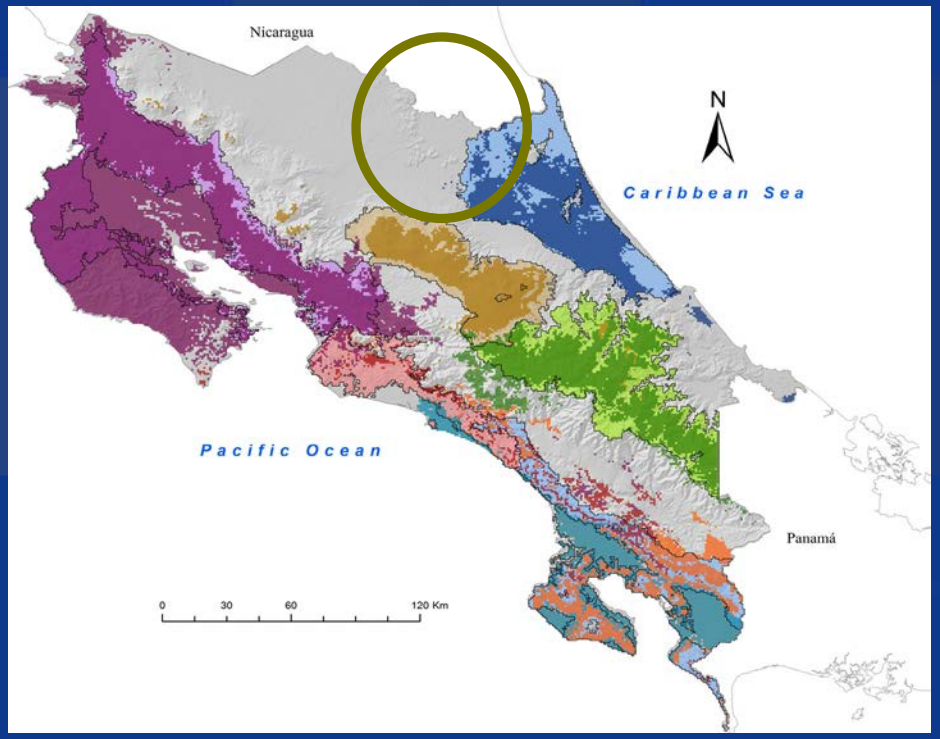

*Baseline*: species richness and diversity characterised at multiple scales




683 tree and palm species observed, ≥ 10 cm dbh

>800 estimated

# ***2050: the future of this tropical wet forest is highly uncertain*** (19 GCMs, RCP 4.5)

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CrossMark

**Mapping conservation priorities and connectivity pathways under climate change for tropical ecosystems**

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Research

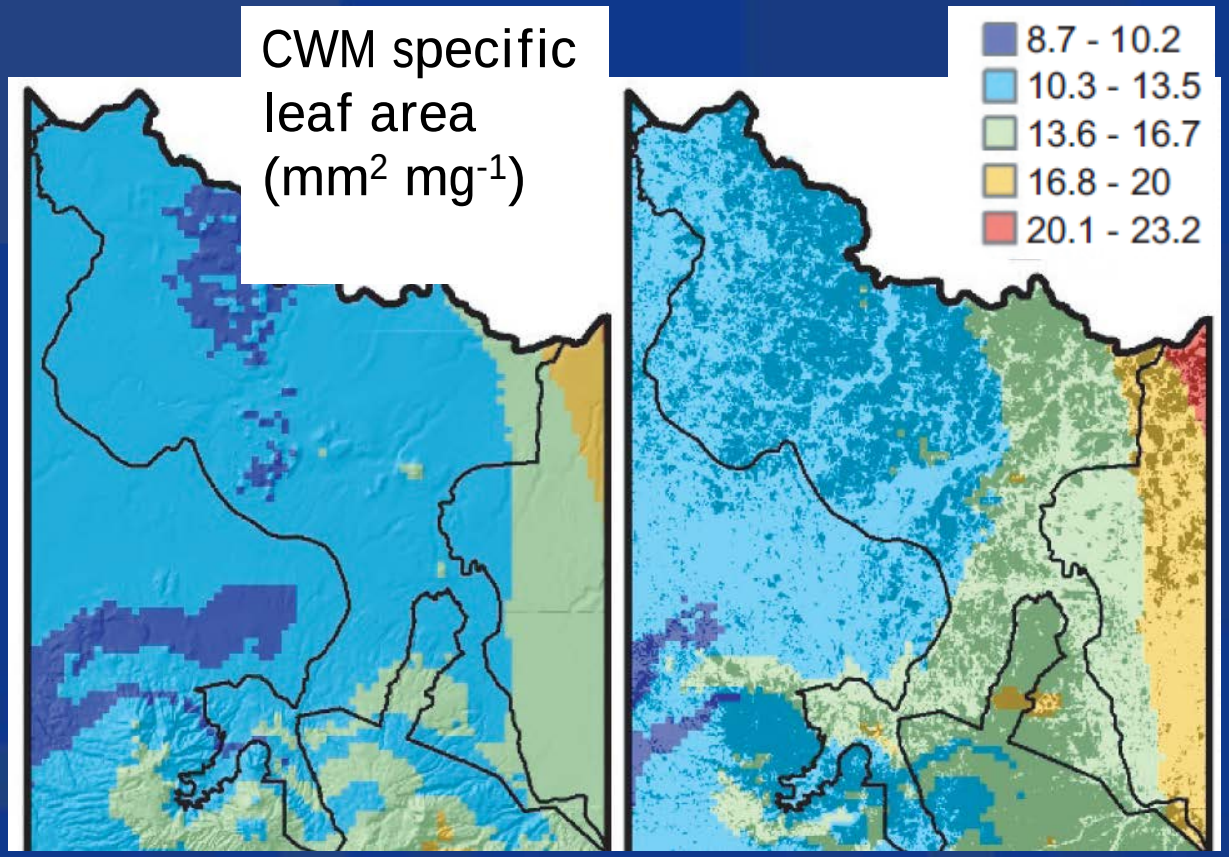
Ecography 40: 001–014, 2017
doi: 10.1111/ecog.02637

Subject Editor: Jason Pither. Editor-in-Chief: Jens-Christian Svenning. Accepted 13 February 2017

**Potential trajectories of old-growth Neotropical forest functional composition under climate change**

Adina Chain-Guadarrama, Pablo Imbach, Sergio Vilchez-Mendoza, Lee A. Vierling and Bryan Finegan

