Plant invasions and their management in Africa

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Cal-IPC, 28 October 2021

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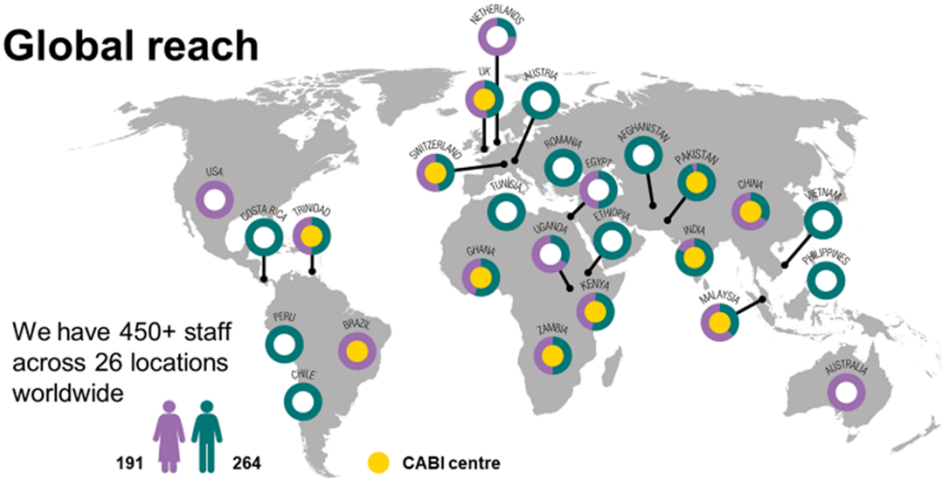
About CABI

Global reach



We have 450+ staff across 26 locations worldwide

191 264

CABI centre

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54 countries

1.3 billion people

Growth rate – 2.5%

40% live below the poverty line – 2/3 of the world's poorest

Most are directly dependent on natural resources

61% are farmers

Some of the worst weeds in Africa!

- *Striga* spp. - Africa
- *Opuntia* spp. - Tropical America
- *Mimosa* spp. – Tropical America
- *Prosopis* spp. – Tropical America
- *Lantana camara* – Tropical America
- *Chromolaena odorata* – Tropical America
- *Tithonia* spp. – Tropical America
- *Pontederia crassipes* – Tropical America
- *Azadirachta indica* – Tropical Asia
- *Acacia* spp. – Australia – sth temperate
- *Leucaena leucocephala* – Tropical America

Chromolaena odorata in NW Tanzania

Chromolaena odorata in eastern Africa

Impacts:

- Reduces livestock carrying capacities from 6 ha./LSU to 15 ha./LSU
- Kills 3000 cattle in the Philippines annually
- Impacts negatively on the breeding biology of the Nile crocodile
- Invasions result in a 95% reduction in species in the Zingiberaceae, main food source of the western lowland gorilla (van der Hoeven, 2007)

Devil weed in Tanzania

Costs and benefits	High density	Low density	p value
Costs			
Decrease grass	82	54	$\chi^2 = 19.943$; $p < 0.0001$
Decrease shrubs	80	51	$\chi^2 = 20.181$; $p < 0.0001$
Decrease trees	66	56	$\chi^2 = 2.072$; $p = 0.150$
Decrease wildlife	25	21	$\chi^2 = 0.501$; $p = 0.479$
Decrease water	67	54	$\chi^2 = 4.051$; $p = 0.046$
Decrease movement	94	84	$\chi^2 = 702$; $p = 0.03$
Decrease availability of useful plants	39	31	$\chi^2 = 7.839$; $p = 0.02$
Negative effects of livestock health	80	63	$\chi^2 = 7.810$; $p = 0.005$
Impact livestock (no. lost)	10 ± 12	5 ± 9	$p = 0.002$
Decrease crop yields	90	74	$\chi^2 = 9.074$; $p = 0.003$
Benefits			
Hedge plant	14	14	$\chi^2 = 0.004$; $p = 0.949$
Medicinal plant	17	19	$\chi^2 = 0.312$; $p = 0.577$
No benefits	75	77	$\chi^2 = 0.336$; $p = 0.562$

Biol Invasions (2017) 19:1285–1298
DOI 10.1007/s10530-016-1338-4

CrossMark

ORIGINAL PAPER

Chromolaena odorata **(Siam weed) in eastern Africa: distribution and socio-ecological impacts**

Ross T. Shackleton · Arne B. R. Witt · Winnie Nunda · David M. Richardson

Devil weed in Tanzania

“Chromolaena has killed us because it has killed our crops and our livestock.” Village elders, Serengeti, Tanzania

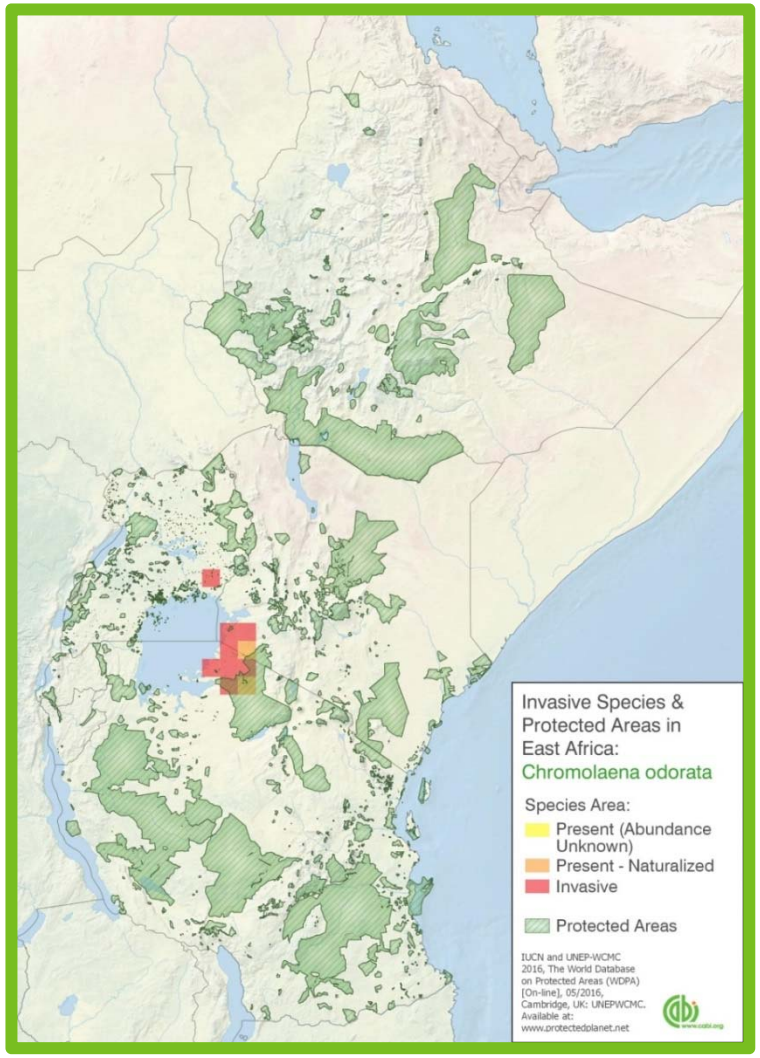
“Anyone who would help us to eradicate these weeds, shall be our God on earth." Elizabeth John Stephen, Kwigutu, Tanzania.

