

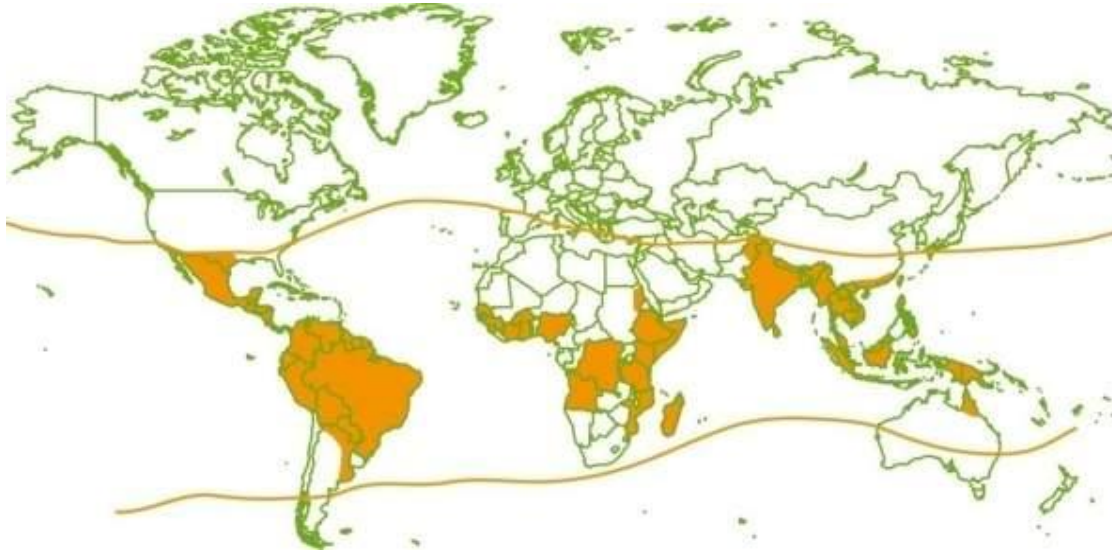


SPAGE in agriculture to combat pest insects

Luke Alphey



dengue fever – a global unmet health challenge



50 -100 million cases pa, increasing
\$5 Bn burden of cost
Aedes aegypti: alien invasive species in most countries
Symptoms – joint/muscle pain ‘Breakbone fever’
Severe form Dengue Haemorrhagic Fever (DHF)
No specific medication or vaccine yet
Same vector – Chikungunya, Yellow Fever and Zika viruses

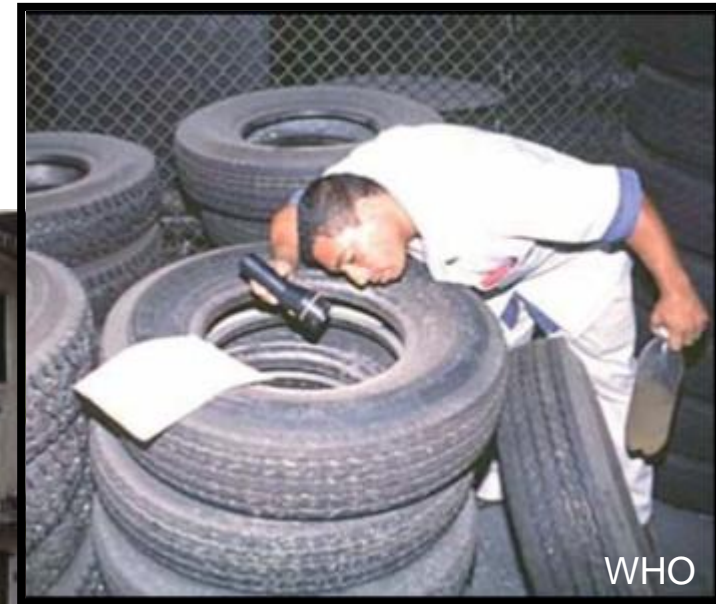


“Today, dengue ranks as the most important mosquito-borne viral disease in the world. Everywhere the human and economic costs are staggering”

