Cross-cutting impacts of IAS and the need for increased collaboration

Arne Witt (a.witt@cabi.org)

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Biggest threats to biodiversity (in no particular order)

- Climate change
- Overexploitation
- Pollution
- Habitat loss
- IAS

IAS are biological pollutants, they drive habitat loss and contribute to climate change

Since the year **1600 39% of animal extinctions** arose mainly from the introduction of alien species, 36% from habitat destruction, and 23% from hunting or deliberate extermination.

Critical to recognize that IAS don't only have an impact on biodiversity. They also impact on:

- Crop and livestock production;
- Human and animal health;
- Water resources;
- Fuel fires;
- Climate change – increased biomass (fires), albedo effect;
- Land degradation – soil erosion;
- Traditions and cultures.

Biggest threats to crop production

- Environmental degradation
- Climate change
- Pests and diseases

"Plant pests: The biggest threats to food security?"

In a changing climate and increasingly complex geopolitical landscape, pests and pathogens pose a growing threat to food security. Steps must be taken to mitigate these threats to agricultural output.

"If crop pests continue to spread at current rates, many of the world's biggest crop-producing nations will be inundated by the middle of the century, posing a grave threat to global food security," Dr. Bebber said.

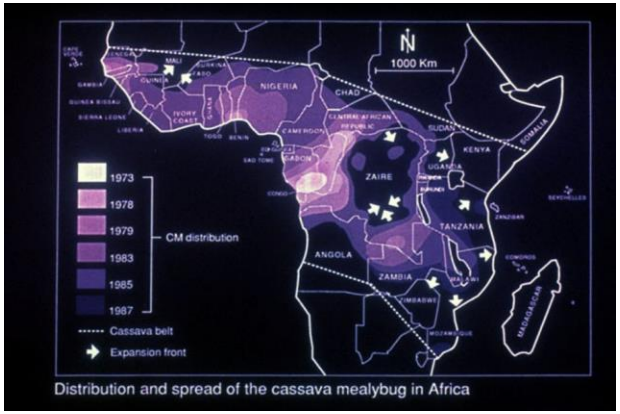
Some estimates suggest crop losses average as high as 40%, at a global cost of 220 billion USD annually.

Witchweed in Africa – maize losses of US$7 billion/annum. Impacts on lives of more than 300 million people

Parthenium – can reduce sorghum yields by 82-95%

(Tamado and Milberg, 2004)

Cassava mealybug in Africa – yield losses of 80%



Distribution and spread of the cassava mealybug in Africa

Biggest threats to livestock production

- Climate change
- Diseases
- Rangeland loss

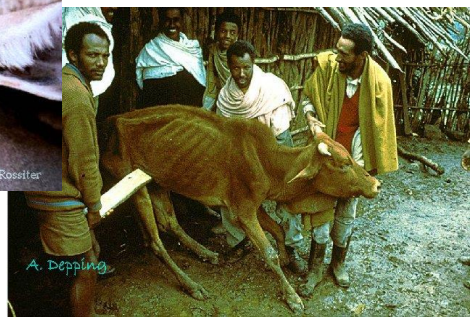
71% of natural grazing in SA will be lost if IAPS not managed (van Wilgen et al. 2007)

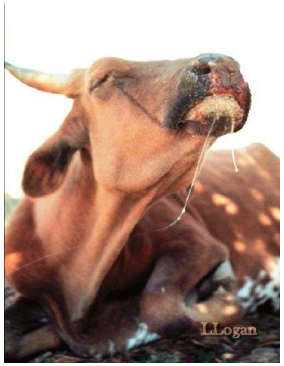
Animal diseases threaten the lives of millions of livestock on a daily basis.

Poor animal health in these countries affects production, exposing farmers to reduced income and well-being.

Rubbervine – can reduce livestock carrying capacities by as much as 100%

Rinderpest – 1/3 of human population of Ethiopia died; 2/3 of the Masai in Kenya and Tanzania starved





fao.org; cvm.tamu.edu; awp.eduwikis.co.za

IAS drive landscape degradation

Invasions of unpalatable plants put increasing pressure on uninvaded rangelands leading to overgrazing.