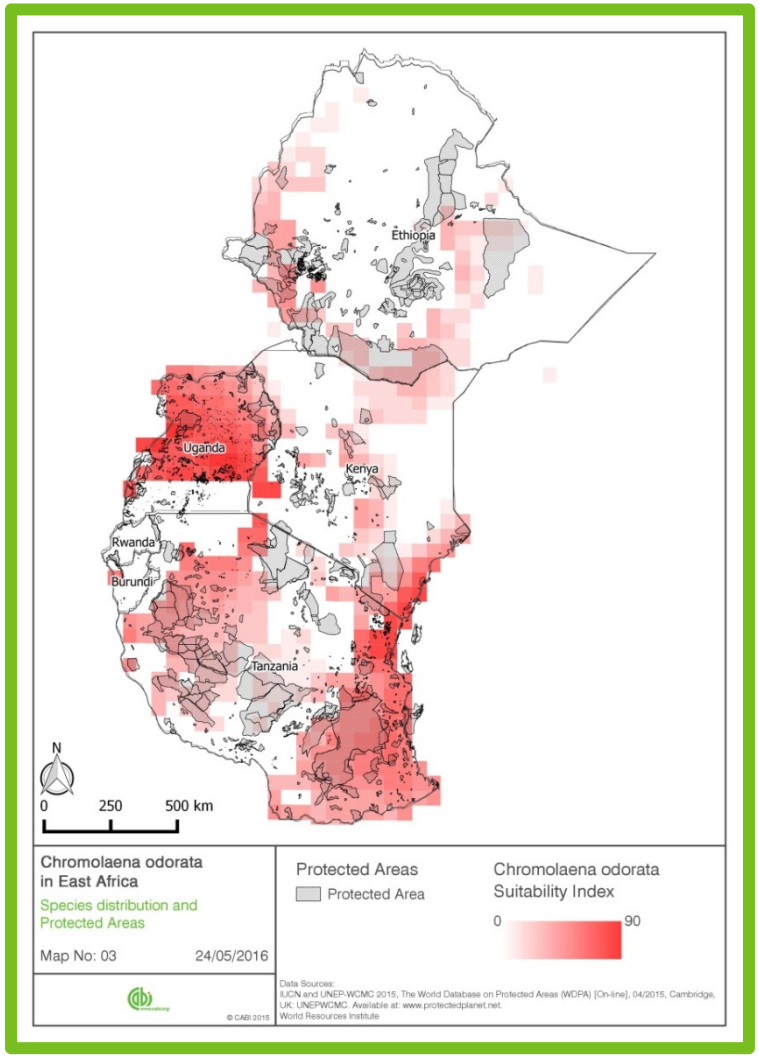
"Agriculture becomes very difficult because of this dangerous plant.” John Wambura Gimanje, RWA, Tanzania.

"I lack a place to graze my livestock. My livestock grows thinner and even die of starvation. Government help us folks" Monica Robert, Nyasirori, Tanzania.

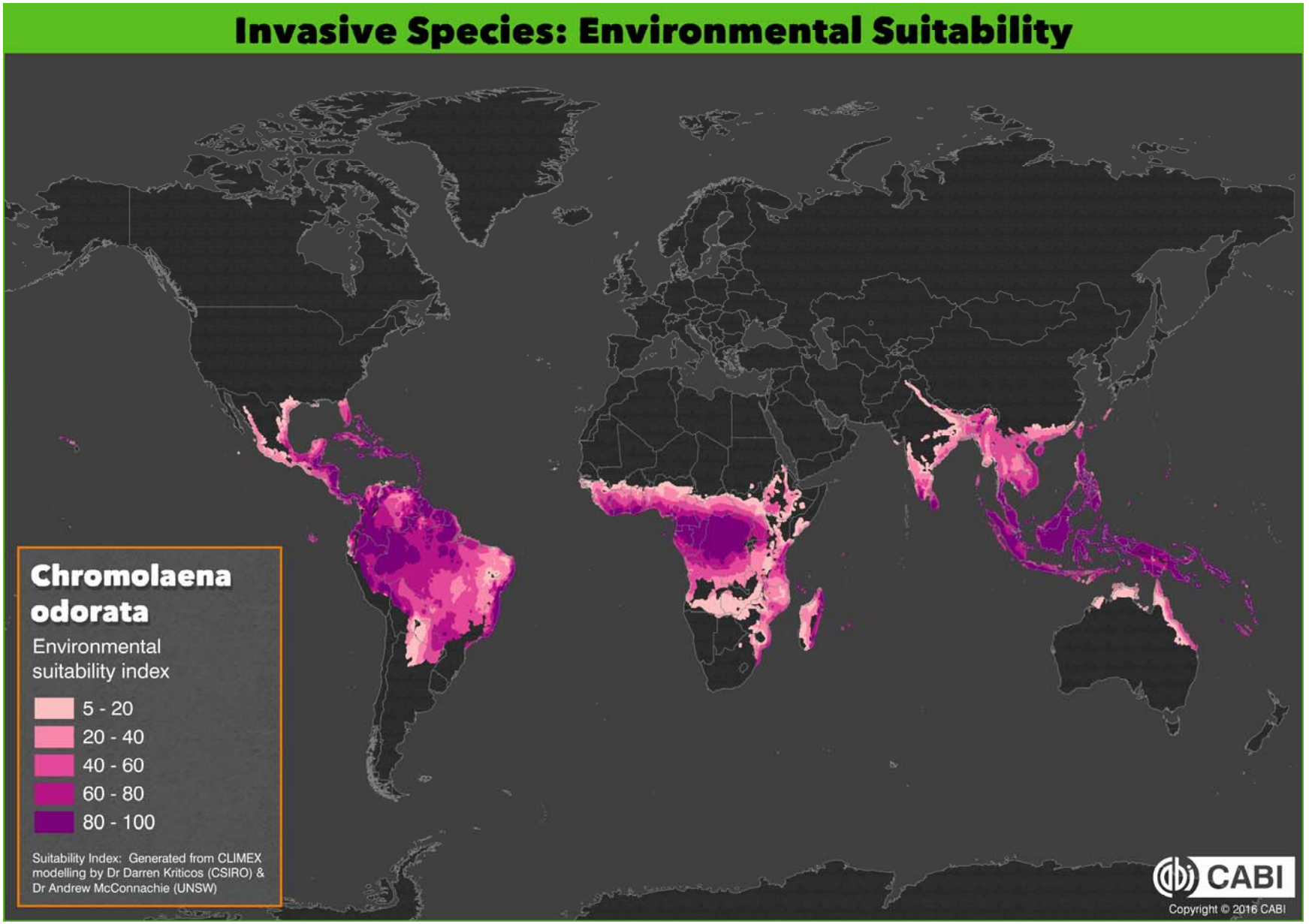
“Cows produce very little milk these days and weigh as much as a goat.” Chichi Marwa, Kyankoma, Tanzania.