***Dr Margaret Chan, 2012
Director General, WHO***

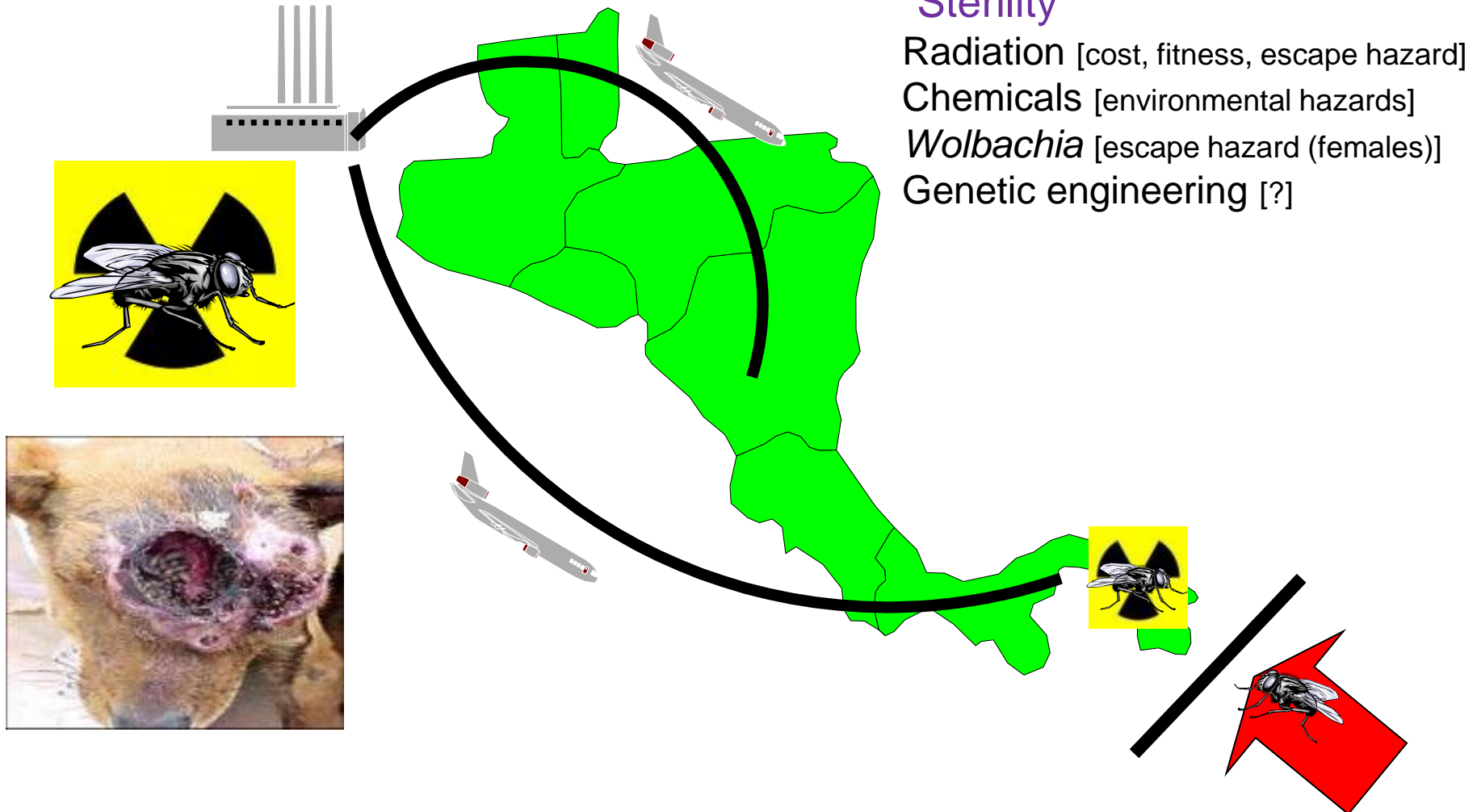
dengue control

“We seek to enable communities to safely address local ecological problems without imposing their choices on others”

