roots in the sea

Nico Koedam

Diana Di Nitto

Vrije Universiteit Brussel

VLIZ, February 12th, 2016

Gazi, (legal) harvest of mangrove building poles

“Amsterdam die mooie stad, die is gebouwd op palen....”

Gazi, (legal) harvest of mangrove building poles


Gerrit Adriaensz Berckheyde (1638-1698)
View of the Golden Bend, Amsterdam (Herengracht)
(1671-1672)
Rijksmuseum Amsterdam

DEN EERSTEN MEŸ ANNO 1598
- MAVRITIVS HOLLANT OVRŸSSEL EN VRIESLANT
  - VIER SCHEPEN SŸN GESEŸLT OM SPECERŸ TE HALEN
    - DEN NEGENTIENDEN IULŸ ANNO 1599
      - NAER BANTAM HEBBEN OOCK DEN HANDEL DAER GEPLANT
        - EN QUAMEN RŸCKLŸC WEER VOOR DAMSTERDAMSCHE PALEN

"1598....four ships sailed.... to Bantam.....and richly returned for **Amsterdam's poles**...."

Hendrick Cornelisz Vroom (1566-1640)
The return to Amsterdam of the 2nd expedition to the East Indies (1599), Rijksmuseum Amsterdam

Earlier lives....

Physio-ecology temperate forests

Koedam N & Büscher P 1983
Studies on the possible role of cation exchange capacity in the soil preference of mosses.
Plant and Soil, 70, 1, 77-93

Fungal-bacterial interactions

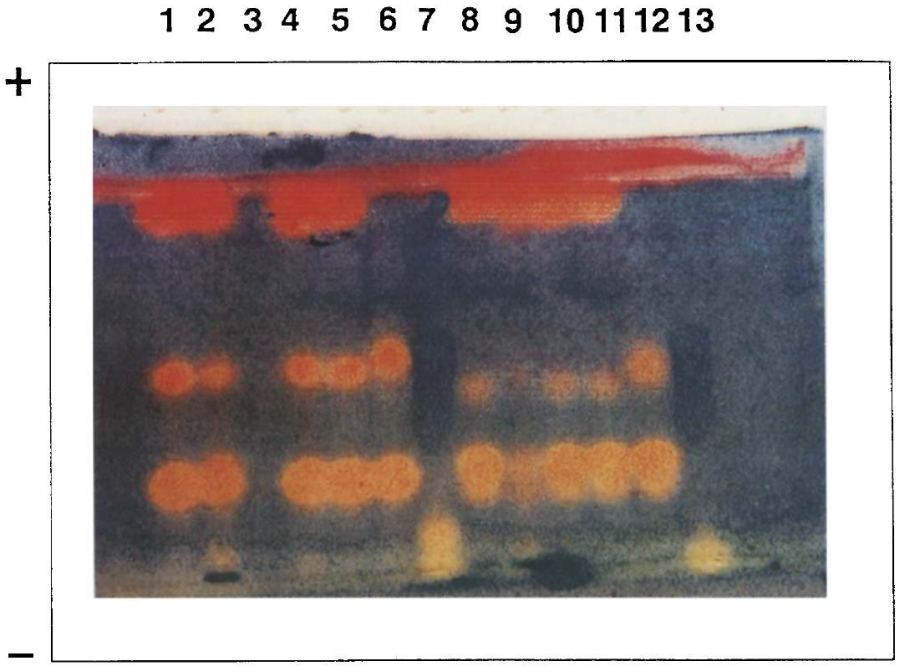


Figure 4. Patterns of partially purified siderophores after IEF as detected in the CAS overlay of *P. aeruginosa* cultures grown in the presence of different metal ions (CAA medium + filter-sterilized metal ion solutions). Lanes 1–7, PA01; lanes 8–13, PA3; lanes 1 and 8, no metal ions added; lanes 2 and 9, + 0.5 mM Fe; lanes 4 and 10, + 2 mM Zn; lanes 5 and 11, + 2 mM Cd, lanes 6 and 12, + 2 mM Ni; lanes 7 and 13, + 2 mM Al. Anode (+) and cathode (−). The figure shows a color scan of the original CAS overlay gel.

Detection and differentiation of microbial siderophores by isoelectric focusing and chrome azurol S overlay

Nico Koedam, Etienne Wittouck, Ahmed Gaballa, Anja Gillis, Monica Höfte* & Pierre Cornelis

BioMetals 1994, 7, 287–291

- Roots in the sea – branches in the air
- Science for the sake of science ?
- Mind the gap
- Straying away allowed
- A first retrospection

Belgian involvement in mangrove research started from the 'South' with two persons

Dirk Van Speybroeck

VVOB lecturer at University of Nairobi 1988-93
Then: UNEP officer 1993-97

Belgian involvement in mangrove research started from the 'South' with two persons

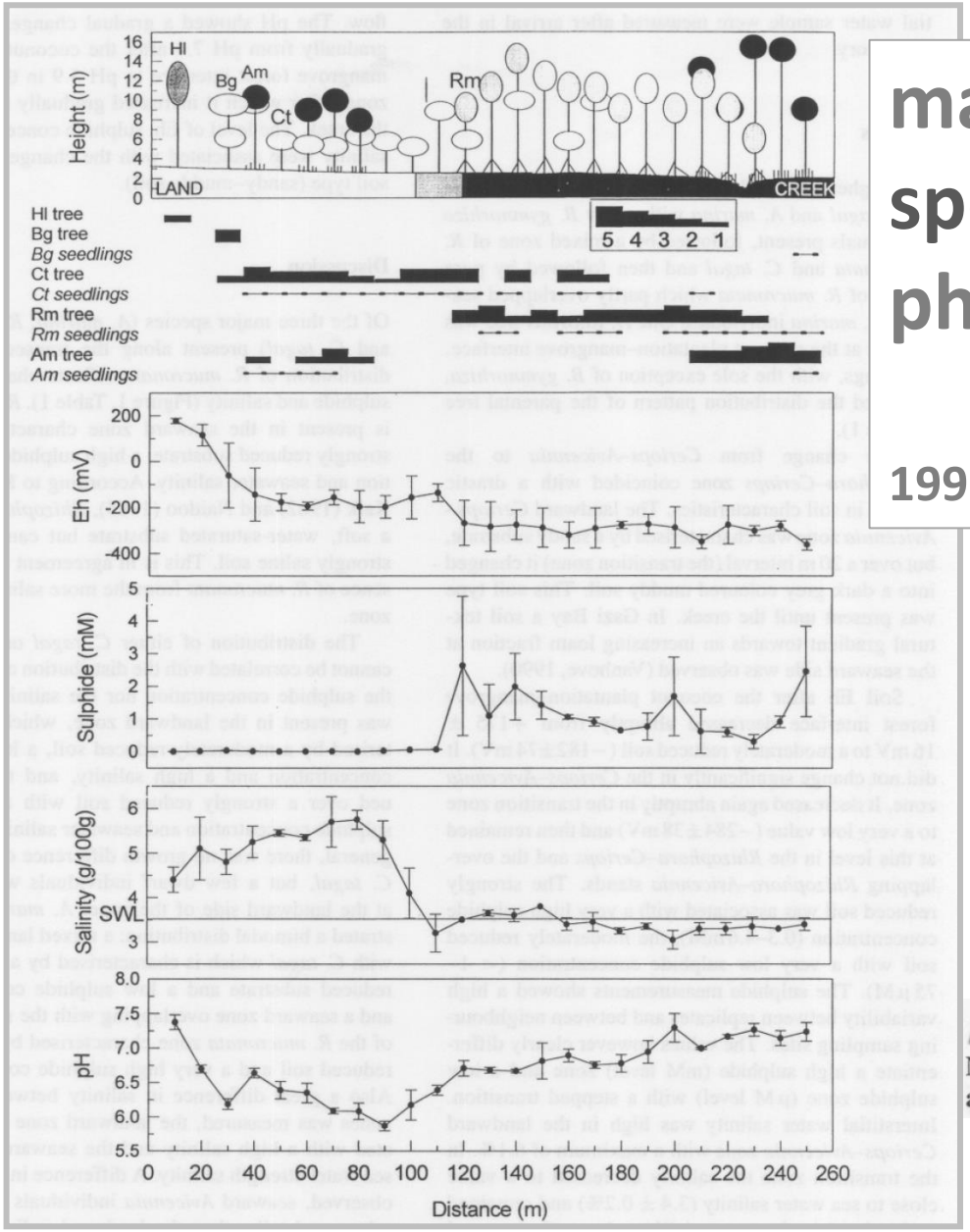
Dirk Van Speybroeck

James G. Kairo – MSc student - 1993

University of Nairobi

....and a field course

"....June 1990 a field course to the Kenya coast with +/- 60 second year students (as part of SBT 203 Plant Ecology) of the University of Nairobi…."



mangrove physio-ecology : species zonation and its physicochemical drivers

1999: start of scientific mangrove career

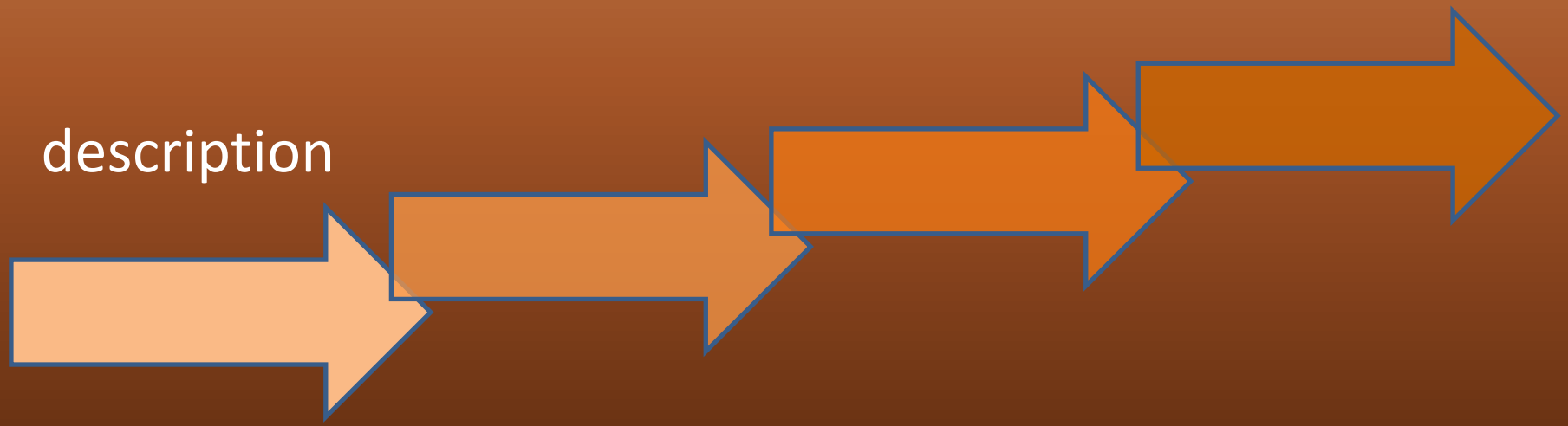
Mangroves and Salt Marshes 3: 243–249, 1999.