Current and potential distribution of *Chromolaena odorata* in eastern Africa



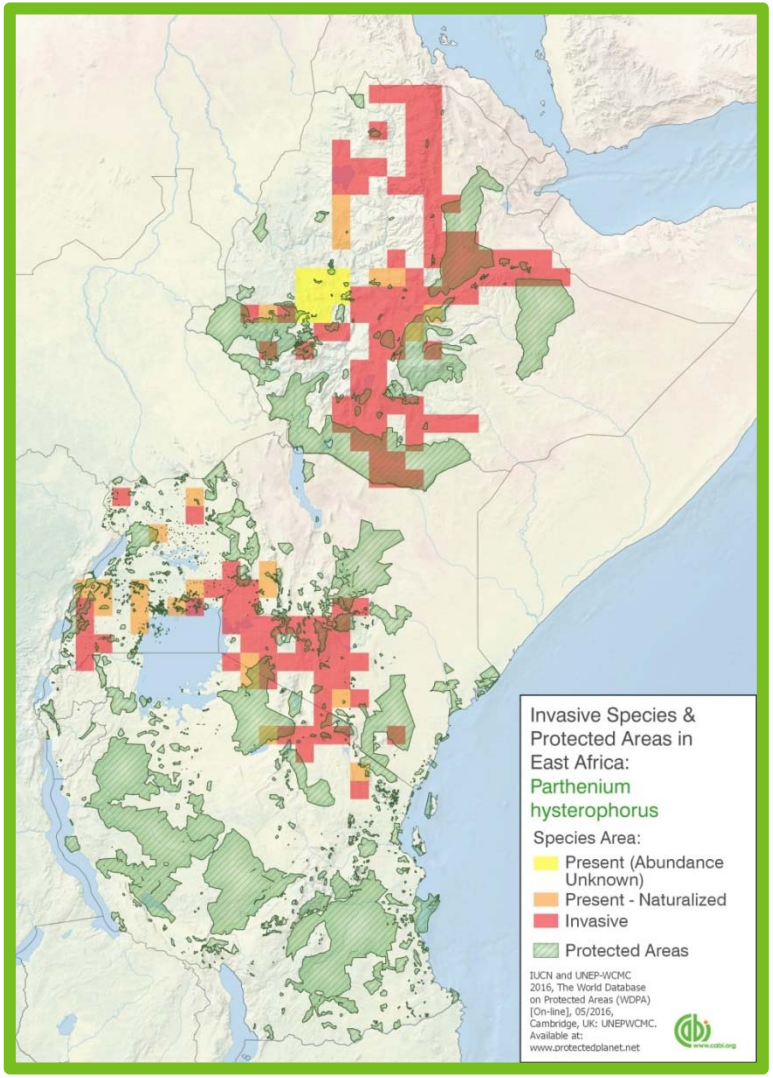


Invasive Species: Environmental Suitability



Parthenium hysterophorus in Kenya

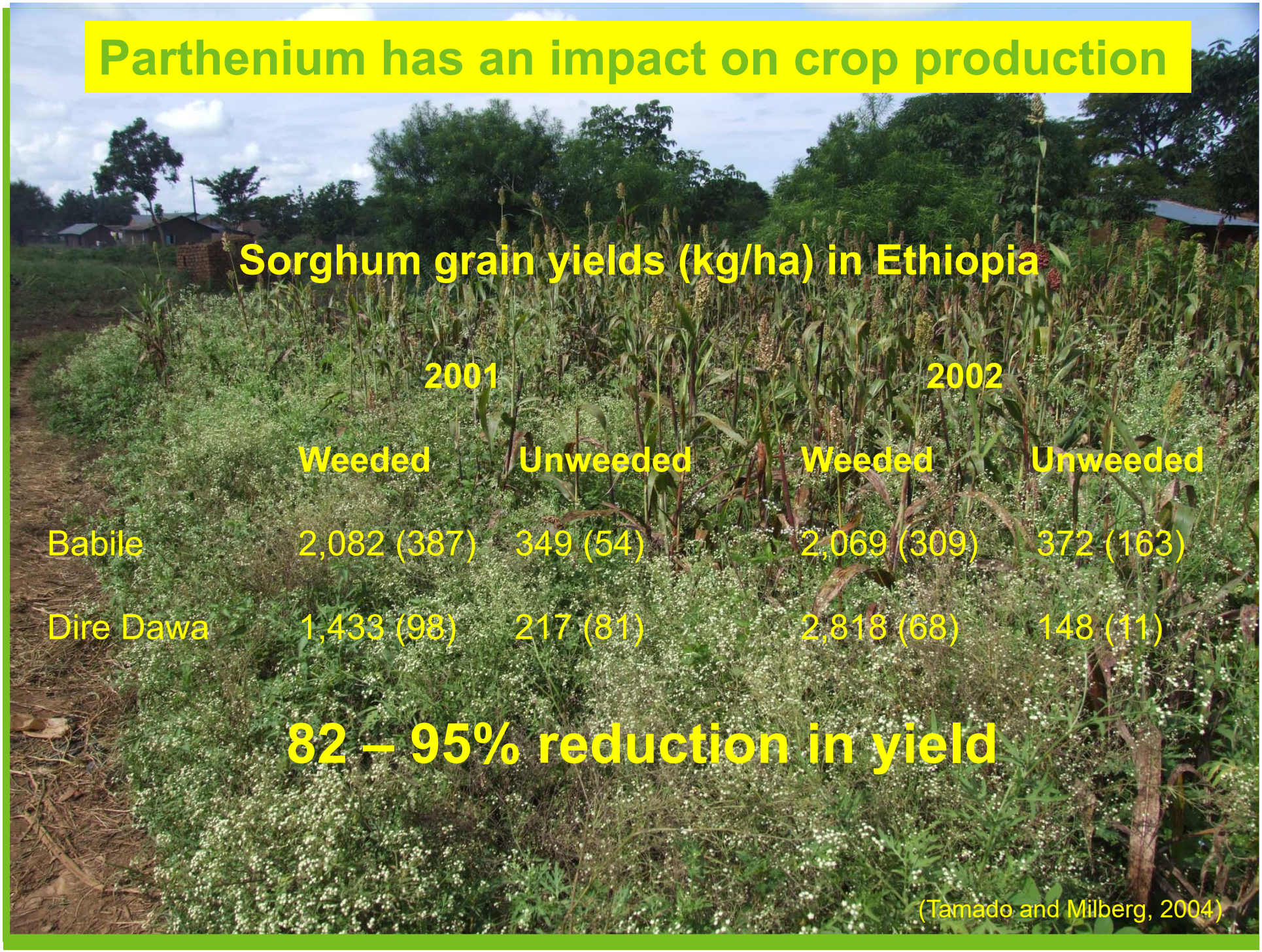
Current distribution of *Parthenium hysterophorus* in eastern Africa



Impacts:

- 90% of farmers now consider parthenium to be the most serious weed of croplands and pasture in Ethiopia (Tamado and Millberg, 2000)
- Can reduce pasture production by as much as 90% (Jayachandra, 1971).
- Taints the meat and milk of livestock
- Causes dermatitis and respiratory problems.

