PREVENTION AND CONTROL OF INVASIVE SPECIES IN HABITAT RESTORATION



Max Zieren, UNEP Regional Office Asia Pacific
Arne Witt, CAB International, Nairobi
(max.zieren@unep.org)

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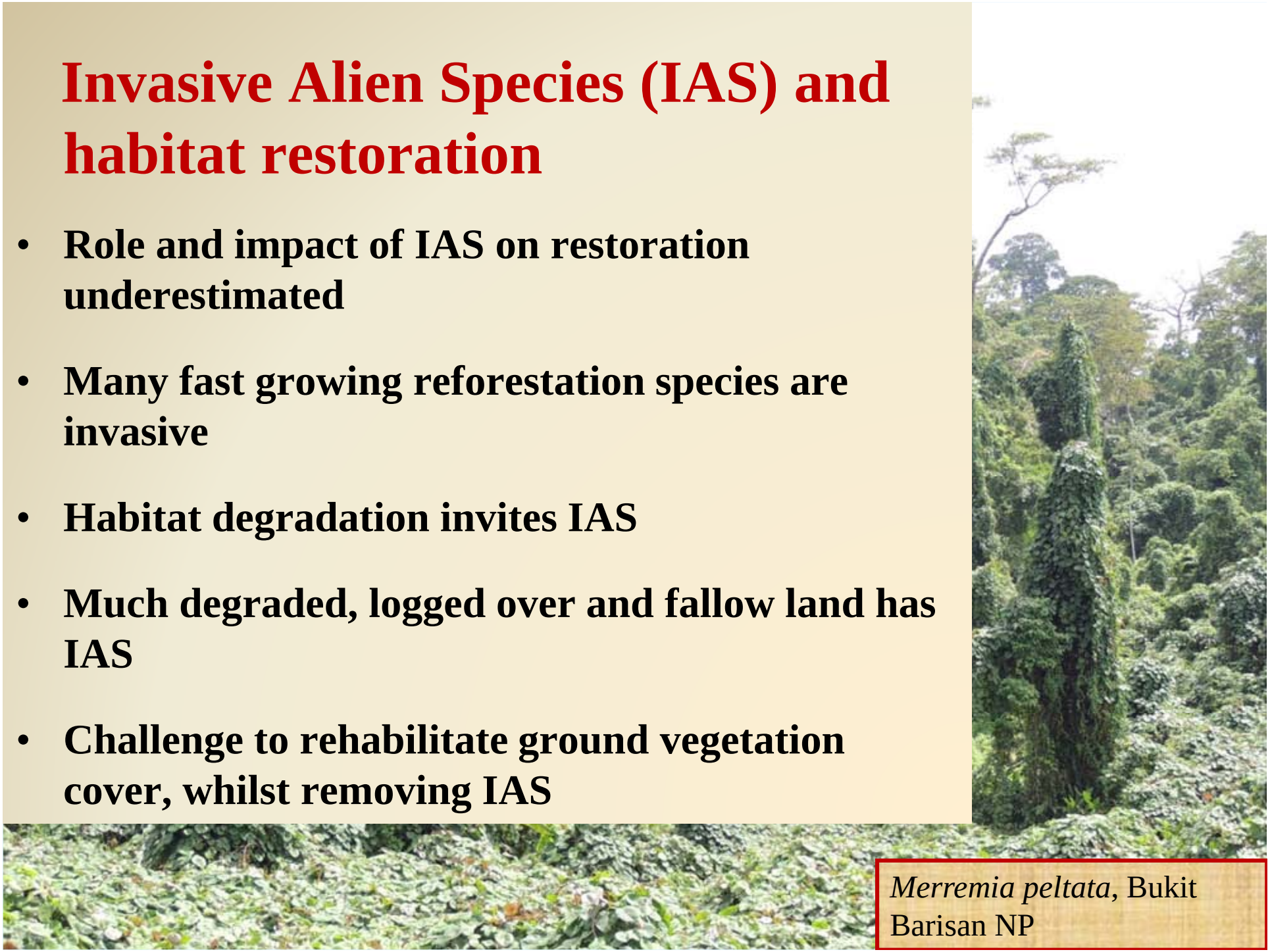
Beauty of invasive species is deceitful…..and costly…

- IPCC - 2 degree rise in temperatures could cost the global economy anything from **0.2-2% of global GDP** (April 2014)
- BUT - Invasive species costing the global economy **5% of global GDP** (2011, USD 1.4 Trillion)

Yet invasive species grossly ignored in economic development, restoration and core conservation programs

Invasive Alien Species (IAS) and habitat restoration

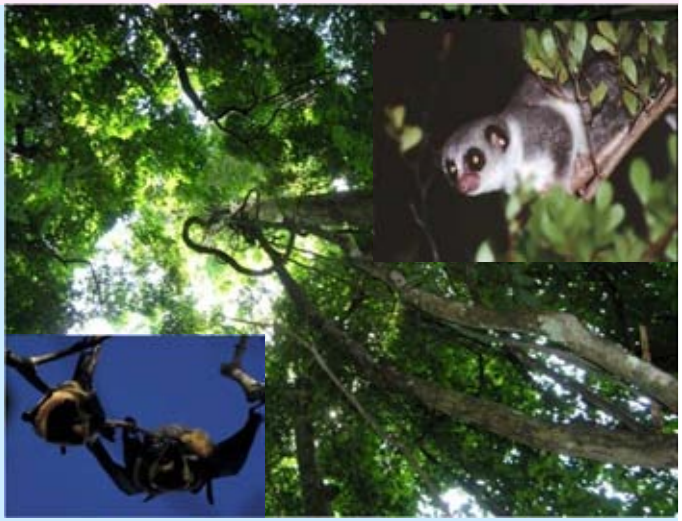
- **Role and impact of IAS on restoration underestimated**
- **Many fast growing reforestation species are invasive**
- **Habitat degradation invites IAS**
- **Much degraded, logged over and fallow land has IAS**
- **Challenge to rehabilitate ground vegetation cover, whilst removing IAS**