The main drivers of soil degradation in Africa are **overgrazing (49%)**, agricultural mismanagement (28%), and deforestation (14%) (Soil Atlas 2024).

About 23% of the surface of Africa, or over 700 million hectares of land, is already degraded. Another three million hectares is being further degraded annually.

IAS pose a significant threat to human health

- Vectors and hosts of numerous pathogens
- Increased pesticide use
- Food insecurity

It has been hypothesized that invasive alien species may have a disproportionate impact on the transmission of zoonotic pathogens (Hulme, 2014).

According to Bradshaw et al. (2016) global **health costs** directly attributable to invasive insects exceed **US$ 6.9 billion per year**, with most costs associated with **dengue (84%), followed by West Nile virus (15%).**

Introduced mosquitoes are vectors of deadly arboviruses, such as dengue virus complex, chikungunya, zika and yellow fever.

Black death or bubonic plague

https://www.thevintagenews.com/2015/12/25/40271/

Prosopis sustaining high *Anopheles* mosquito populations

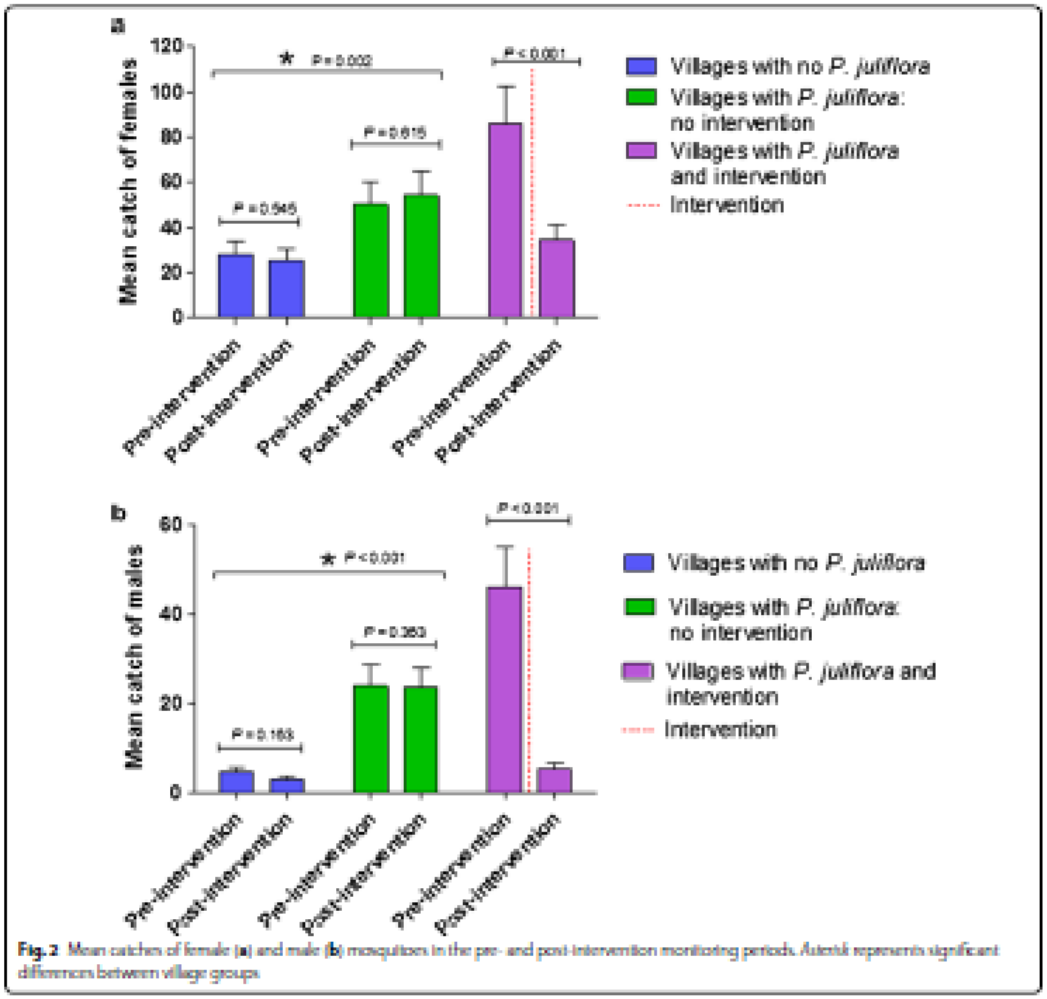


Fig. 2 Mean catches of female (**a**) and male (**b**) mosquitoes in the pre- and post-intervention monitoring periods. Asterisk represents significant differences between village groups