Parthenium has an impact on crop production



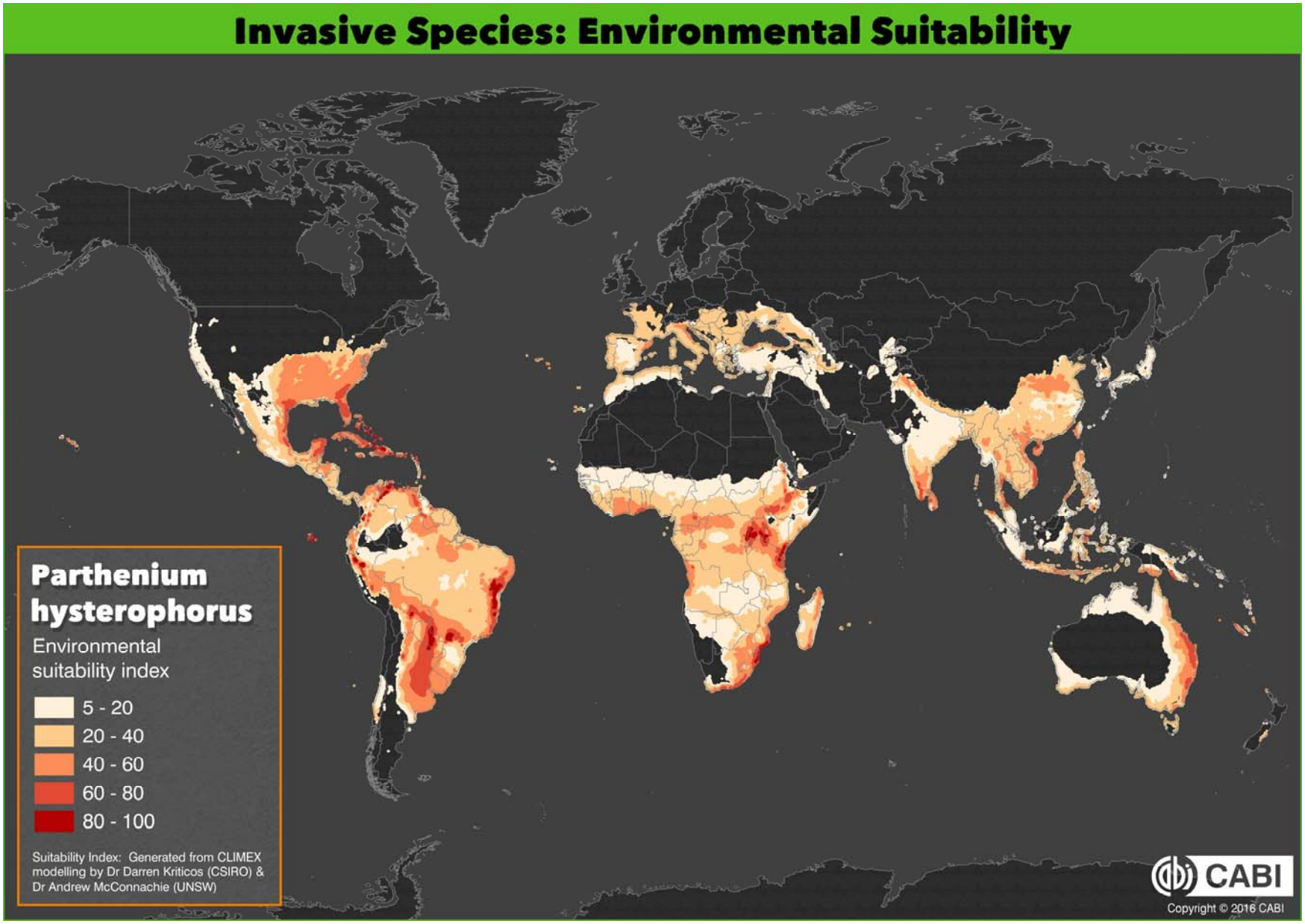
Sorghum grain yields (kg/ha) in Ethiopia

	2001		2002	
	Weeded	Unweeded	Weeded	Unweeded
Babile	2,082 (387)	349 (54)	2,069 (309)	372 (163)
Dire Dawa	1,433 (98)	217 (81)	2,818 (68)	148 (11)

82 – 95% reduction in yield

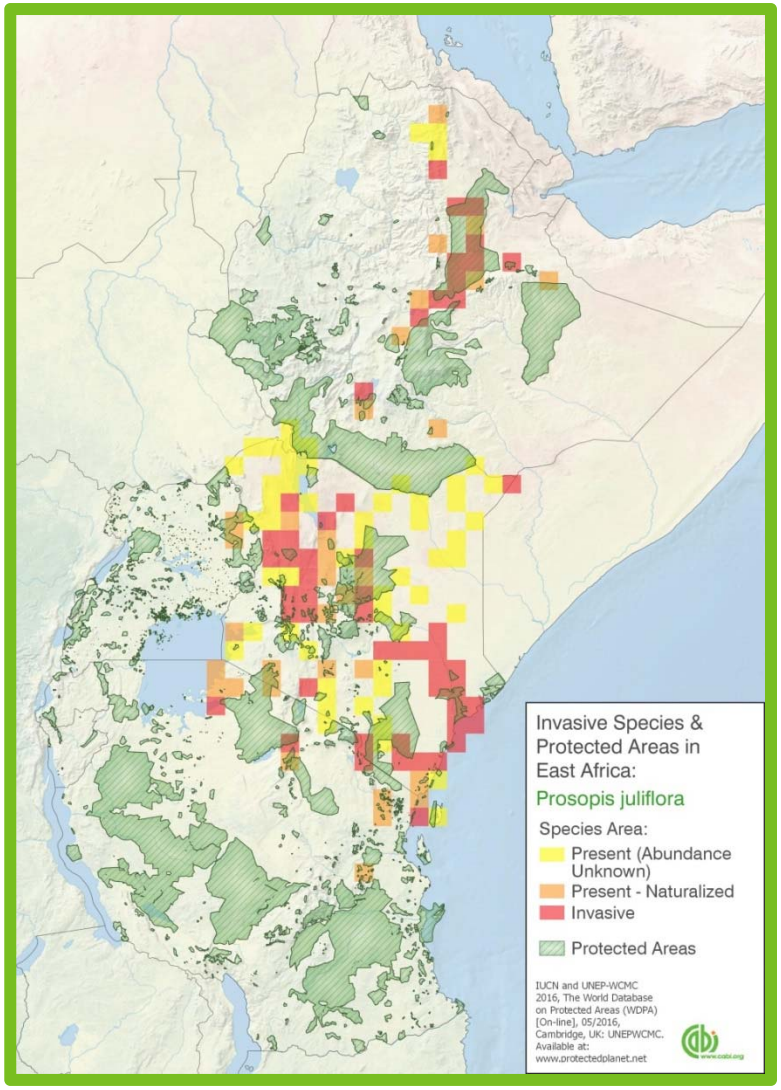
(Tamado and Milberg, 2004)