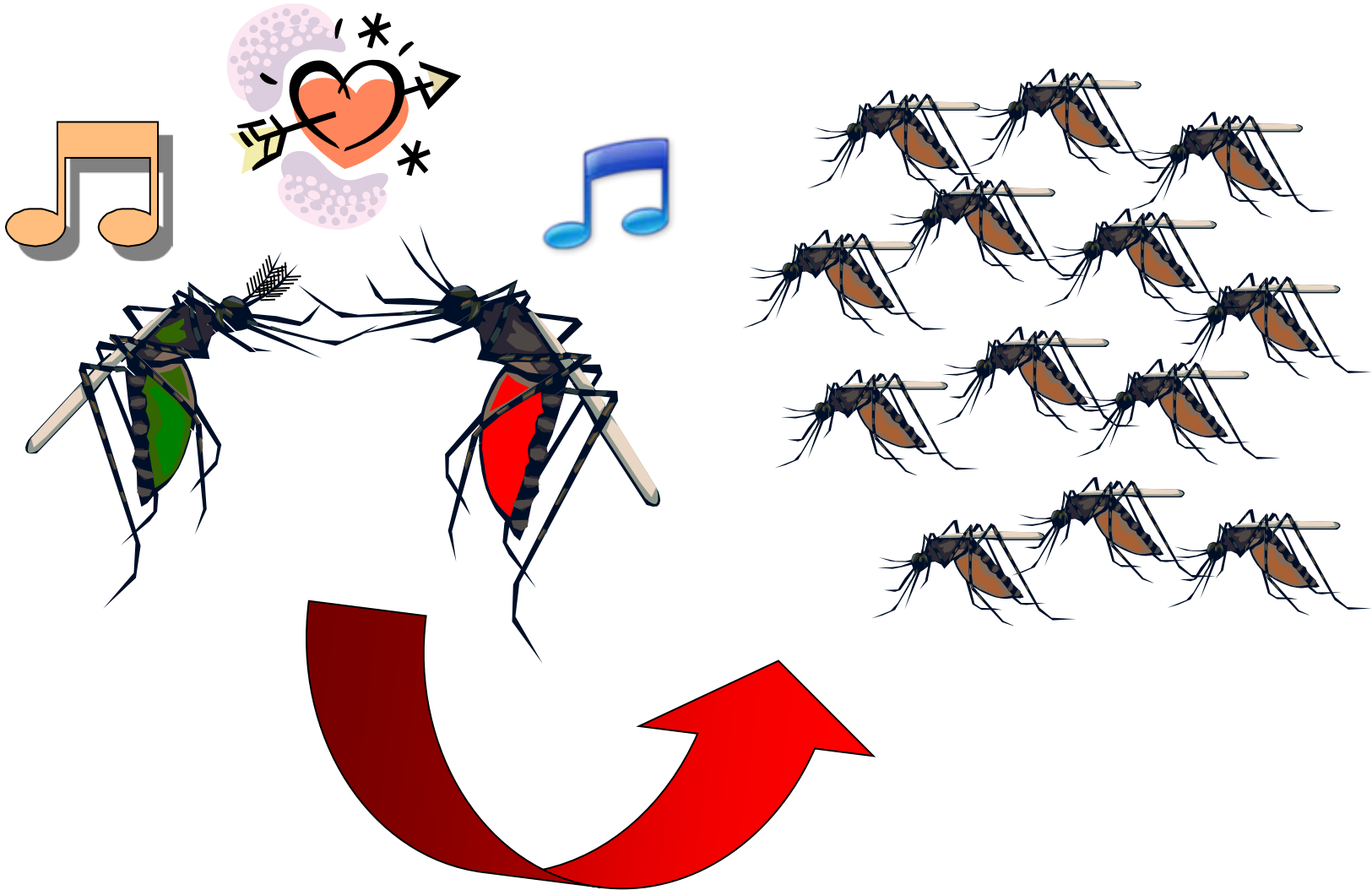


WHO

Sterile Insect Technique



mosquito reproduction



genetic control



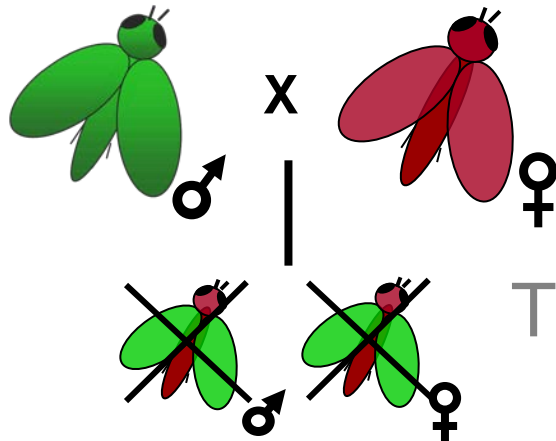
RIDL – “genetic sterility”