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]

Stone et al. Parasites & Vectors (2016) 9:170
DOI 10.1186/s13071-016-1444-8

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]

Abstract

Vector control has been the most effective preventive measure against malaria and other vector-borne diseases. However, due to concerns such as insecticide resistance and budget shortfalls, an integrated control approach will be required to ensure sustainable, long-term effectiveness. An integrated management strategy should entail some aspects of environmental management, relying on coordination between various scientific disciplines. Here, we review one such environmental control tactic: invasive alien plant management. This covers salient plant-mosquito interactions for both terrestrial and aquatic invasive plants and how these affect a vector's ability to transmit malaria. Invasive plants tend to have longer flowering durations, more vigorous growth, and their spread can result in an increase in biomass, particularly in areas where previously little vegetation existed. Some invasive alien plants provide shelter or resting sites for adult mosquitoes and are also attractive nectar-producing hosts, enhancing their vectorial capacity. We conclude that these plants may increase malaria transmission rates in certain environments, though many questions still need to be answered, to determine how often this conclusion holds. However, in the case of aquatic invasive plants, available evidence suggests that the management of these plants would contribute to malaria control. We also examine and review the opportunities for large-scale invasive alien plant management, including options for biological control. Finally, we highlight the research priorities that must be addressed in order to ensure that integrated vector and invasive alien plant management operate in a synergistic fashion.

Keywords: Invasive alien plants, Biological control, Environmental management, Plant-vector interactions, Nectar feeding, Resting, Larval habitat, Vector-borne disease

RESTORATION ECOLOGY
The Journal of the Society for Ecological Restoration

SER

UN DECADE ON ECOSYSTEM RESTORATION

STRATEGIC ISSUES ARTICLE

Ecological countermeasures for preventing zoonotic disease outbreaks: when ecological restoration is a human health imperative

Jamie K. Reaser[1,2,3,4], Arne Witt[5], Gary M. Tabor[1], Peter J. Hudson[6], Raina K. Plowright[4,7]

Ecological restoration should be regarded as a public health service. Unfortunately, the lack of quantitative linkages between environmental and human health has limited recognition of this principle. The advent of the COVID-19 pandemic provides the impetus for further discussion. We propose ecological countermeasures as highly targeted, landscape-based interventions to arrest the drivers of land use-induced zoonotic spillover. We provide examples of ecological restoration activities that reduce zoonotic disease risk and a five-point action plan at the human-ecosystem health nexus. In conclusion, we make the case that ecological countermeasures are a tenet of restoration ecology with human health goals.

Key words: ecological countermeasures, invasive alien species, land use-induced spillover, landscape immunity, restoration ecology, zoonotic disease

Pesticide use - 385 million cases of UAPP occur annually world-wide including ~11,000 fatalities. This means that ~44% of farmers are poisoned by pesticides every year (Boedeker et al., 2020)

Banerjee et al. 2013

IAPS and water – a great thirst!!

- Water run-off could be reduced by 56% in SA
- A dense 1 ha stand of invasive *Acacia saligna* with access to groundwater uses up to 8,000m^3 of water/year (TNC)
- Invasive *Neltuma juliflora* trees in Ethiopia's Afar region consume approximately 3.1 to 3.3 billion\m^3 of water/annually; average of 7 litres/tree/day.

In 1995, former World Bank vice president Dr Ismail Serageldin said: "**If the wars of this century were fought over oil, the wars of the next century will be fought over water -- unless we change our approach to managing this precious and vital resource.**“

About 4 billion people, representing nearly two-thirds of the global population, experience severe water scarcity during at least one month of the year (Mekonnen and Hoekstra, 2016).