Invasive Species: Environmental Suitability



Prosopis juliflora in Ethiopia

Current distribution of *Prosopis juliflora* in eastern Africa



Impacts:

- In Ethiopia, *P. juliflora* has reduced understorey basal cover for perennial grasses from 68 % to 2%, and has reduced the number of grass species from seven to two (Kebede and Coppock, 2015).
- Reduces bird diversity and abundance.
- Has a negative impact on underground water resources.

Mosquitoes (malaria) and *P. juliflora*

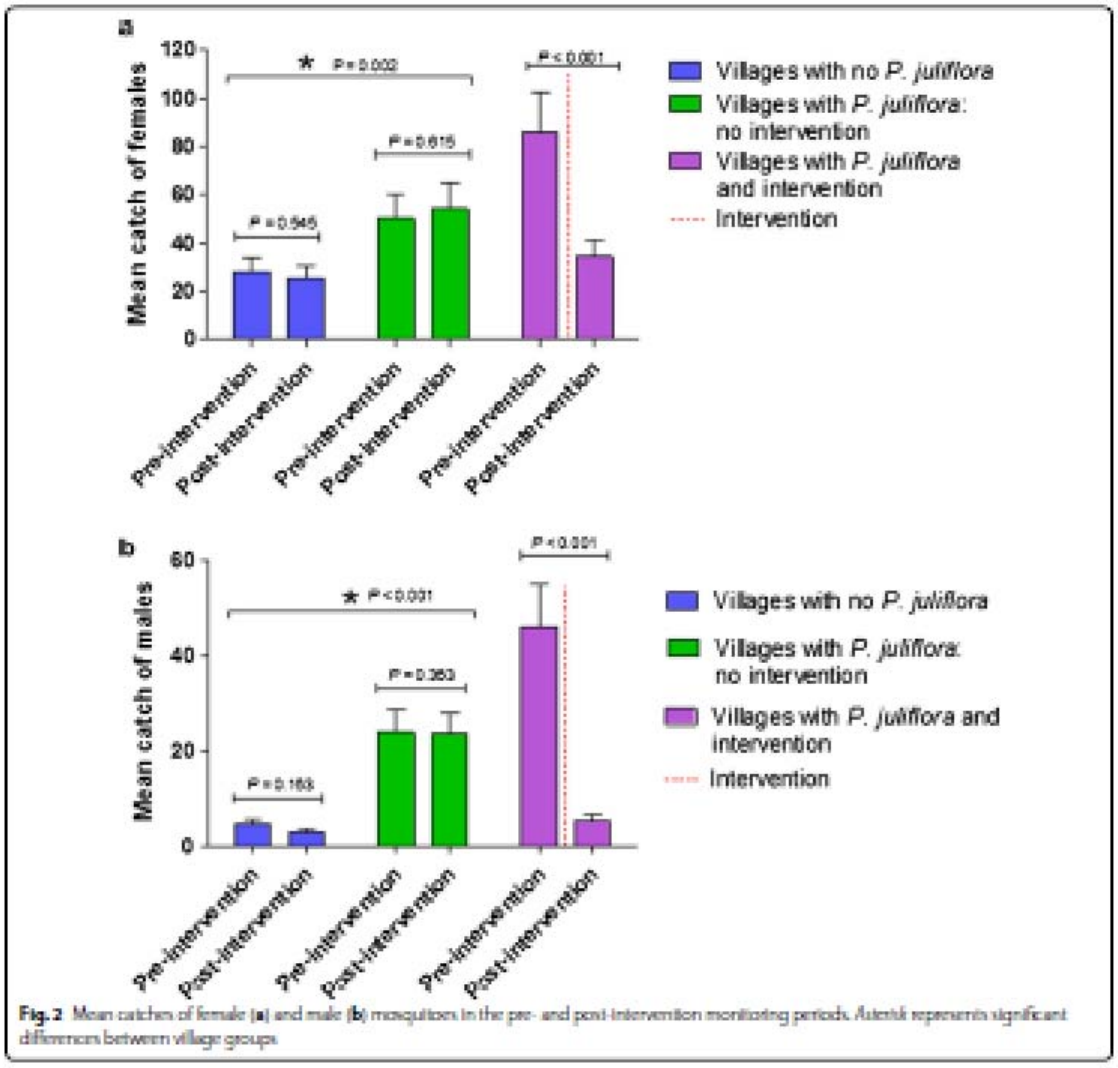


Fig. 2 Mean catches of female (**a**) and male (**b**) mosquitoes in the pre- and post-intervention monitoring periods. Asterisk represents significant differences between village groups

For survival mosquitoes need:
A blood meal;
Standing water;
Resting sites;
Sugar for energy (nectar, etc.)