Mangrove species zonation and soil redox state, sulphide concentration and salinity in Gazi Bay (Kenya), a preliminary study

Sandra Matthijs, licentie Biologie, 1995

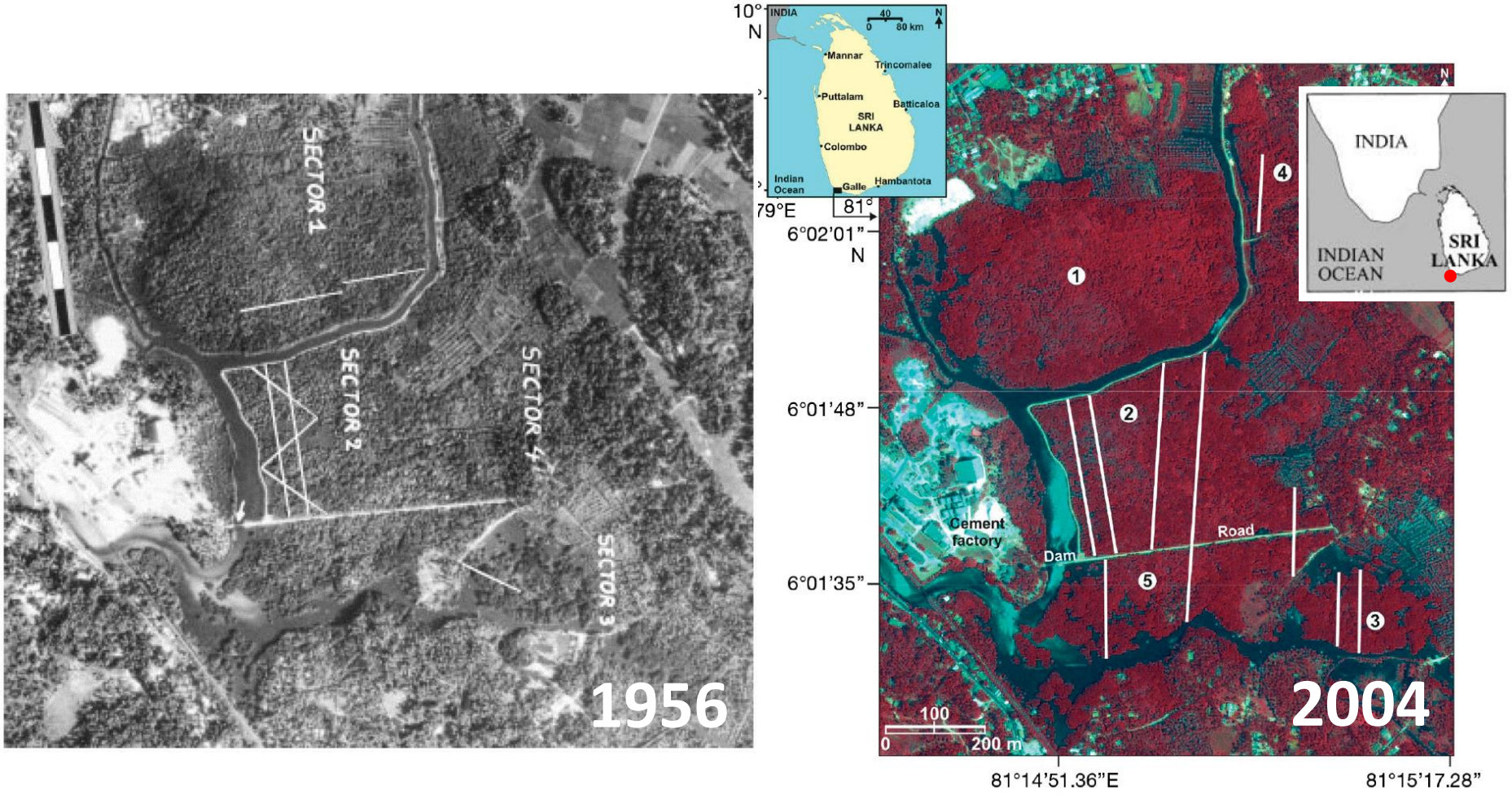
MANGROVES

description



Aerial photograph mangrove area 1956 – Galle, Sri Lanka

mangrove **vegetation structure** and retrospective dynamics



mangrove vegetation structure – long term observation (aerial & satellite RS / ground truthing)

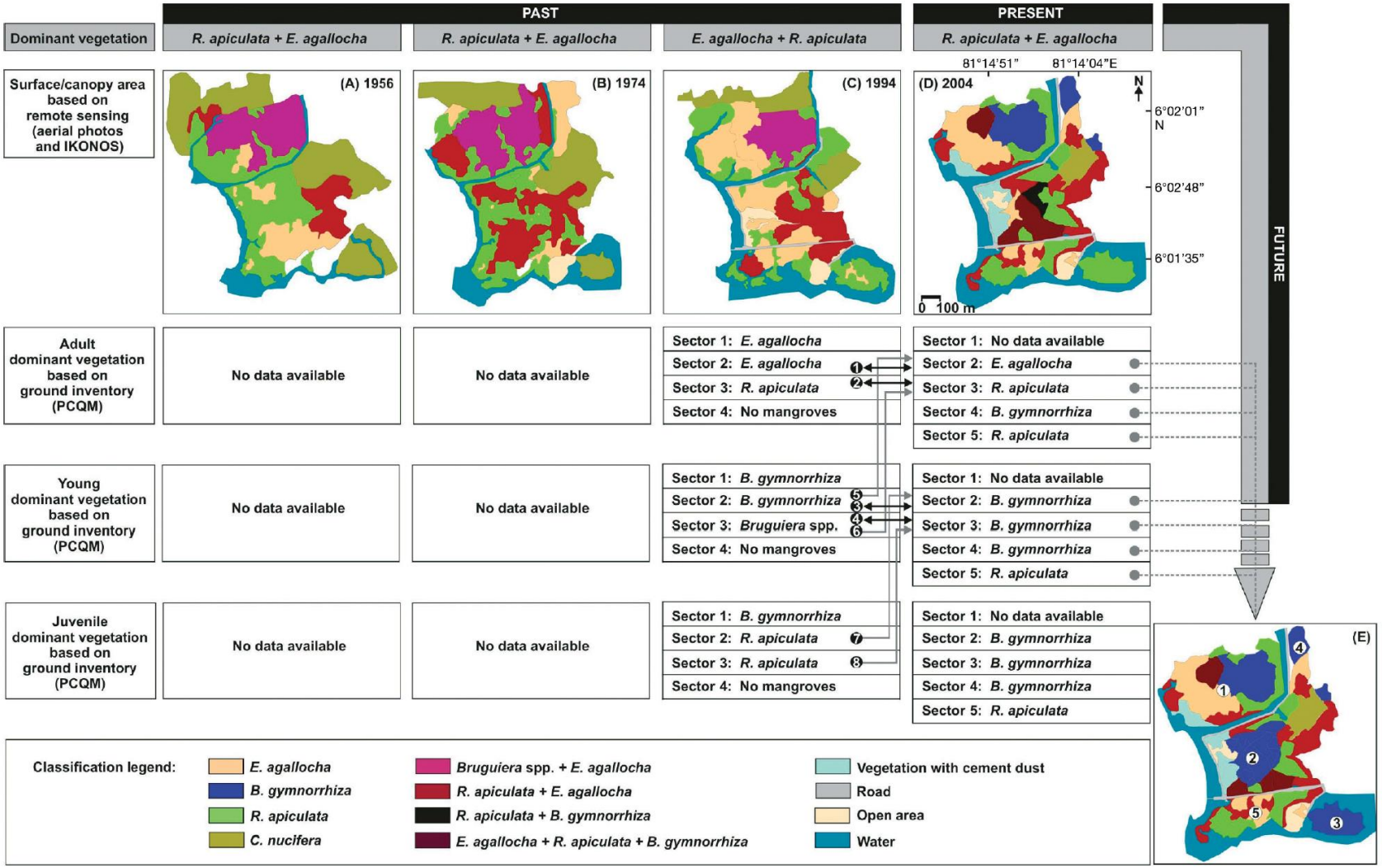


Fig. 3. Digitized vegetation maps of Galle-Unawatuna mangroves along with ground-truth information on the (dominant) adult and young trees: (A–C) distribution of mangrove species/assemblages from 1956 to 1994, (D) distribution of mangrove species/assemblages in 2004 based on ground-truth and IKONOS satellite imagery, and (E) predicted future mangrove structural scenario with the abundance of *Bruguiera gymnorrhiza*. Numbers in each white circle of (E) represent the mangrove sectors as outlined in Fig. 1; black circles with white numbers along gray arrows signify different phases in the vegetation (from juvenile to young and from young to adult within the same sector) that could be responsible for possible mangrove structural changes between 1994 and 2004. Black arrows indicate a similar comparison but within the same vegetation layer. See 'Discussion' for a detailed description of the black circles

Vol. 443: 51–63, 2011
doi: 10.3354/meps09397

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

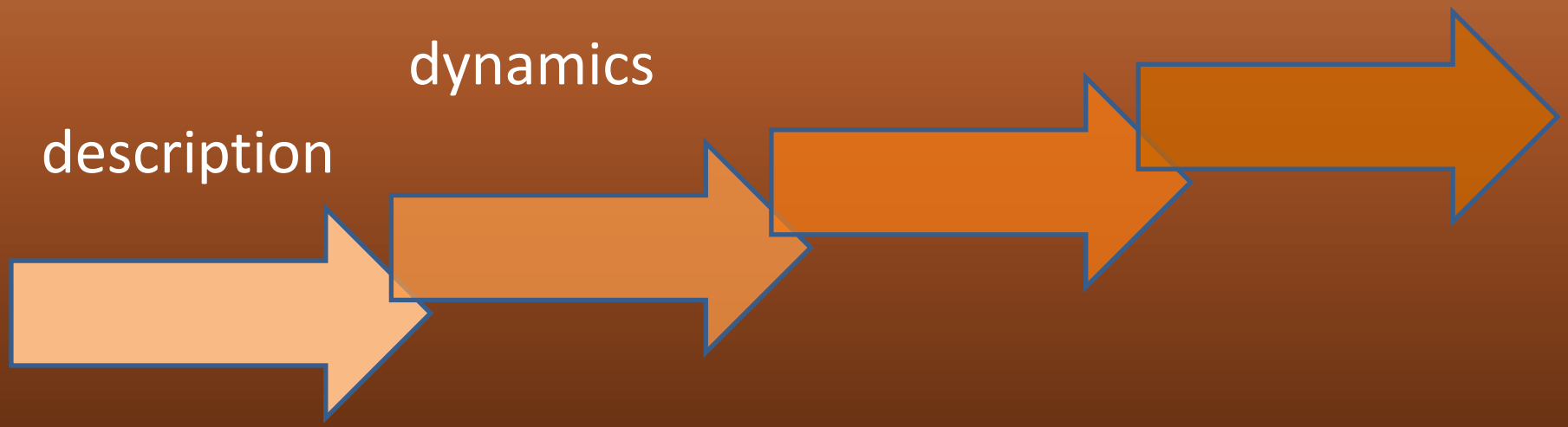
Long-term mangrove forest development in Sri Lanka: early predictions evaluated against outcomes using VHR remote sensing and VHR ground-truth data

Behara Satyanarayana[1,2,3], Nico Koedam[2], Kriki De Smet[2], Diana Di Nitto[1,2], Maite Bauwens[2], Loku Pulukkuttige Jayatissa[4], Stefano Cannicci[5], Farid Dahdouh-Guebas[1,2,*]

MSc 1994 (crabs)
PhD 2001 (vegetation)

Farid Dahdouh-Guebas, Biology VUB Erasmus → Firenze (**mangrove crabs**) → Brussels
→ Vrije Universiteit Brussel
→ Université Libre de Bruxelles