RIDL insects are genetically sterile

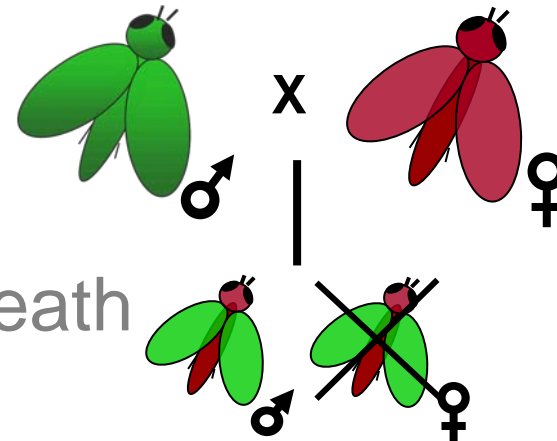
Repressible

Release homozygous males

Bi-sex lethal



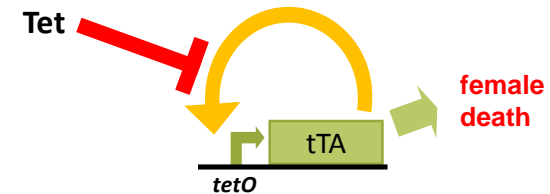
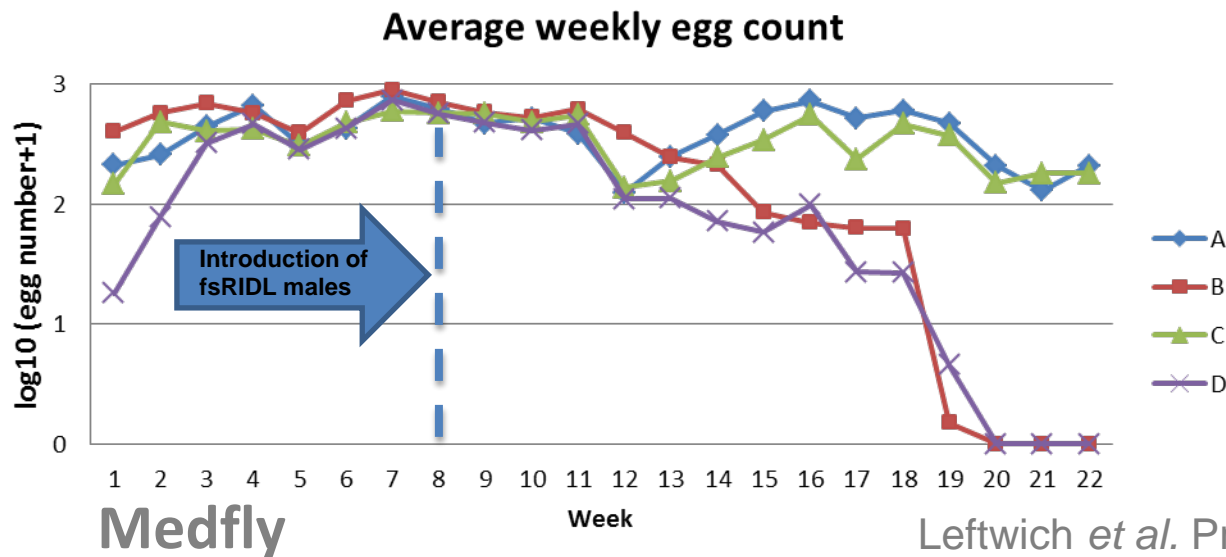
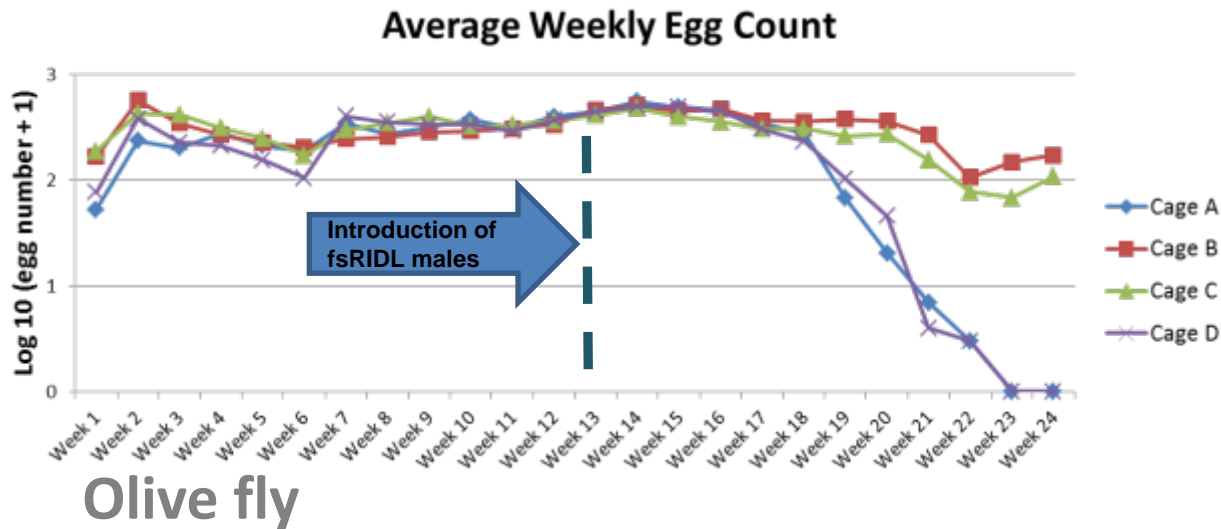