Over 400,000 people
die from malaria
each year – most in
Africa

Muller et al. Malar J (2017) 16:237
DOI 10.1186/s12936-017-1878-9

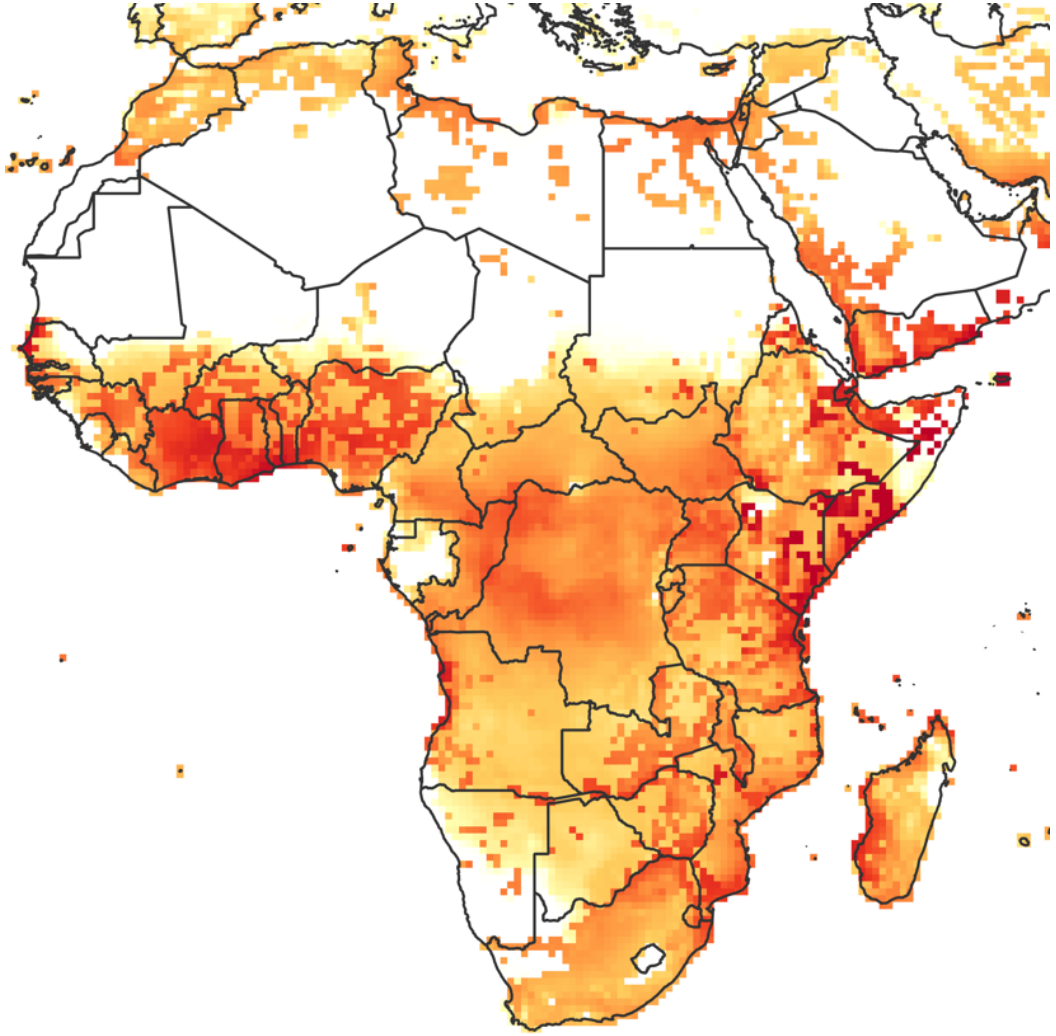
Malaria Journal

RESEARCH Open Access

The invasive shrub *Prosopis juliflora* enhances the malaria parasite transmission capacity of *Anopheles* mosquitoes: a habitat manipulation experiment

Gunter C. Muller[1,2*], Amy Junnila[1], Mohamad M. Traore[2], Sekou F. Traore[2], Seydou Doumbia[2], Fatoumata Sissoko[2], Seydou M. Dembele[2], Yosef Schlein[1], Kristopher L. Arheart[3], Edita E. Revay[4], Vasiliy D. Kravchenko[5], Arne Witt[6] and John C. Beier[3]

Potential distribution of *P. juliflora* in Africa



Could the management of invasive *Prosopis* spp. reduce the incidence of malaria?

Stone et al. Parasites & Vectors (2016) 11:70
DOI 10.1186/s13071-016-1344-6

Parasites & Vectors

REVIEW Open Access

Would the control of invasive alien plants reduce malaria transmission? A review

Christopher M. Stone[1], Arne B.R. Witt[2*], Guillermo Cabrera Walsh[3], Woodbridge A. Foster[4] and Sean T. Murphy[5]

What will happen to natural grazing lands if we don't manage invasive plants?

71%

of natural grazing could be lost in South Africa (van Wilgen *et al*., 2008)

What will happen if we don't weed?

Under unweeded conditions, crop losses have been measured for:

Maize: 55-90%
Common bean: 50%
Sorghum: 40-80%
Cowpea: 40-60%
Rice: 50-100%
Cotton: 80%
Wheat : 50-80%
Groundnut: 80%
Cassava: 90%

This said, everyone does some weeding yet crop losses are still high

(various authors from Gianessi, 2009)

Invasive alien plants are eroding the natural resource base on which millions of people in Africa directly depend. Although the continent, with the exception of SA, has relatively few IAPs, those that are present are widespread and extremely damaging.








So what is being done to manage the problem in countries outside of South Africa?

NOT NEARLY ENOUGH!!

Most IAP interventions in Africa (outside of SA) are ad hoc, localized, donor-funded, not sustained, etc.

In order to address this CABI has, together with partners, tried to address some of these barriers:

- Lack of policy or implementation thereof;
- Little awareness;
- Limited capacity;
- Insufficient resources;
- No countrywide interventions;
- No available herbicides;
- Little support for biological control;
- Conflict species;
- Etc.

Strengthening policy and legislation

Establishment of Coordinating Unit;
Development of NISSAP;
NBSAP modified to include IAPs;
Cost-recovery mechanisms for IAP management.

Information and awareness

Websites; posters, documentaries, radio jingles, etc.