# *Baseline and potential response to climate change -* forest canopy functional properties




2050, 17 GCMs, RCP 8.5

127 0.25 ha plots

traits for 253 tree and palm species

GAMMs

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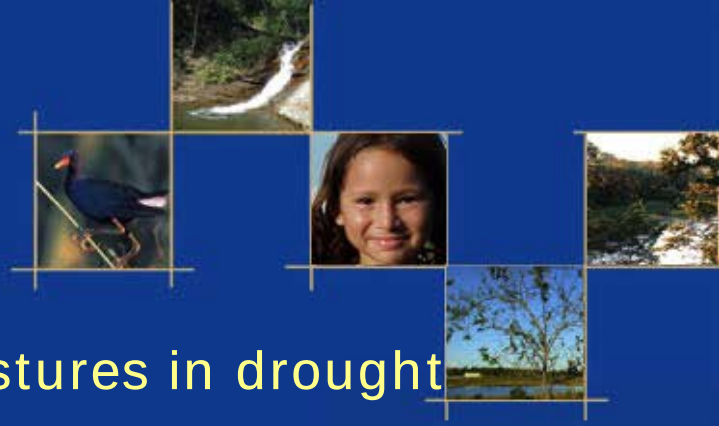
# Messages



- No-analog forests rehabilitated on pastures in drought affected areas are already a fact of life but their ecological sensitivity to climate change and fire require evaluation
- Fire ecology and proactive, not reactive, fire management of these broadleaved forests are now a pressing concern
- Tropical forests currently considered mature will have to be rehabilitated during the coming decades due to cllimate change
- Forest rehabilitation/restoration, adaptation and mitigation need to be considered holistically - synergies