By 2050, three out of four people worldwide could face drought impacts. Current drought costs already exceed $307 billion annually (UNU-INWEH,2024)

IAPS and fire – a lethal combination

"How Invasive Plants Caused the Maui Fires to Rage"

"Invasive grasses are fueling wildfires across the US"

"Blue gum eucalyptus is one of the most fire-intensive plants"

"Even in inaccessible highlands, huge areas are occupied by a monoculture of eucalyptus that's an ideal fuel for forest fires"

"The 1991 Oakland Hills firestorm which destroyed almost 3,000 homes and killed 25 people was partly fuelled by large numbers of eucalypts close to the houses."

"Scientists have found that non-native pine and eucalypt forests planted to supply pulp and timber mills in central Chile are contributing to the massive fires."

"Plantations of highly flammable exotic species, such as pines and eucalypts, probably helped to fuel the recent catastrophic fires in Portugal and in Chile."

Peter Chadwick, Table Mountain Fund

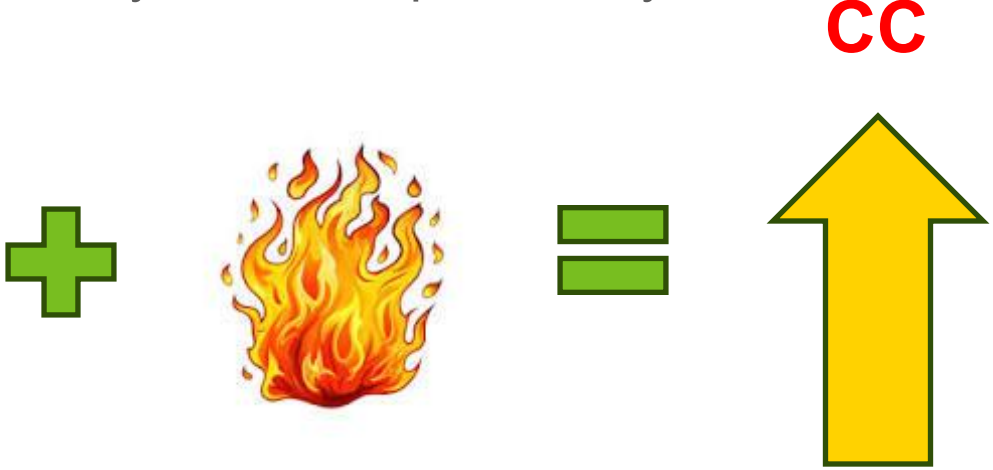
IAPS and climate change

A mature live tree **can absorb more than 48 pounds of CO_2 /year** which is stored in its fibers until the tree experiences a physical event that releases it into the atmosphere**, like fire** or decomposition (Androff, 2021).

Fynbos – invasives increase above ground biomass by up to 60%

Climate change threatens to increase the **frequency, extent, and severity of f**ires through increased temperatures and drought …..