www.cabi.org

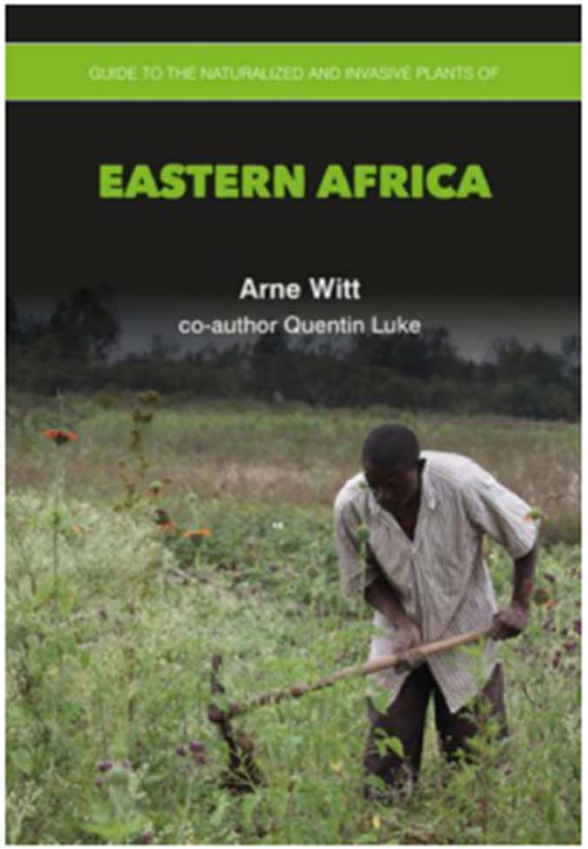
Capacity building

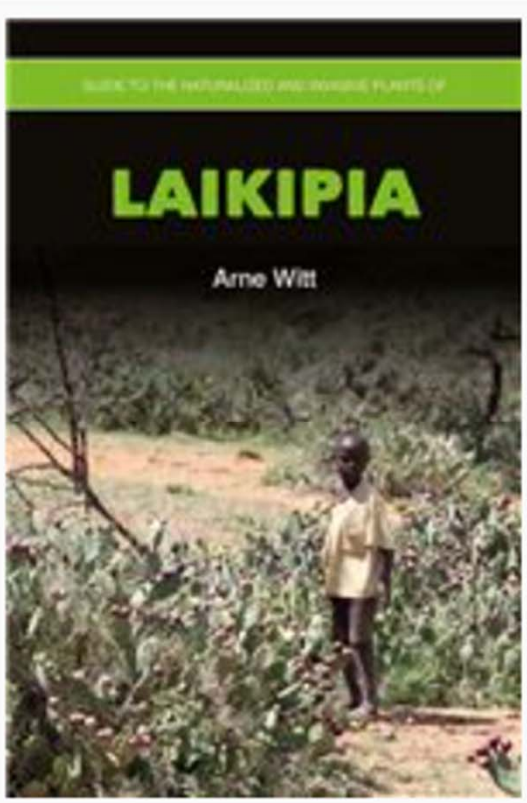
Training strategy developed and promoted;
Equipment and material support to quarantine departments etc.;
Conference attendance;
Curriculum development;
Support for students.

IAP prevention and management

Risk analysis procedures developed;
Early detection and rapid response mechanisms developed;
Presence and impact of IAS recorded;
Integrated management at pilot sites.

Development of field guides which include information on impacts and management



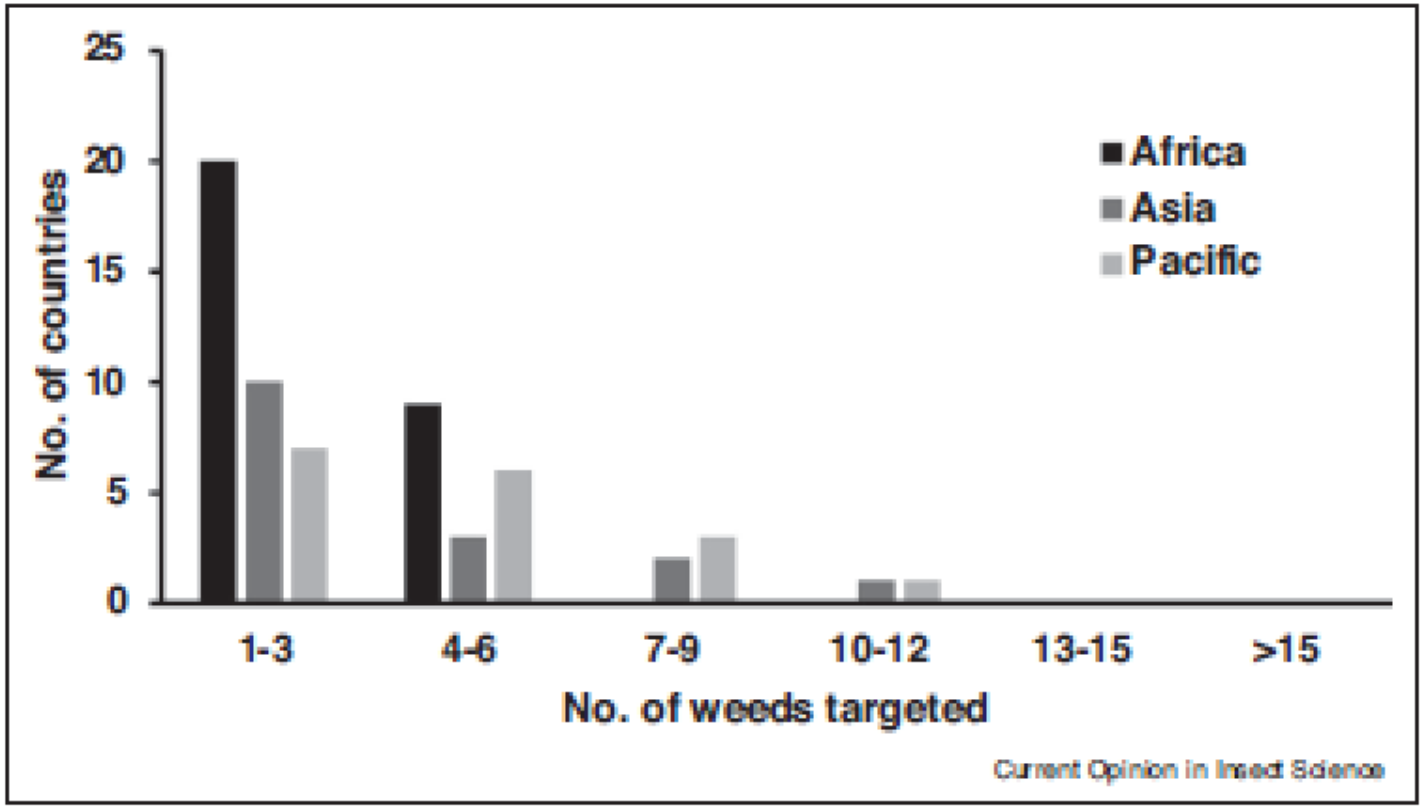


Biological control of pests in Africa

	# target species	# agents released	# agents established	Target species at least partially controlled	
				#	%
Weed biological control	66	143	103	49	74.2
Arthropod biological control using insects	119	404	124	91	76.5
Arthropod biological control using pathogens	12	8	5	4	33.3
Arthropod biological control using mites	2	15	4	1	50
Snail biological control	2	4	3	0	0
Total	**206**	**574**	**239**	**145**	**-**