MANGROVES



- Roots in the sea – branches in the air
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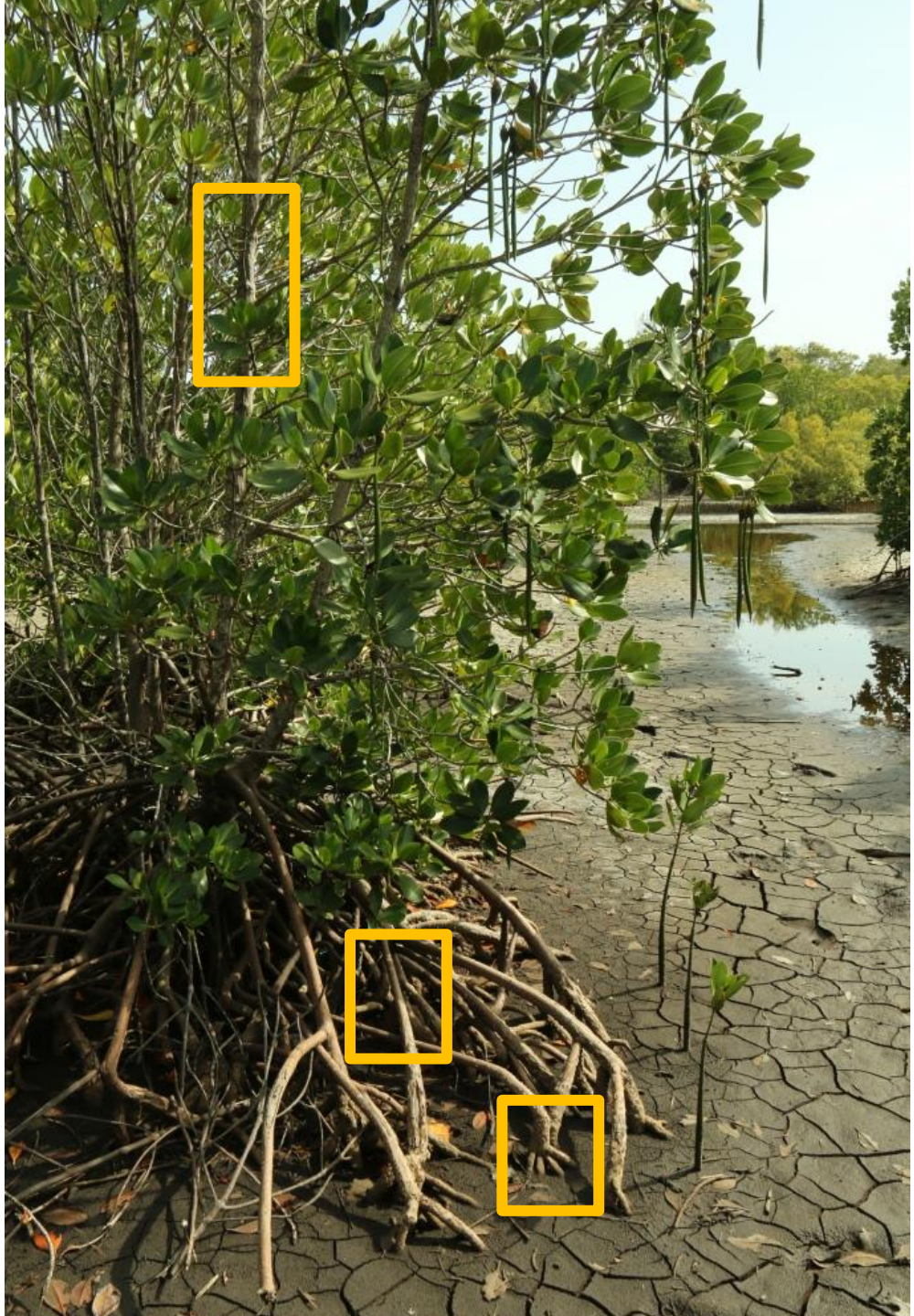
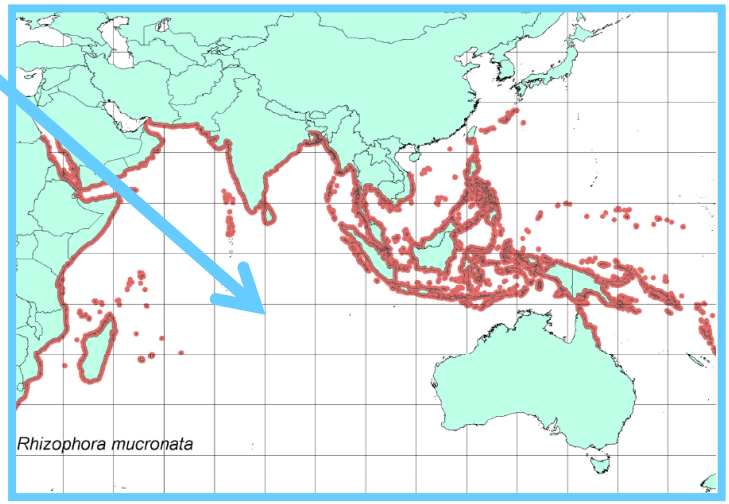


How to survive (drought, hypoxia, nutrient imbalance, salinity far above seawater,...)

How to survive (drought, hypoxia, nutrient imbalance, salinity far above seawater,...)

How to reproduce, recruit, disperse, establish...

Short Distance Dispersal – Long Distance Dispersal



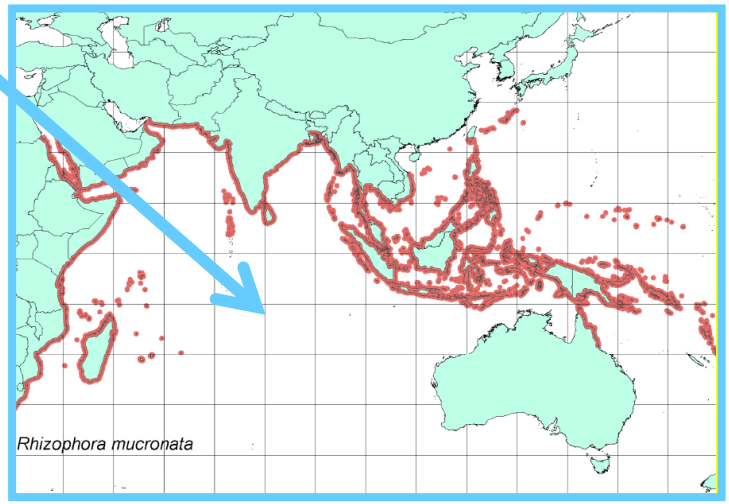
Spalding et al., 2008 (draft version)

How to survive (drought, hypoxia, nutrient imbalance, salinity far above seawater,...)

How to reproduce, recruit, disperse, establish...

How to adapt and evolve...

SDD - LDD



Spalding et al., 2008 (draft version)

MANGROVES

water

"tree habitat paradox"

a **very hostile environment** for tree growth in general but **thriving forests**

Efficiency

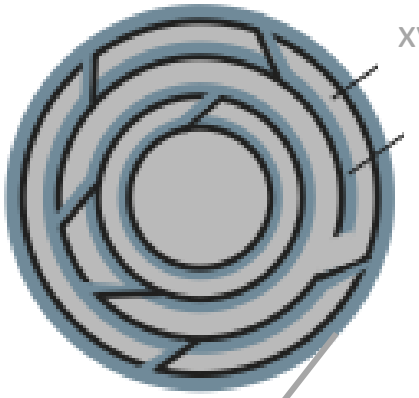
- good water uptake
- good water transport
- ….

Safety

- avoiding damage
- coping with damage
- ….

Properties ? Processes ? Triggers ? Effects ?

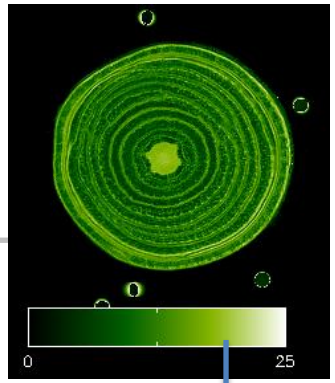
anatomical features in the **vessels and meristems** – key to environmental adaptation



Avicennia has a **high proportion** of **internal phloem tissue** and shows a patchy growth through **successive cambia**

= ALLOWS COPING WITH EXTREME ENVIRONMENTAL CONDITIONS

Robert *et al.*, 2011 – PLoS ONE

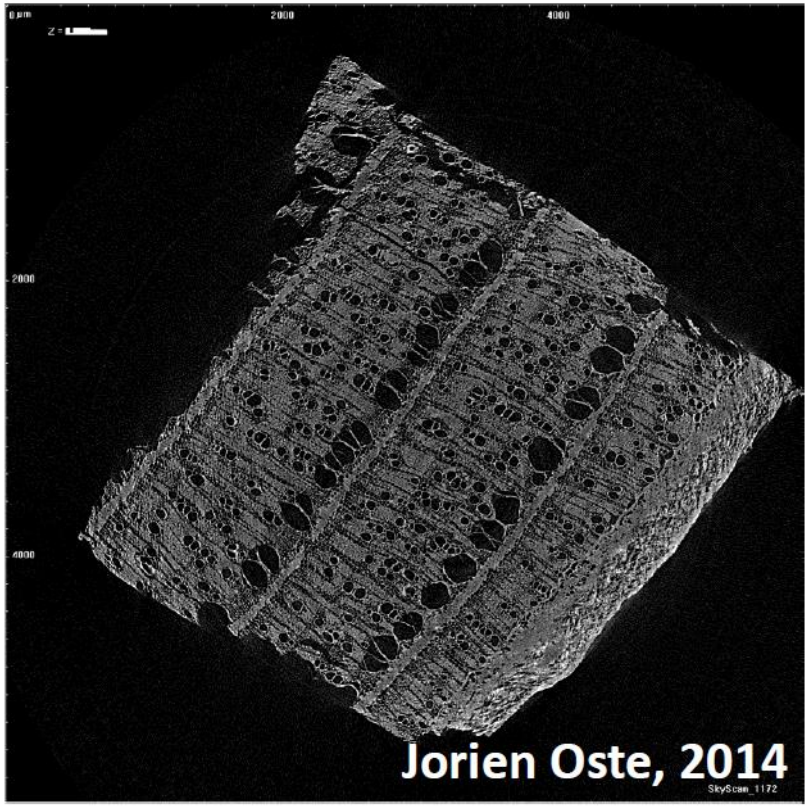


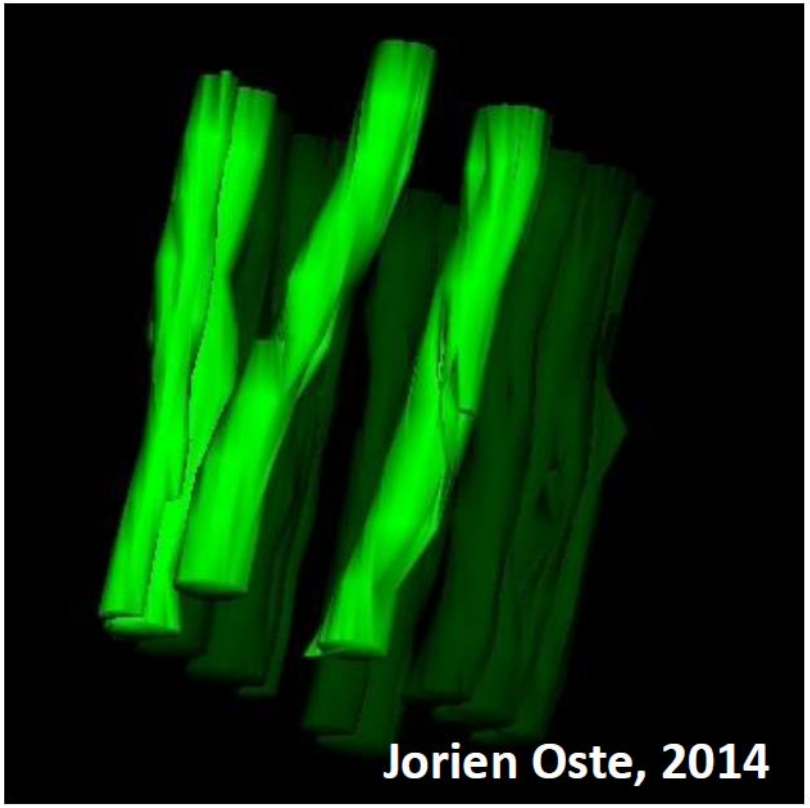
lighter = more water

Internal phloem tissue has high water content

→ presence of water in the stem

Guidance and experimental equipment: Dr Henk Van As *et al.* (Wageningen University)





micro CT scan ‘sections’ - 3D vessel reconstruction

MANGROVES

impacts and survival

ABIOTIC - tree and root burial due to natural and human causes: experimental simulation – tree response and survival