Female-specific lethal



Time of death

Bias inheritance so that >50% of males inherit?

cage suppression trials: fruit flies

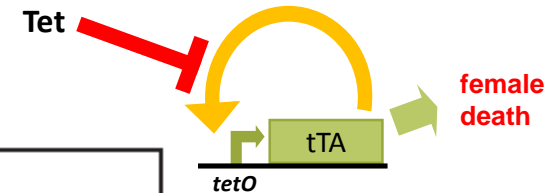
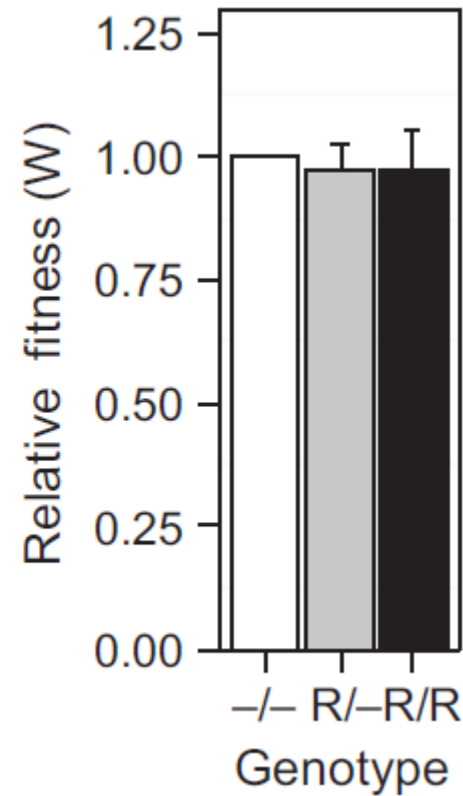
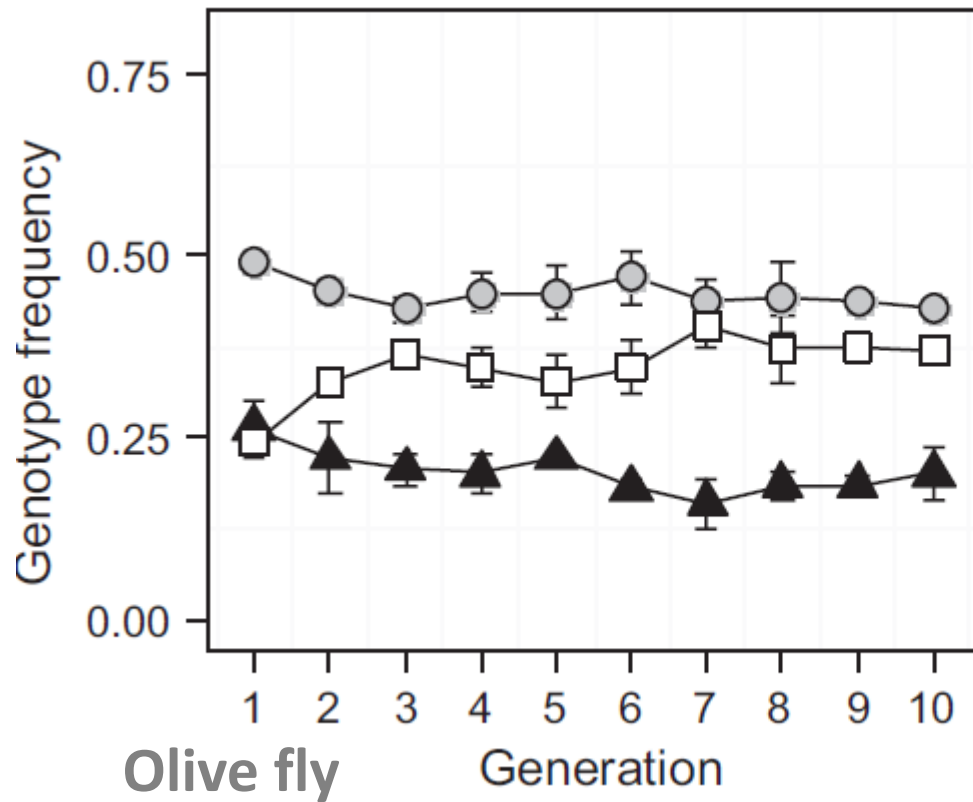