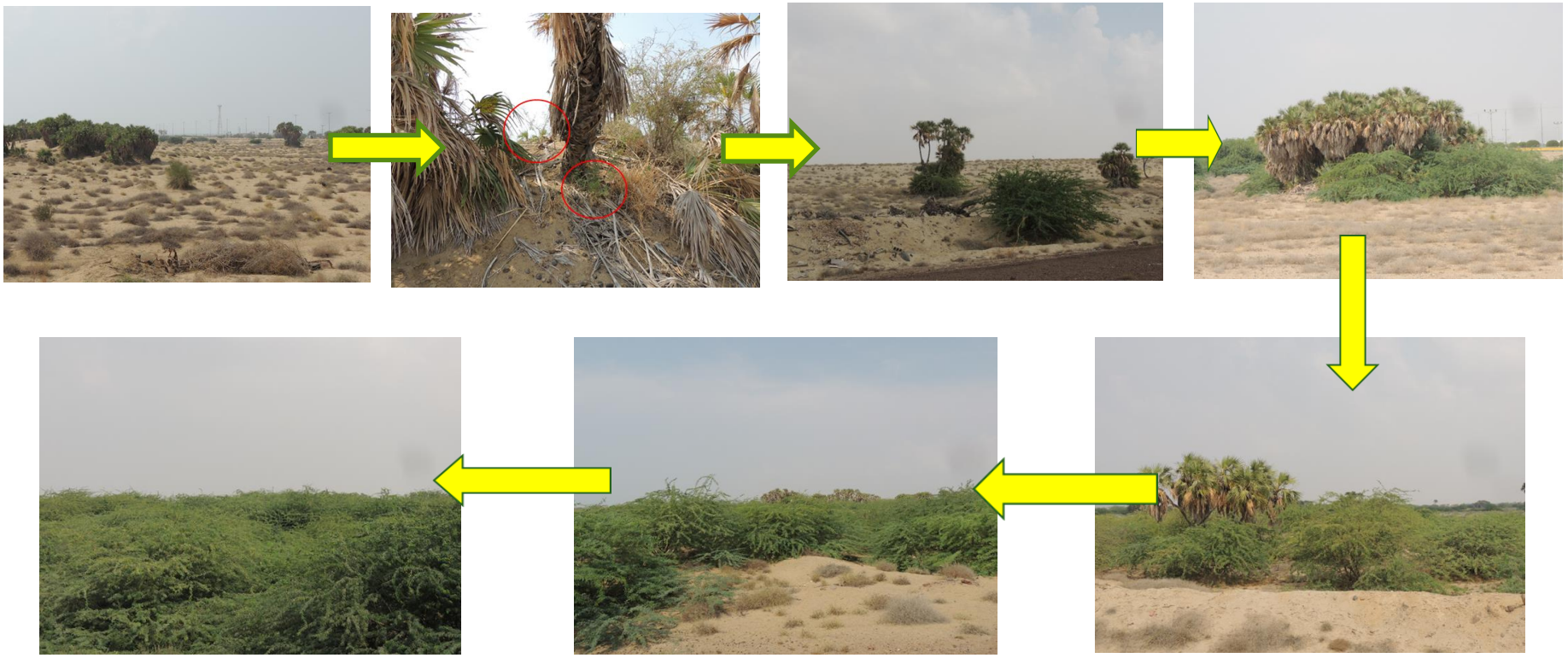
IAPS will exacerbate CC, especially in fire-adapted ecosystems.



IAPS and climate change

The albedo effect – how much energy from the sun is reflected back into space = ~31%

Forest (15%); Grass (25%); **Desert (40%)**; Ocean (60%); Fresh snow (80%)



IAPS, land degradation and climate change

IAPS contribute to overgrazing, which leads to soil erosion

Soils store more carbon than vegetation and the atmosphere combined.

At a global level the top 30 cm of soil holds about 694 gigatonnes of carbon (Soil Atlas 2024).

IAPS in rangelands are therefore contributing to climate change by reducing available forage, leading to overgrazing and associated soil loss.

IAS have cross-cutting impacts and therefore require a coordinated approach!!

An IAP such as parthenium impacts on biodiversity; crop and pasture production; and human and animal health

Who is responsible - Department of Environment. Agriculture or Health? Which Department or donor will fund management?

In previous GEF IAS Projects we established Coordination Units or Apex Bodies represented by all interested and affected parties. These were not sustained due to a lack of funds despite cost-recovery mechanisms being proposed. Difficult to develop and implement. The key issue is funding, who pays for the management of a x-sectoral issue.

We definitely need a new approach, but who will fund it?

According to UNEP:

"achieving the SDGs by 2030 will require a radically different paradigm of development than was applied to the MDGs.

A new approach that **breaks down sectoral barriers**, **capitalizes on synergies in land uses and human development,** and **strengthens coordination and participation of a wide range of stakeholders** is needed. **Integrated landscape management (ILM) is that approach."**

Integrated landscape approaches

CABI Landscapes Initiative

- ✓ Holistic, inclusive and participatory
- ✓ Cross-sectoral and cross scale
- ✓ Multi-stakeholder forums

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