Judith Auma Okello

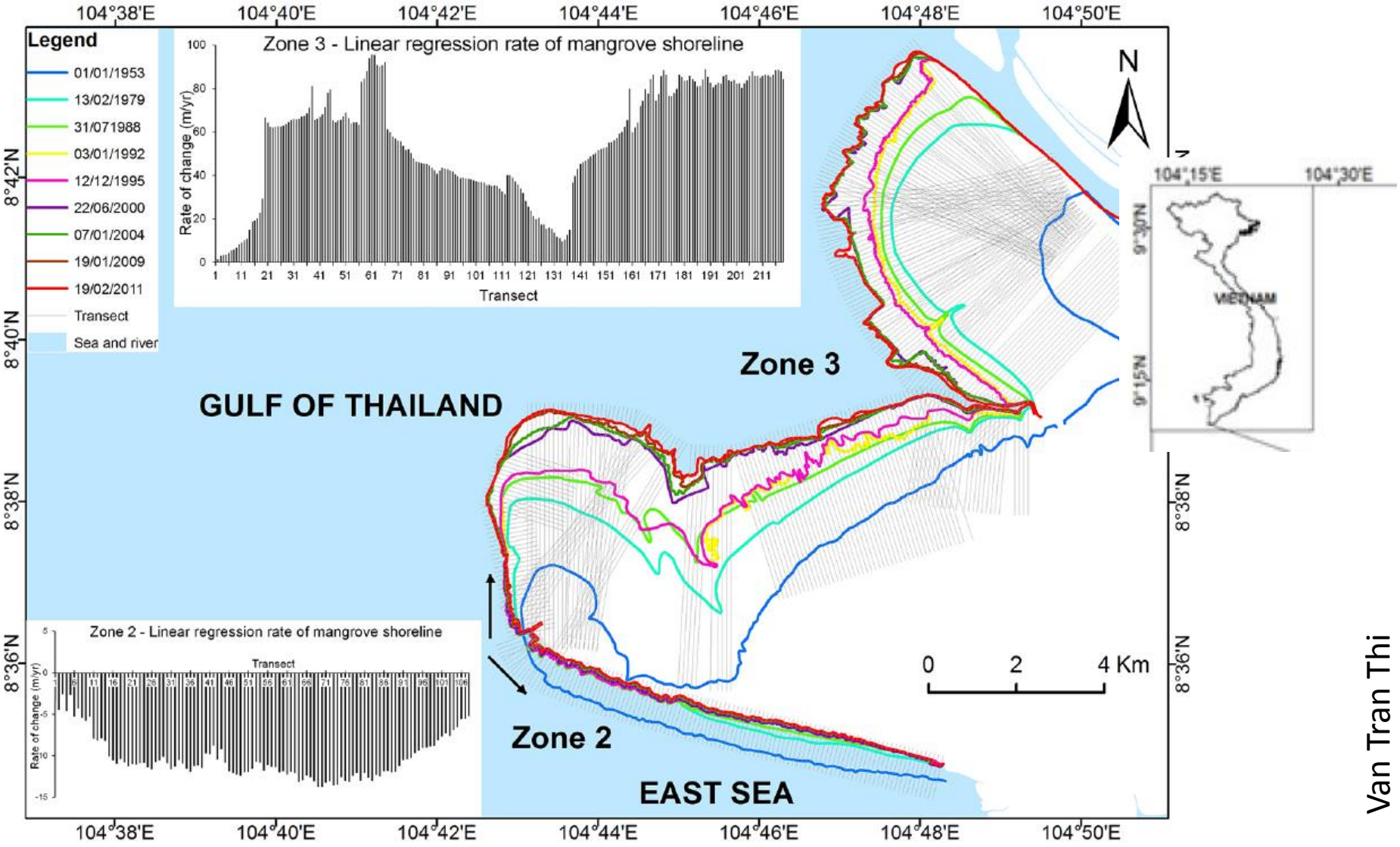
control pneumatophore

buried emerging pneumatophore

coastal **accretion and erosion** – mangrove vegetation responses...

Accretion zone with juvenile mangroves

(Ca Mau, Vietnam)

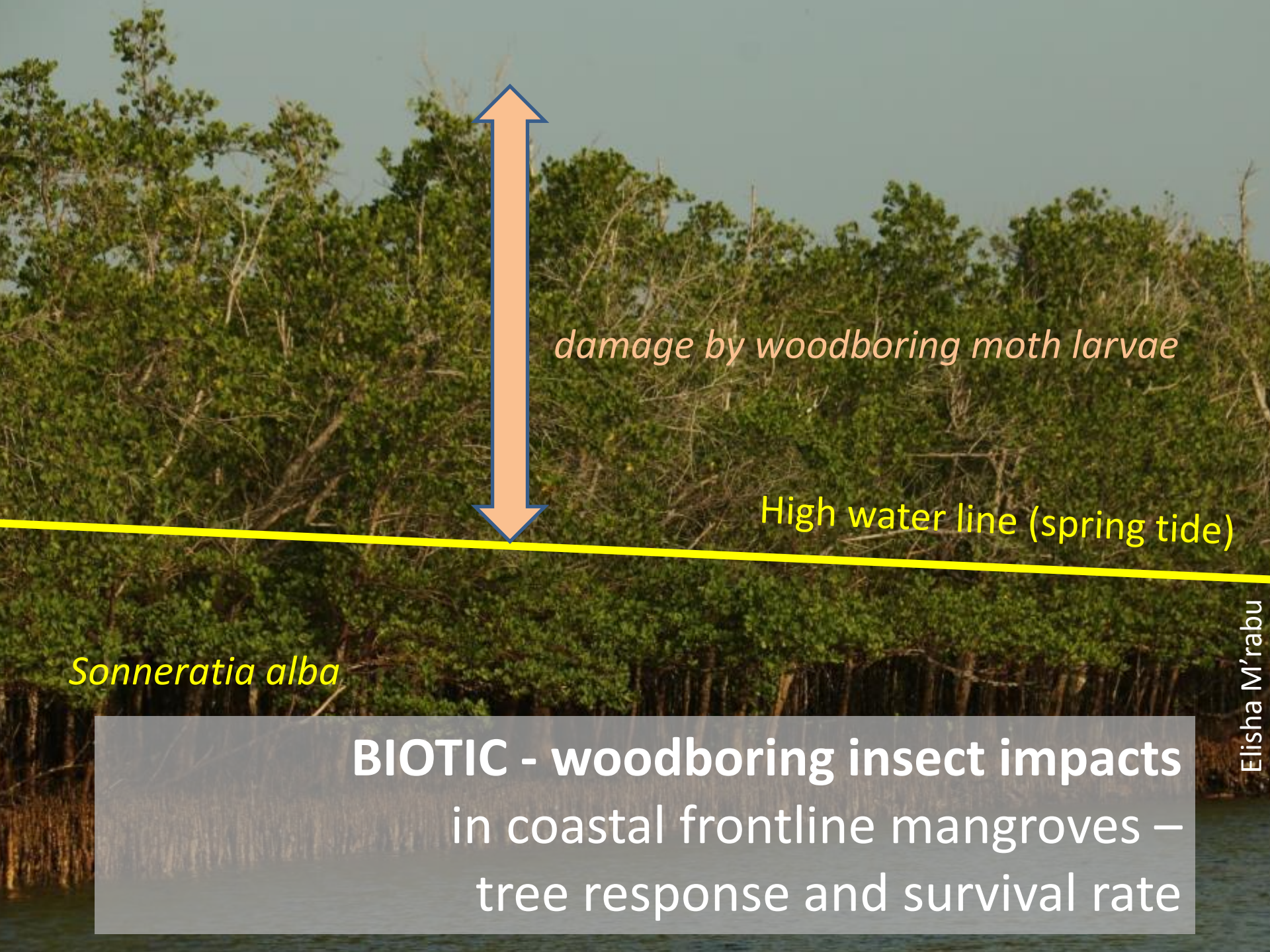


Van Tran Thi

Application of remote sensing and GIS for detection of long-term mangrove shoreline changes in Mui Ca Mau, Vietnam

V. Tran Thi[1,2,3], A. Tien Thi Xuan[3], H. Phan Nguyen[4], F. Dahdouh-Guebas[1,2,*], and N. Koedam[1,*]

Biogeosciences, 11, 3781–3795, 2014



BIOTIC - woodboring insect impacts in coastal frontline mangroves – tree response and survival rate

Elisha M'rabu

Elisha M'rabu

woodborers on *Sonneratia alba* (in Kenya) –
metarbelid moth (gen. nov.) and coleopteran (*Bottegia rubra)*

MANGROVES

dispersal

(over water)

propagules (dispersal units)

Dennis De Ryck

"propagule paradox"

a **very costly structure** has a dual function with a **major risk of loss**

Excellent recruitment

- good retention
- fast establishment
- fast rooting

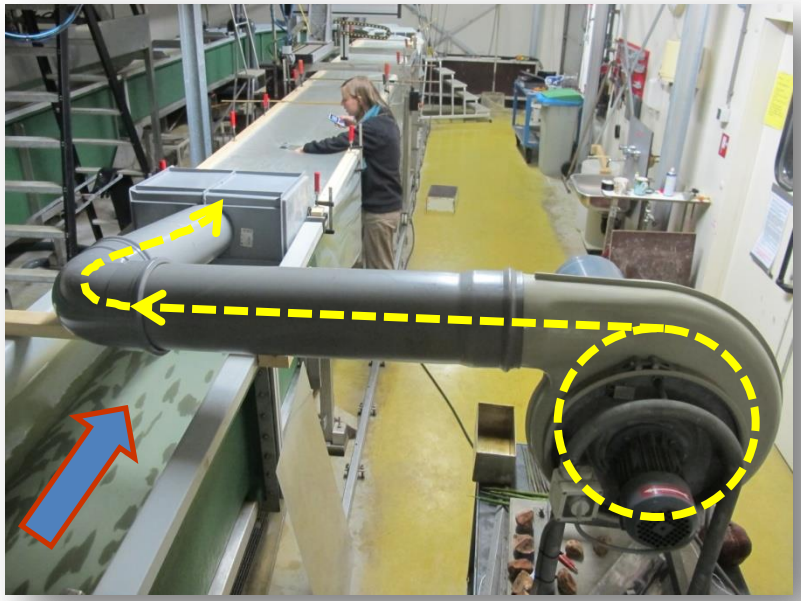
Excellent dispersal

- excellent dispersal
- longevity
- postponed dormancy
- delayed rooting

Properties ? Processes ? Triggers ? Effects ?