Leftwich *et al.* Proc Roy Soc B 2014 281:20141372

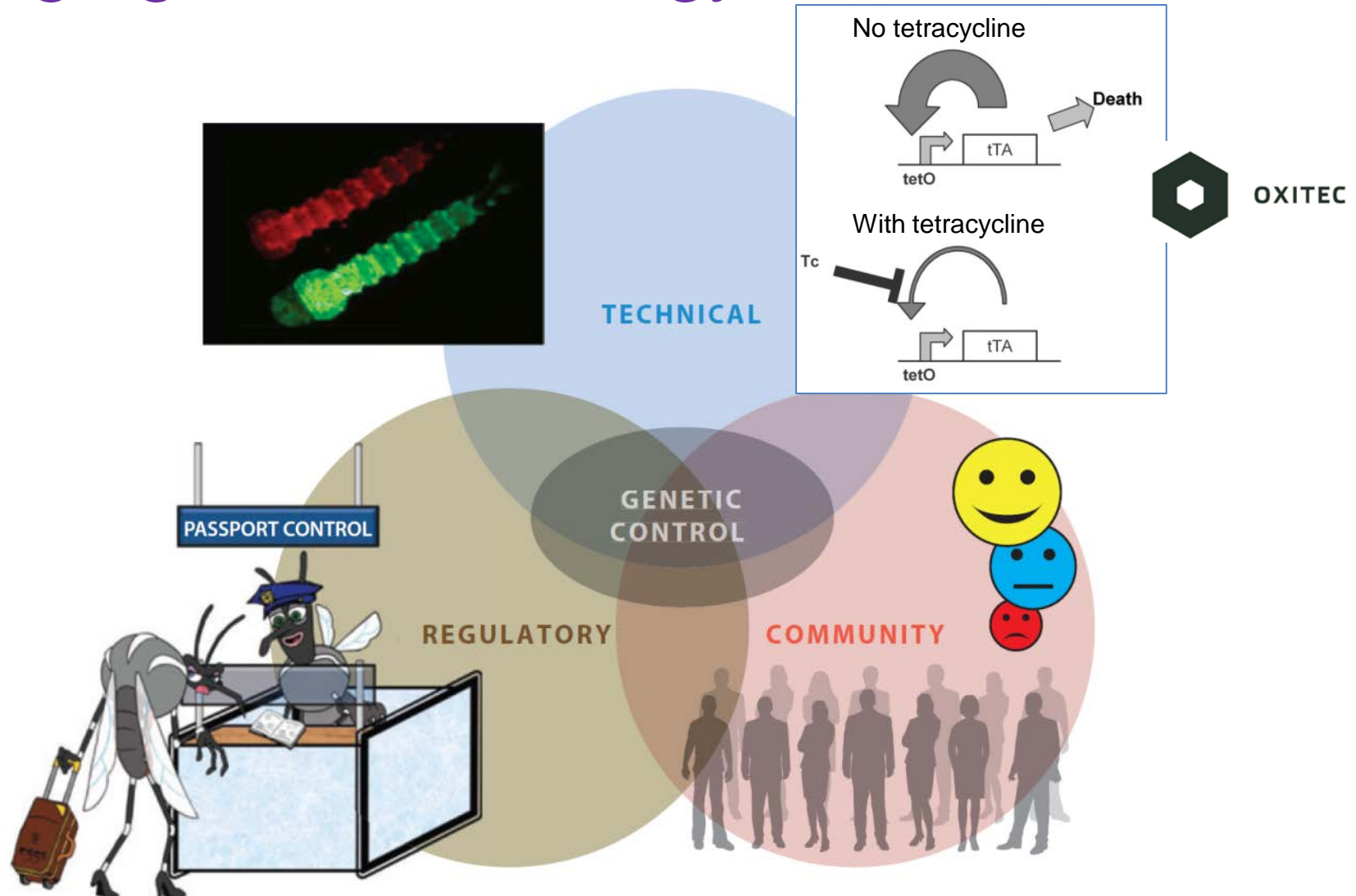
Ant *et al.* 2010 BMC Biology 10: 51

www.pirbright.ac.uk

cage suppression trials: fruit flies



bringing new technology to the field



presentations



Projeto Aedes Transgênico



TV and radio

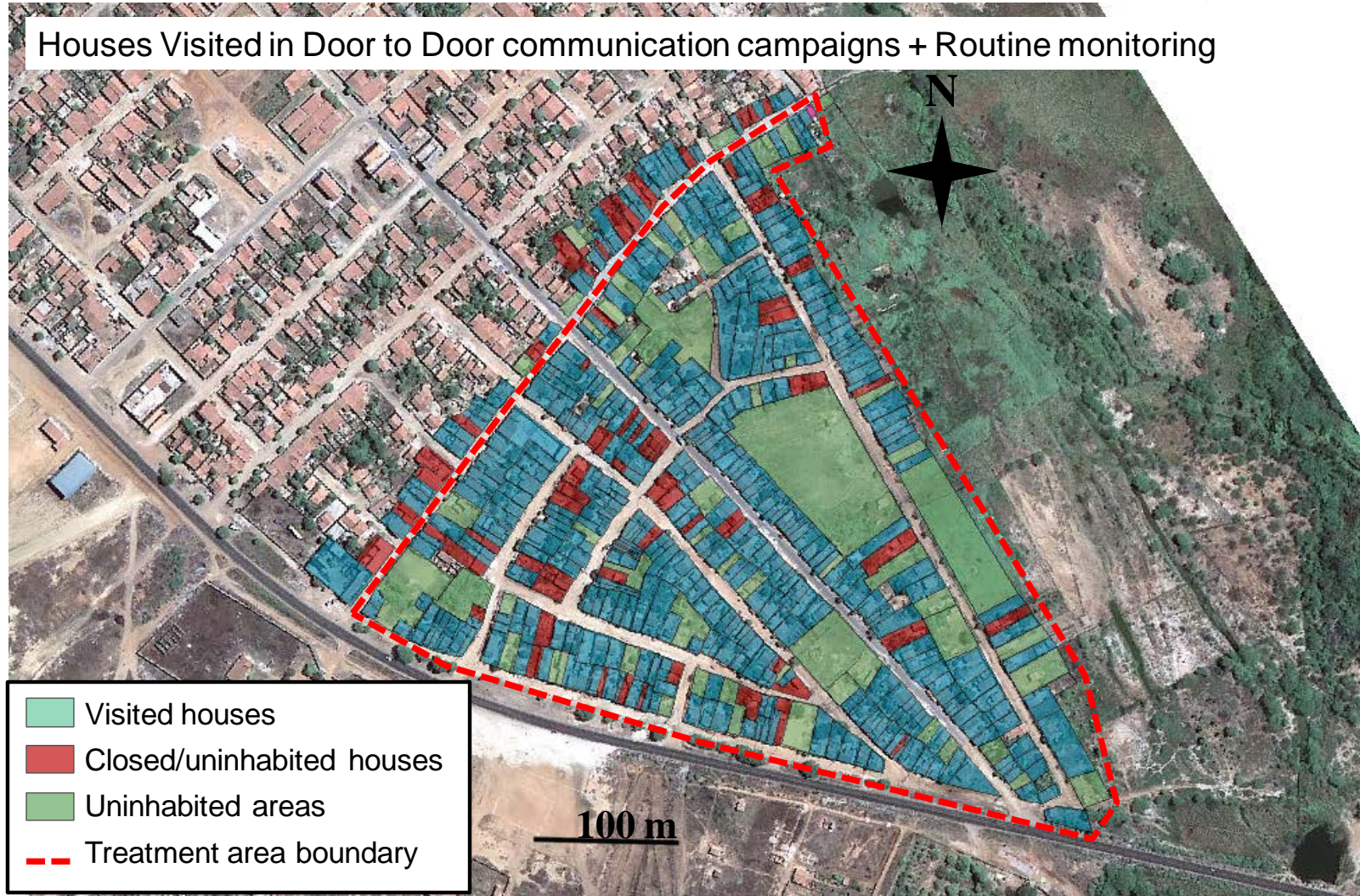


local festivals



house visits

Houses Visited in Door to Door communication campaigns + Routine monitoring



survey

Question	Itaberaba	Mandacaru
	Yes / No (%)	Yes / No (%)
Do you know/have heard about PAT?	84 / 16	94 / 6
Do you know if releases occurred in this area?	94 / 6	97 / 3
Did the releases impact your routine?	13 / 87	4 / 96
Do you believe the project can help mosquito control?	91 / 9	97 / 3
Did the visit of PAT agents to your home bother you?	1 / 99	1 / 99
Do you understand the results of PAT?	66 / 34	84 / 16
Do you want PAT to continue with releases in this community?	97 / 3	98 / 2
Are you aware that other measures for mosquito control are needed?	99 / 3	98 / 2