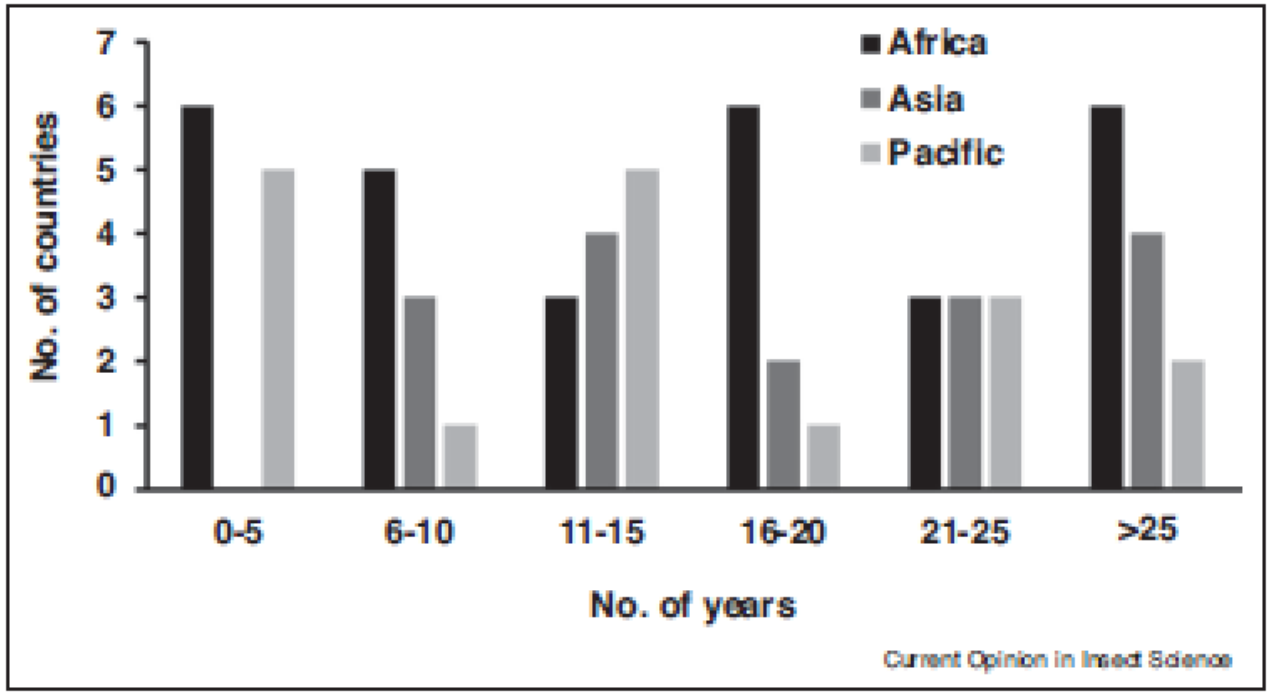
Witt et al. (2021)

Number of countries in Africa (excl. SA), Asia and the Pacific and the number of weeds each country has targeted for CBC



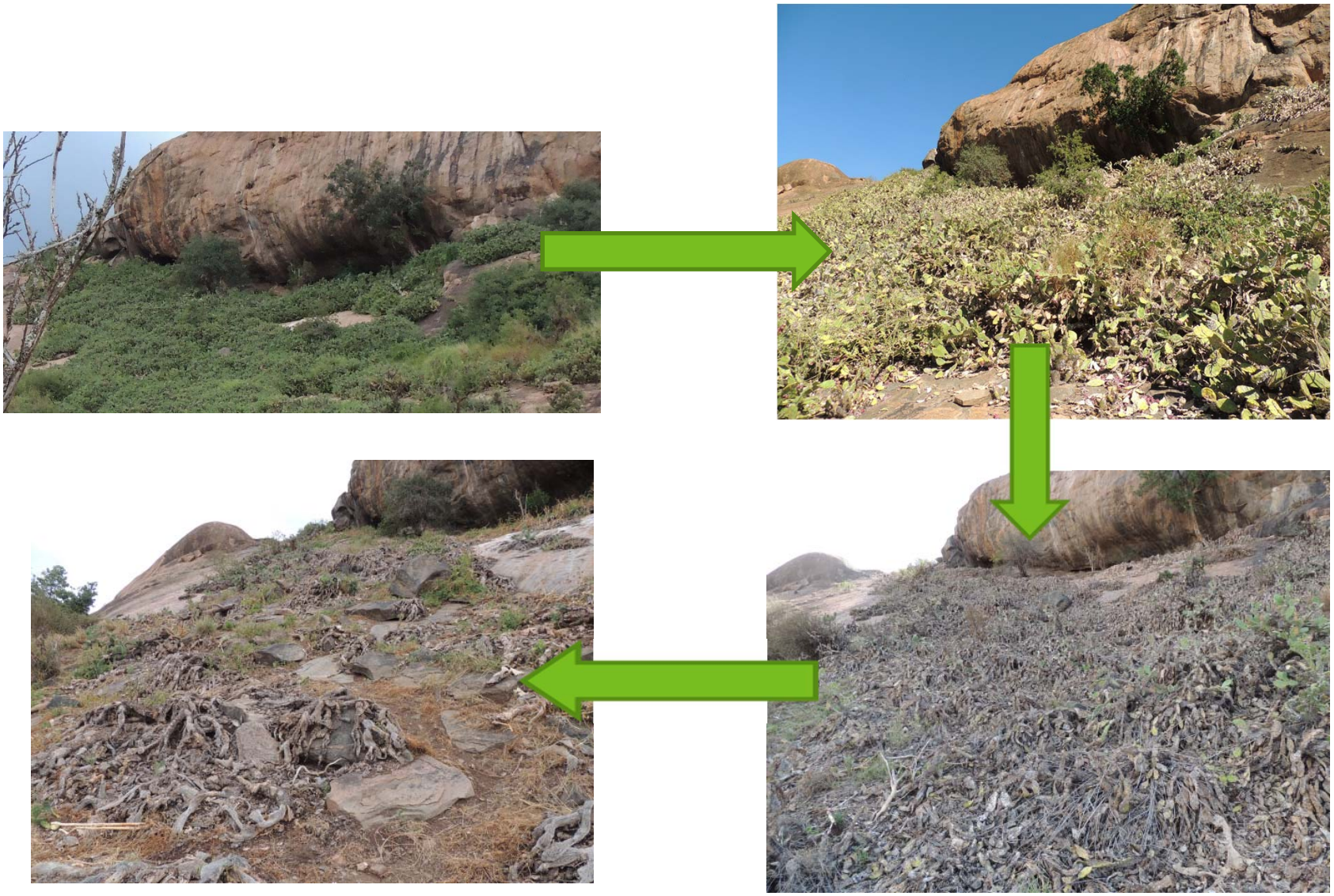
Day et al. (2020)

The number of countries in Africa (excl. SA), Asia and the Pacific and the number of years since weed CBC agents were intentionally released.



Day et al. (2020)

CBC – *Dactylopius opuntiae* on *Opuntia stricta* in Kenya



The biggest impediment to IAP management is the perception that it is only a biodiversity issue, when in fact it is one of the biggest threats to livelihoods on the planet.

We know how to manage IAPS, what we don't know is how to 'manage' people to manage IAPS

CABI is an international intergovernmental organisation, and we gratefully acknowledge the core financial support from our member countries (and lead agencies) including:

UKaid
Ministry of Agriculture and Rural Affairs, People's Republic of China
Australian Government Australian Centre for International Agricultural Research
Agriculture and Agri-Food Canada
Ministry of Foreign Affairs of the Netherlands
Swiss Agency for Development and Cooperation SDC