DISPERSAL - FLUME EXPERIMENTAL APPROACH (NIOZ, Yerseke)

Tom Van der Stocken,
Dennis De Ryck,
Tjeerd Bouma (NIOZ)

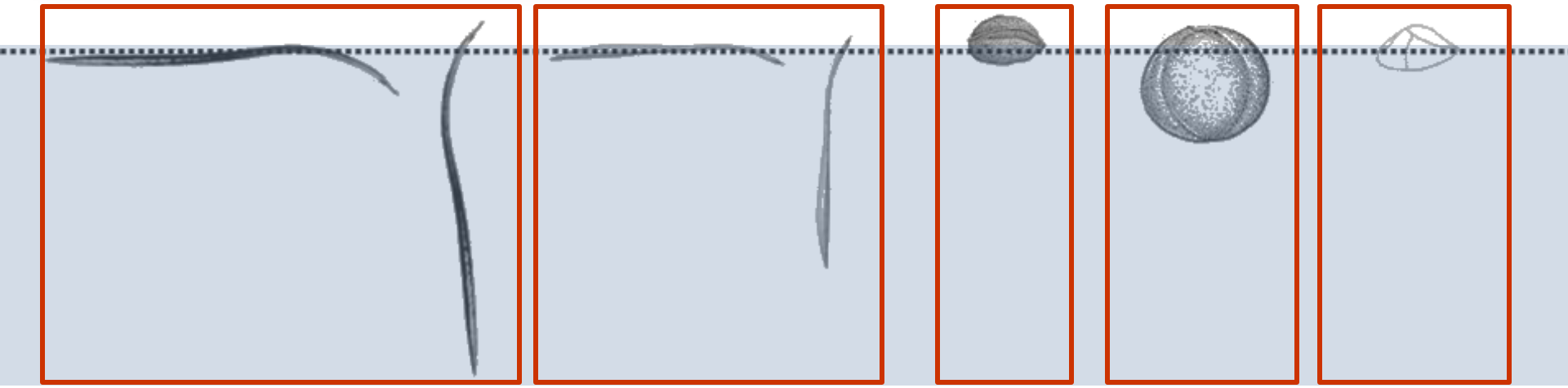


hydrodynamics

wind flow direction

water flow direction

retention by root mimics



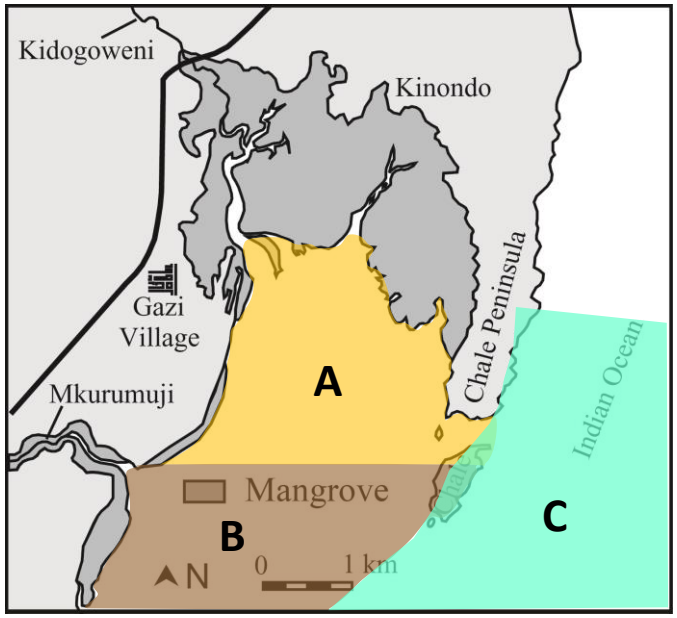
Rhizophora mucronata

Ceriops tagal

Heritiera littoralis

Xylocarpus granatum fruit and seed

DISPERSAL - OBSERVATIONAL APPROACH (Gazi Bay, Kenya)



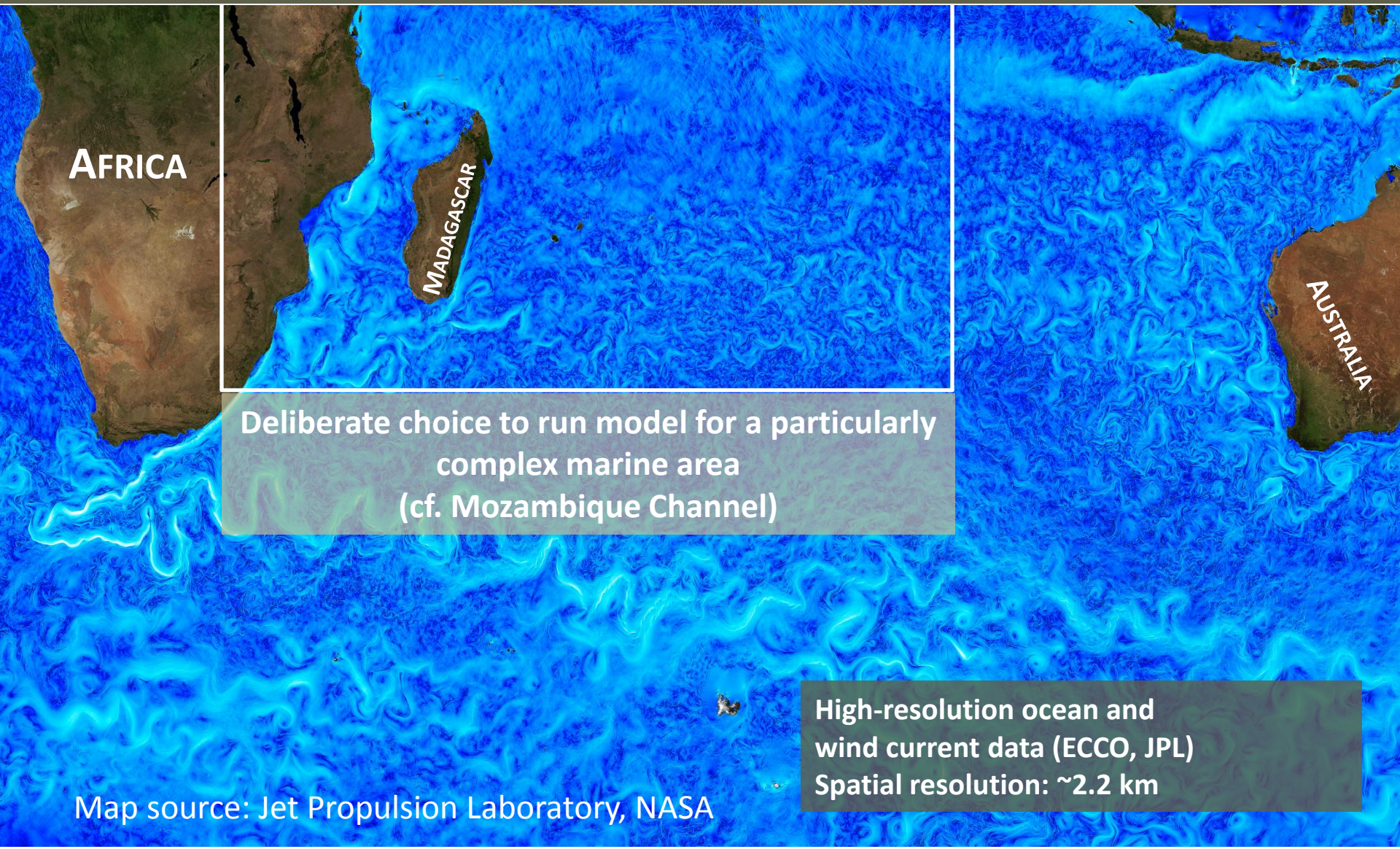
Tom Van der Stocken, Dennis De Ryck

	Rhizophora mucronata	*Ceriops tagal*	*Bruguiera gymnorrhiza*	*Avicennia marina*	*Sonneratia alba*	*Xylocarpus granatum*	*Heritiera littoralis*
ZONE A	20559	12278	2063	722	9	276	2
ZONE B	3234	1861	449	142	0	53	28
ZONE C	7101	2797	6	1	0	1	0
TOTAL	30894	16936	2518	865	9	330	30
TOTAL (%)	59.89	32.83	4.88	1.68	0.02	0.64	0.06
	~93 %						

Flume experiments NIOZ

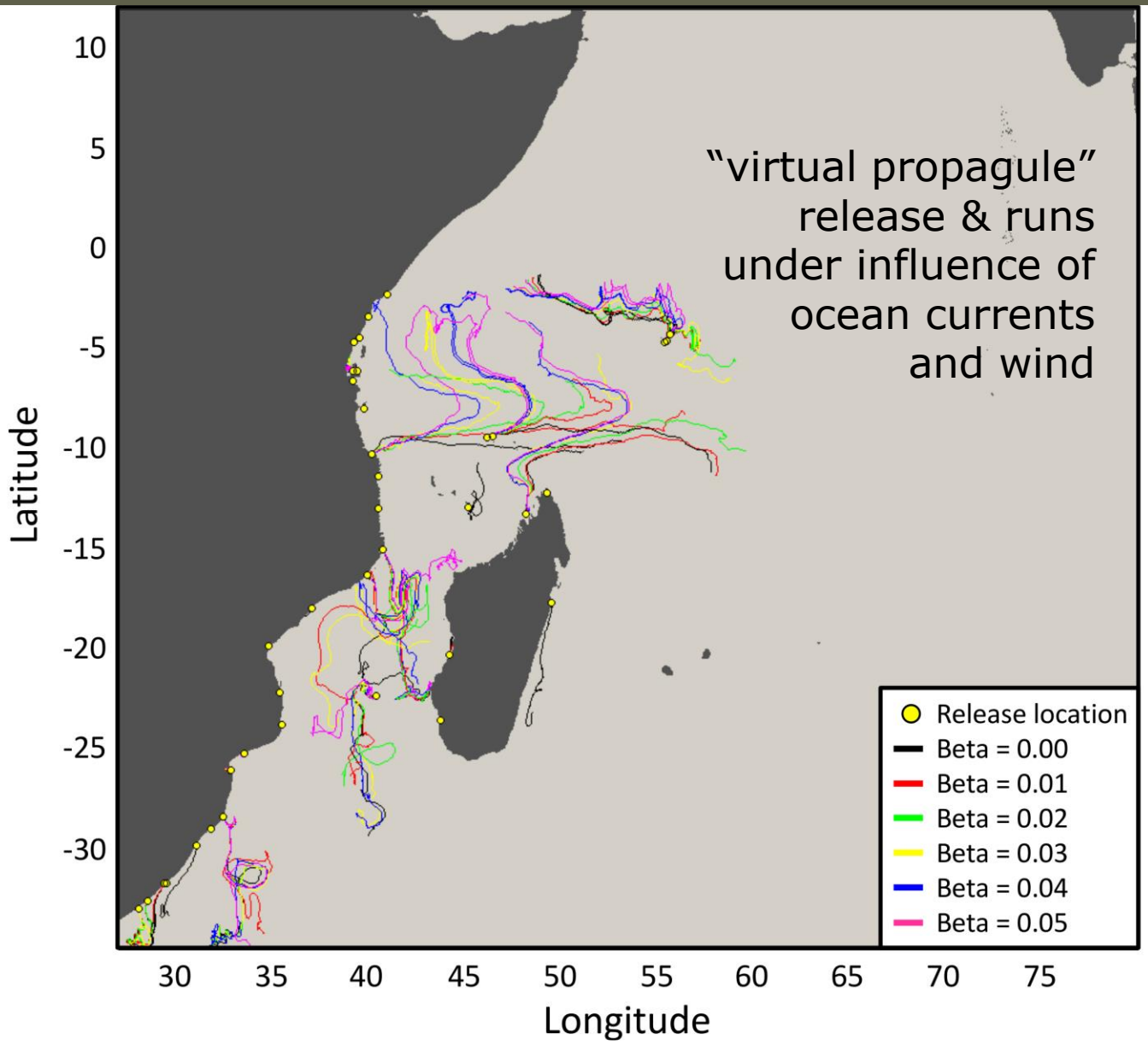
164 fishing events in total over a period of 21 months (March 7th, 2012 to July 6th, 2014)