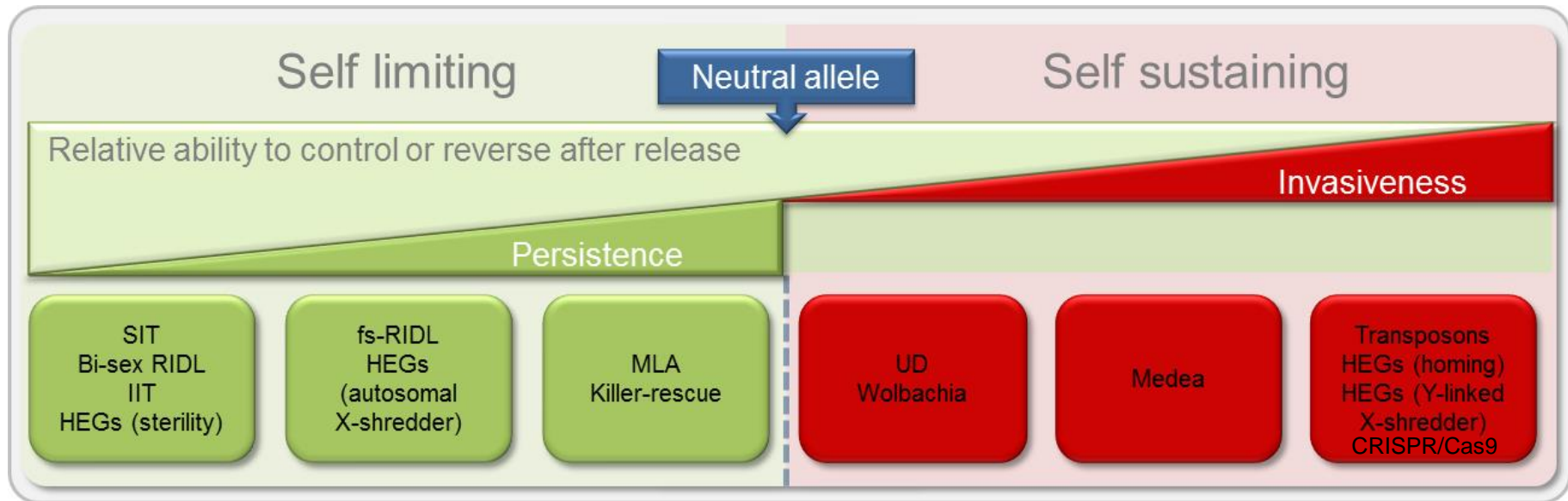
survey

Question	Itaberaba	Mandacaru
	Yes / No (%)	Yes / No (%)
Do you know/have heard about PAT?	84 / 16	94 / 6
Do you know if releases occurred in this area?	94 / 6	97 / 3
Did the releases impact your routine?	13 / 87	4 / 96
Do you believe the project can help mosquito control?	91 / 9	97 / 3
Did the visit of PAT agents to your home bother you?	1 / 99	1 / 99
Do you understand the results of PAT?	66 / 34	84 / 16
Do you want PAT to continue with releases in this community?	97 / 3	98 / 2
Are you aware that other measures for mosquito control are needed?	99 / 3	98 / 2

RIDL is effective in multiple settings

[unpublished data redacted]

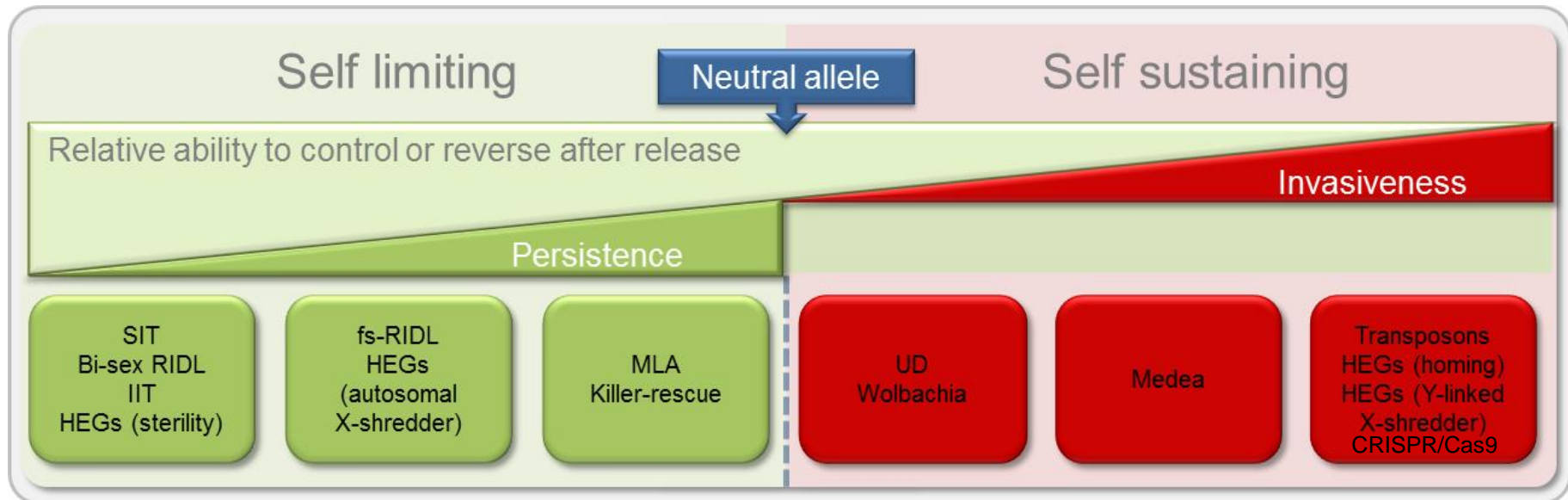
Self-limiting or self-sustaining/invasive?