DISPERSAL TRAJECTORIES – MODELING APPROACH



Van der Stocken & Menemenlis, 2016

DISPERSAL TRAJECTORIES – MODELING APPROACH



'Beta' is the weight of wind in the dispersal velocity equation

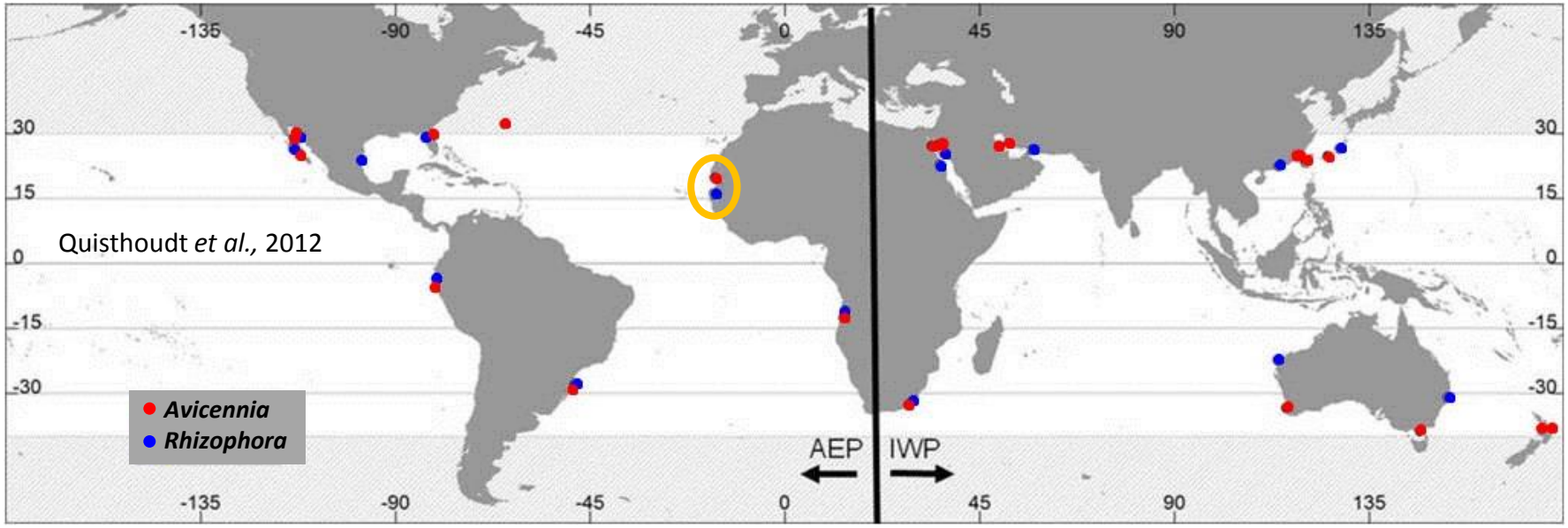
Tom Van der Stocken

MANGROVES

biogeography

range and change

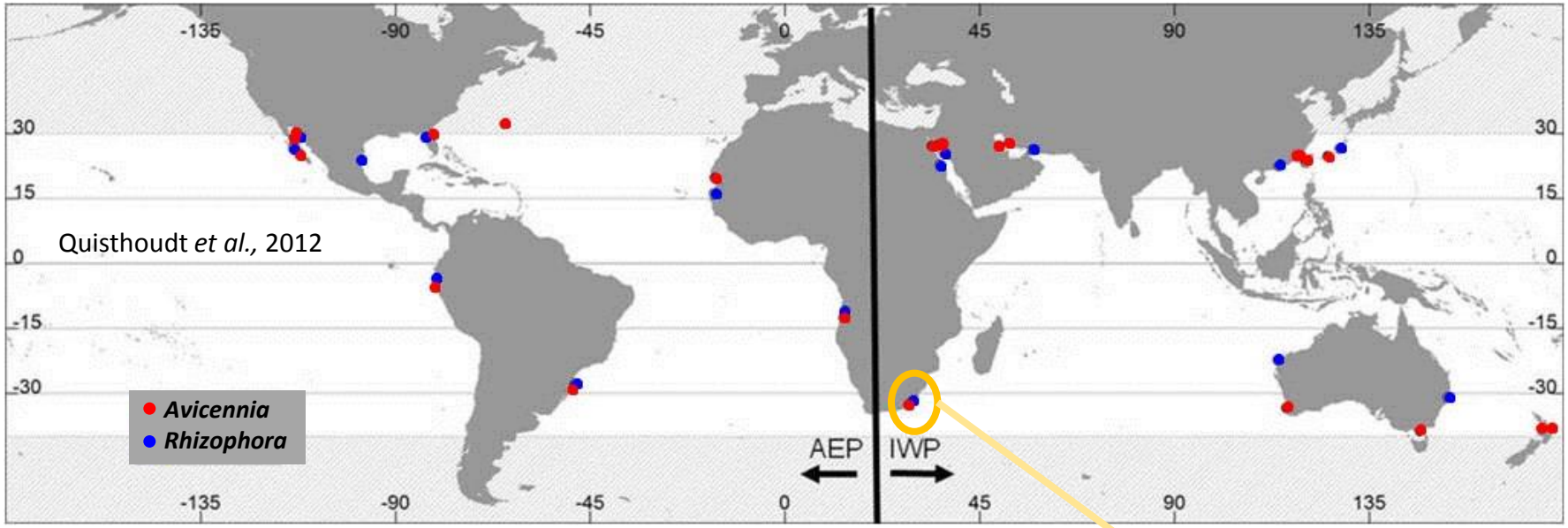
latitudinal mangrove range limits – 'windows' into adaptation

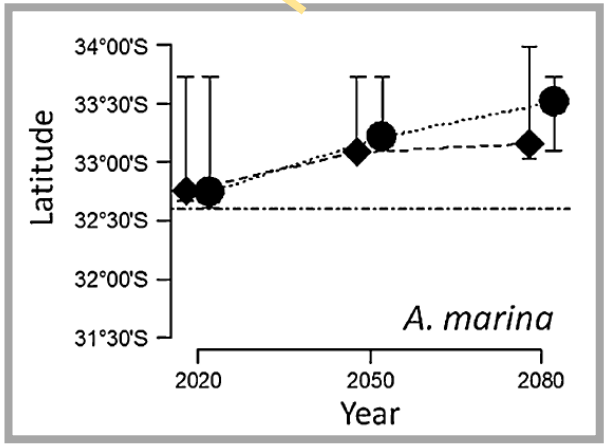


global:
interaction drought and temperature

Katrien Quisthoudt

latitudinal mangrove range limits – ‘windows’ into adaptation and sentinels of change





Biodivers Conserv (2013) 22:1369–1390
DOI 10.1007/s10531-013-0478-4

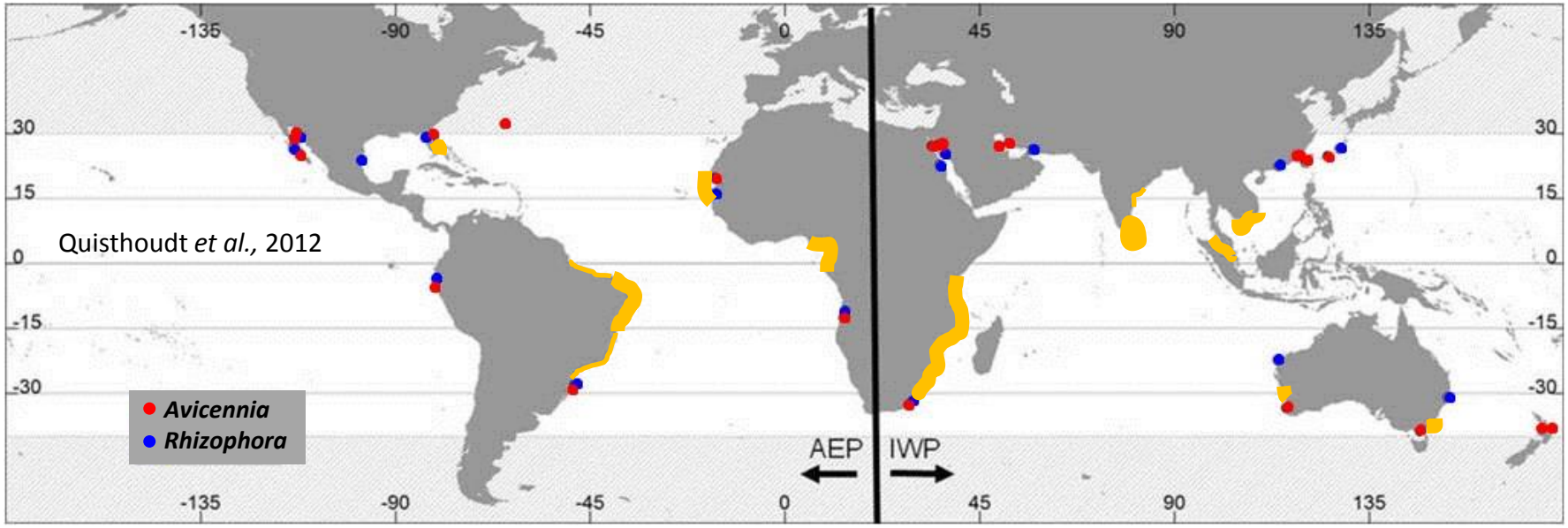
ORIGINAL PAPER

Disentangling the effects of global climate and regional land-use change on the current and future distribution of mangroves in South Africa

Katrien Quisthoudt · Janine Adams · Anusha Rajkaran · Farid Dahdouh-Guebas · Nico Koedam · Christophe F. Randin

Katrien Quisthoudt

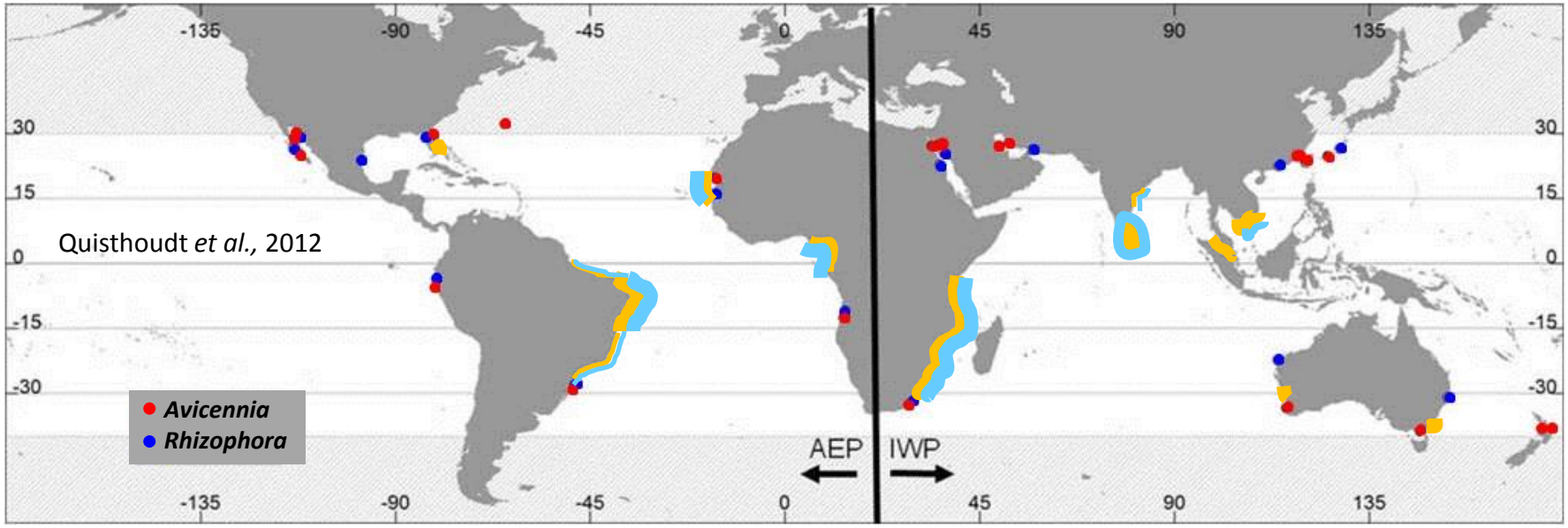
research areas



research ongoing

past research

research areas and development

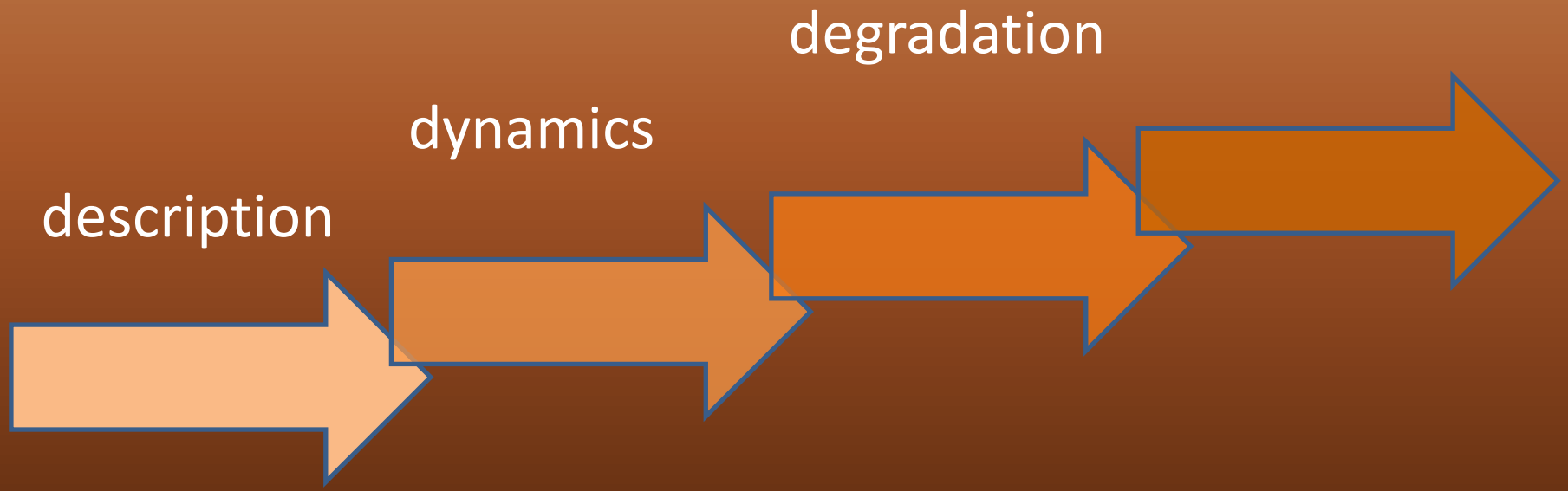


research ongoing
in a developing country

past research
in a developing country

illegal mangrove cutting in outskirts and slums of Mombasa

MANGROVES



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- A first retrospection


Kenya coast – subsistence...

Continuation of Belgian involvement in mangrove is due to commitment from the 'South'

Dirk Van Speybroeck

James G. Kairo – PhD researcher VUB 2001

Vrije Universiteit Brussel

Rhizophora mucronata

Planted April 2000

Gazi, Kenya

Mangroves among the most carbon-rich forests in the tropics

Daniel C. Donato[1]*, J. Boone Kauffman[2], Daniel Murdiyarso[3], Sofyan Kurnianto[3], Melanie Stidham[4] and Markku Kanninen[5]

NATURE GEOSCIENCE PUBLISHED ONLINE: 3 APRIL 2011

CARBON CYCLE

Storage beneath mangroves

Empirical data on mangrove carbon pools and fluxes are scarce. A field survey in the Indo-Pacific region suggests that the sediments below these remarkable trees hold exceptionally high quantities of carbon.

Steven Bouillon

NATURE GEOSCIENCE | VOL 4 | MAY 2011

"Mangroves have been shown to be amongst the most C-dense forests: 1023 $Mg.ha^{-1}$"

Donato *et al.*, 2011

East Africa Forum for Payment of Ecosystem Services

Font size Bigger Reset Smaller Regional Workshop on Building Capacity for Applying PES and CCD in WIO Region 25th – 30th November 2013, Mombasa Kenya

Search...

"Mikoko Pamoja"

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A Small Scale Carbon-offset Project in Mangroves

Although mangrove forests occupy only 0.1% of the earth's continental surface, the forests account for 11% of the total input of terrestrial carbon into the ocean. However, loss and transformation of mangrove areas in Kenya is affecting local livelihoods through shortage of firewood and building poles, reduction in fisheries, and increased erosion.

Mikoko Pamoja is a small scale carbon feasibility project in the South Coast of Kenya that aims at enhancing mangrove productivity and integrity by carrying out activities that benefit local communities and that could be eligible for attracting carbon investment.The project P.I.N was developed using Plan vivo standards.

Initially the Project will protect 107 ha of mangrove forest at Gazi bay and replant 0.4 ha degraded forest per annum, over a Project time-scale of 20 years. Carbon capture through the Project is conservatively estimated at 3000 tonnes CO_2 yr^{-1}, which is derived from a mix of avoided deforestation, prevented forest degradation and reforestation activities. Through these

Every year, Mikoko Pamoja aims to sell about 2100 credits, while managing and extending the mangrove forests, corresponding to 2100 tonnes of CO_2e, at a minimum price of 10 USD (about 9.3 EUR)…..

In practice, to offset a **return flight between Brussels and Mombasa** which produces about 3.4 tonnes of CO_2e per person, this would mean paying 32 EUR in Mikoko Pamoja credits – the equivalent of having breakfast and lunch in the VUB restaurant for one week. Doughnuts and tortelloni or mangrove credits today?