Introduced trait:

- Fitness load: “population suppression”
- Other gene, e.g. reduced ability to transmit a pathogen: “population replacement”

Self-limiting or self-sustaining/invasive?



Common features:

- extremely species-specific, minimal direct off-target effects
- self-dispersing, target-seeking control agent

High release rates

Low persistence

Low invasion probability

Release rates (~cost)

Environmental persistence (reversibility)

Invasion probability

Low release rates

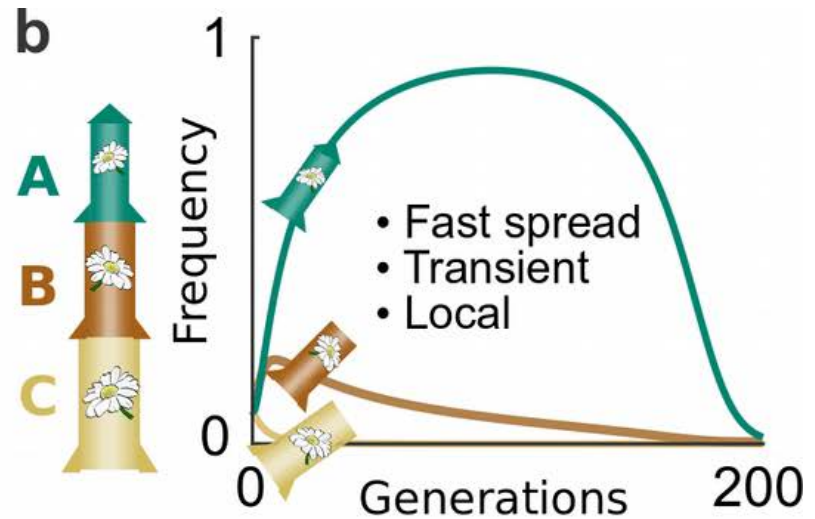
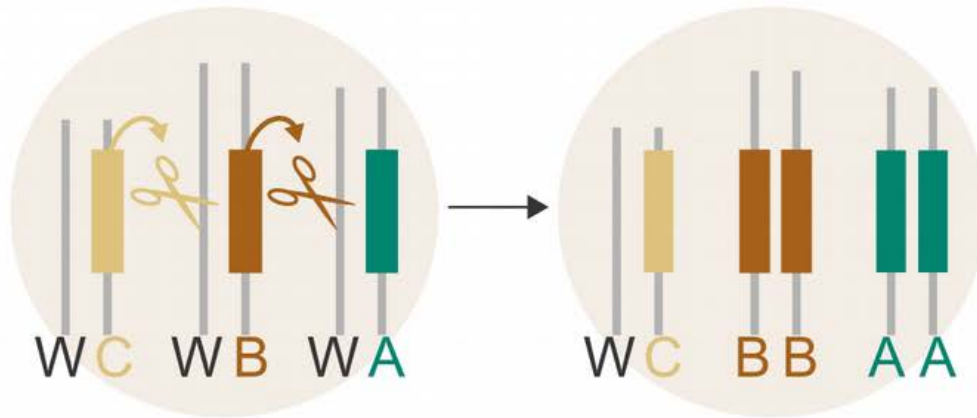
High persistence

High invasion probability

“We seek to enable communities to safely address local ecological problems without imposing their choices on others”

local drives – “daisy drives”

a Daisy drive: $C \xrightarrow{\text{drives}} B \xrightarrow{\text{drives}} A$



Basal element (C) does not drive.

Each subsequent element drives only in presence of previous one

Element C therefore acts as “licensing factor” or “tether” for entire system

Thank you

Refractory insects (Wellcome-MRC)
Sanjay Basu
Katharina von Wyszczetki

Rennos Fragkoudis, Barry Atkinson (Pirbright, UK)
Jamal I-Ching Sam (U Malaya, Malaysia)
Andres Merits (U Tartu, Estonia)
John Fazakerley (U Melbourne, Australia)

UD gene drive (Wellcome)
Phil Leftwich
Matt Edgington
Priscilla Tng
Victoria Sy
Robert Potts



OXITEC



MOSQUITO RESEARCH
& CONTROL UNIT
CAYMAN ISLANDS GOVERNMENT

Moths
Tim Harvey-Samuel
Victoria Norman
Ruth Carter



European
Commission

Horizon 2020
European Union funding
for Research & Innovation



Daisy drive
Michelle Anderson
Sebald Verkuijl
Jessica Mavica
Sophia Fochler
Rebekah Ireland



Core
David Navarro



Instituto Conmemorativo
Gorgas de Estudios de la Salud
Líderes de la investigación,
comprometidos con la solución de los problemas de la salud

PhD students
Jessica Purcell
Deepak Purusothaman