Learn more on: www.weareparis.be and

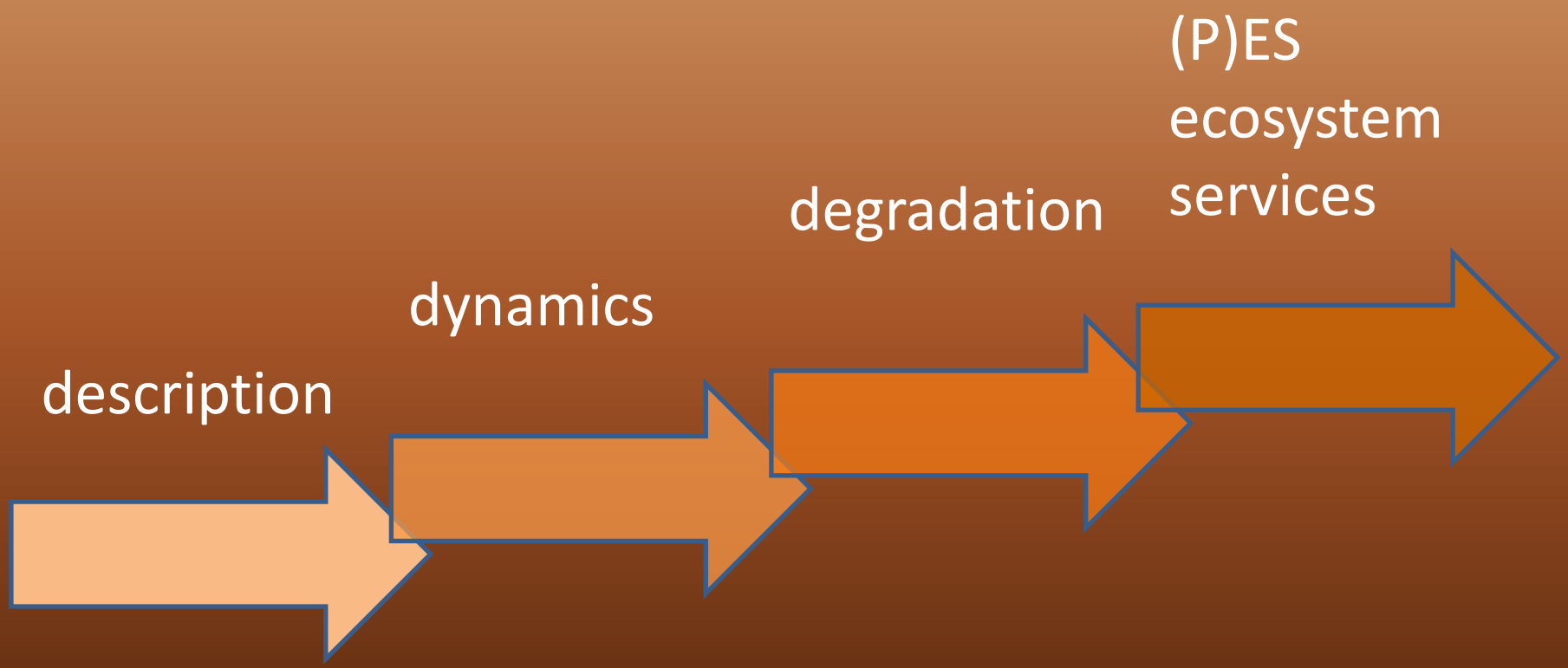
created by Evelien Deboelpaep

Rhizophora mucronata

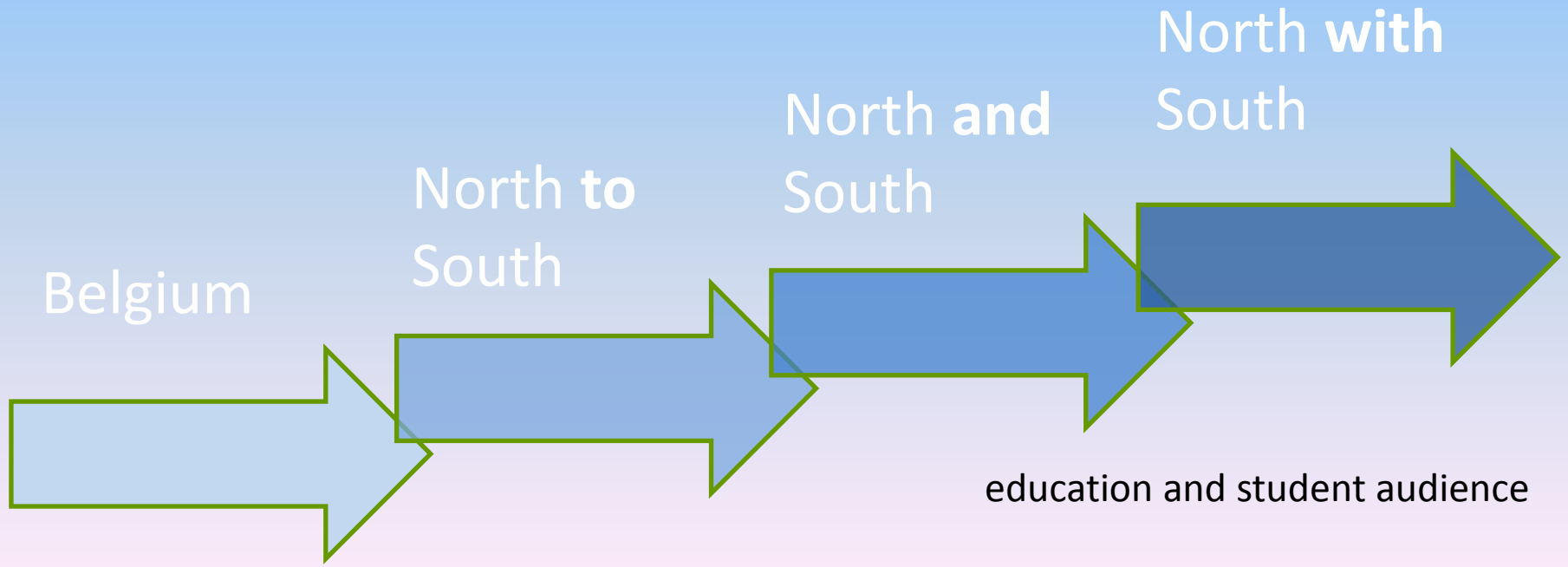
mangrove wood carbon density and its environmental drivers

Xylocarpus granatum

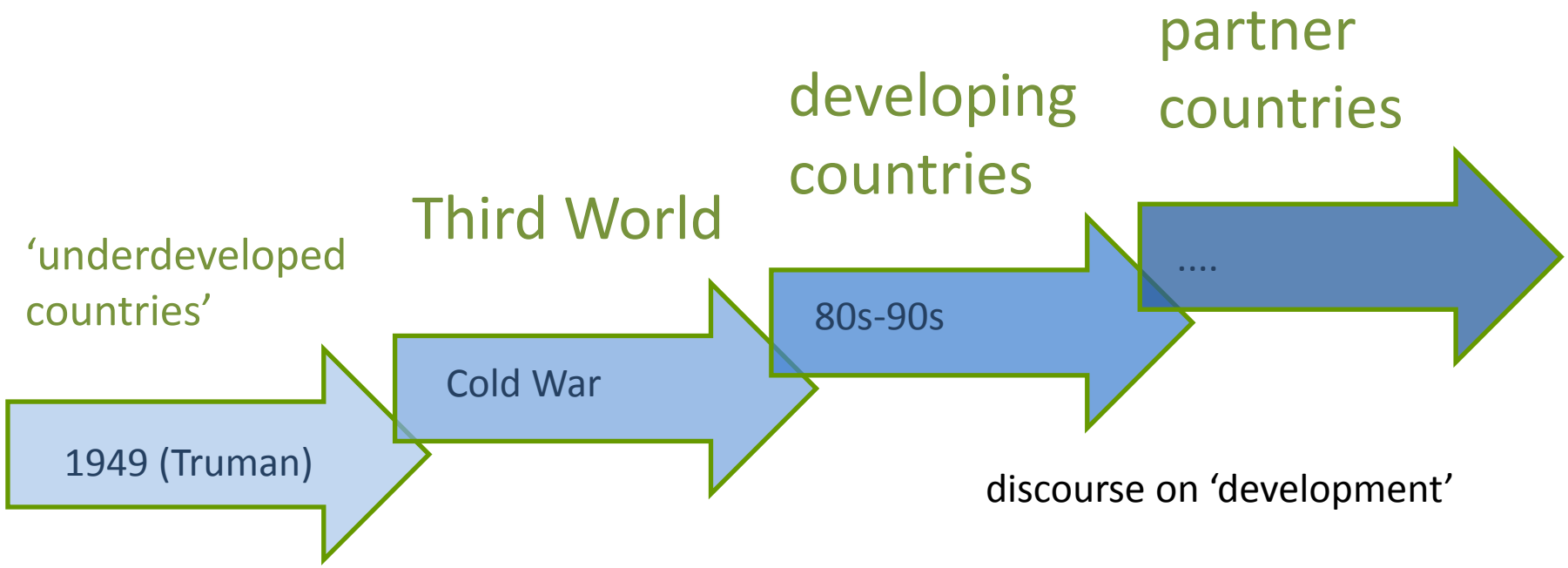
MANGROVES


description
dynamics
degradation
(P)ES
ecosystem
services

UNIVERSITY COOPERATION



DEVELOPMENT COOPERATION



ABOS

Algemeen Bestuur van de Ontwikkelingssamenwerking

Raymond Hamers

Master in Molecular Biology (Tropical Molecular Biology)

1983-1993

Alumni from Flanders (MSc & PhD) Kenya, Tanzania, Madagascar

October 2015, WIOMSA
Port Edward, South Africa

vliruos
SHARING MINDS, CHANGING LIVES

MASTER OF MARINE AND LACUSTRINE SCIENCE AND MANAGEMENT

OCEANS & LAKES
Master of Marine and Lacustrine Science and Management

Universiteit Antwerpen

UNIVERSITEIT GENT

Vrije Universiteit Brussel

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Mangroves in history: who depicted them first ?

The Hague: the ‘Mauritshuis’ , de Hofvijver (‘court pond’) en het Torentje, ‘the Little Tower’

Built for Johan Maurits van Nassau-Siegen by Jacob Van Campen & Pieter Post 1633-44

Frans Post - *View of Itamaracá island in Brazil* (1637), Mauritshuis (The Hague)

Mangrove value: what about spiritual value ?

(cf. UNESCO 2008: Kenya sacred Mijikenda kaya forests - World Heritage)

Tidal spring, Feb 10th, 2016

Offering, low tide during spring tide, Feb 10th, 2016

Mzimu, mangrove shrine after ritual, Feb 10th, 2016, Gazi, Kenya

sacrifice, Feb 10th, 2016

protecting cultural values = protecting mangroves ?

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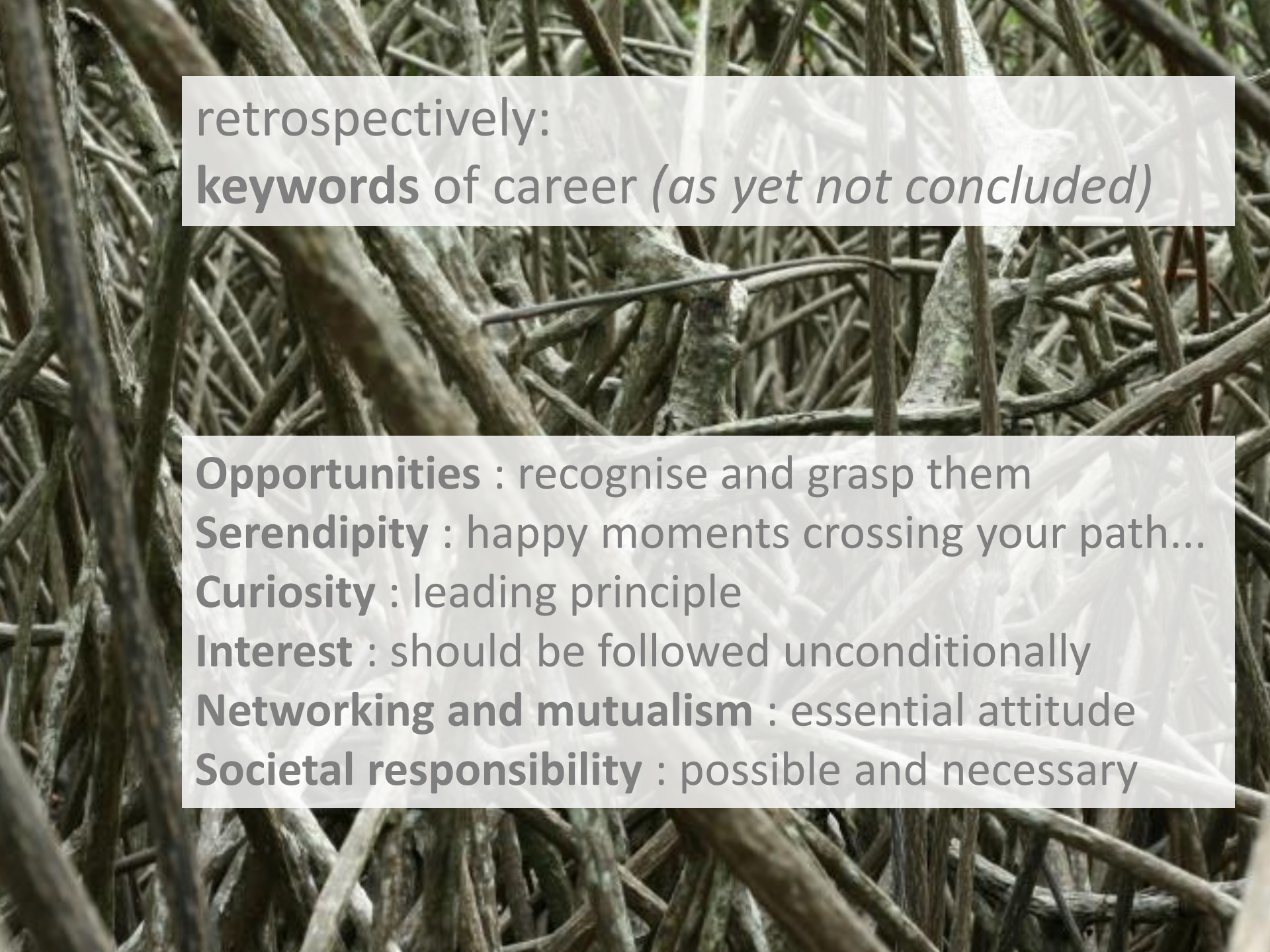
- Straying away allowed
- A first retrospection



retrospectively:
keywords of career *(as yet not concluded)*

Opportunities : recognise and grasp them
Serendipity : happy moments crossing your path...
Curiosity : leading principle
Interest : should be followed unconditionally
Networking and mutualism : essential attitude
Societal responsibility : possible and necessary

retrospectively:

through capacity building over three decades, we are no longer ‘needed’ in several places

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