Merremia peltata, Bukit Barisan NP

Invasive Alien Species – *the basics*

- Invasive Alien Species (IAS) are "introduced species that become established in a new environment, then spread in ways that are destructive to human interests and natural systems"
- Intentional and non-intentional introductions
- Key entry points or pathways: economic development, logging & major habitat degradation, increased trade & transport
- Invasive species more than a pest -> IAS change ecosystems functioning!
- Prevention better and cheaper than control afterwards



Scope of the Problem

- IAS are **everywhere** - and still being introduced or promoted due to carelessness or ignorance - e.g. as 'solution' to land degradation!
- *Prosopis juliflora* – e.g. invaded c. 800 000 Ha in Ethiopia, c. 600,000 Ha in Kenya, 1.8 mill. Ha in South Africa & 5.6 mill. Ha India
- **Cost invasives** in EU (Euro 12 billion/yr) – an 'Act' in the making to blacklist 'possession, transport, selling or growing species deemed as of Union concern'

- **Cornerstone of BD conservation** – the Protected Areas sytems, are increasingly infested, impacted or being lost
- **Key wildlife** such as One-horned Rhinoceros (Chitwan National Park), Banteng (Baluran NP), or Asian Elephant affected by changes in available fodder

- **Reduced agriculture production**: USD 21.6 million p.a in SE Asia; Coffee plantations East Java loose 83% production
- Natural forest **regeneration severely affected**

Impacts of invasive species

Types:

1. Economic
2. Production & food
3. Human health
4. Biodiversity & ecosystems

(i) Economic impacts

Australia

- 2681 alien species have become established
- Annual cost of invasive *weeds to crops* – USD 1.2 billion; *pasture* – USD 462 million; *horticulture* USD 199 million.
- Cost of introduced invertebrates like mosquitoes, honeybees and wasps, fire ants, cattle tick, screw-worm, earth mite, wood wasp – USD 4.7-7.5 billion p.a.

USA

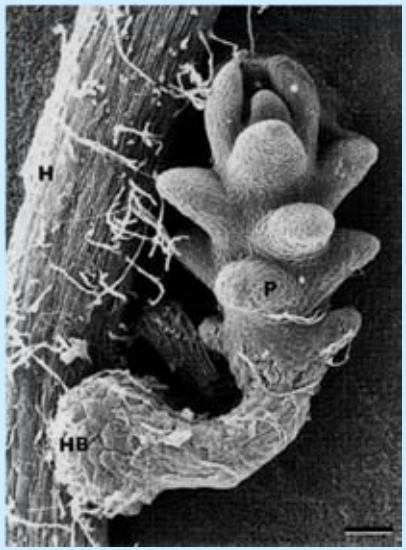
- Economic costs of invasive plants and animals are estimated at US$ 137 billion p.a.

Total costs AUS + USA over USD 140 billion per year

(ii) Food security

Witchweed

(Striga hermonthica)



Africa – maize losses of USD7 billion p.a. and impacts on the lives of more than 300 million Africans

(ii) Food security - Impacts on crop and pasture production

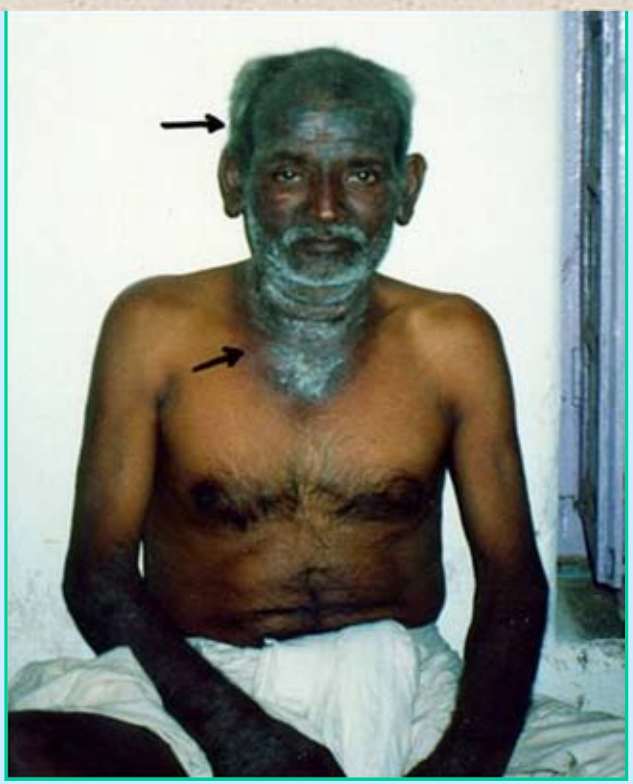
Lantana camara poisoning !

- Has invaded majority of pasturelands India (13.2 million ha.) – damage estimated USD 924 million per year
- Pastoral losses Queensland (AUS) USD 7.2 million, 1,500 animal deaths, reduction in productivity, loss of pasture, and control costs

Exposed flesh where skin has died – photosensitive!

Depressed and weak

(iii) Human & Animal Health - *Parthenium* impacts

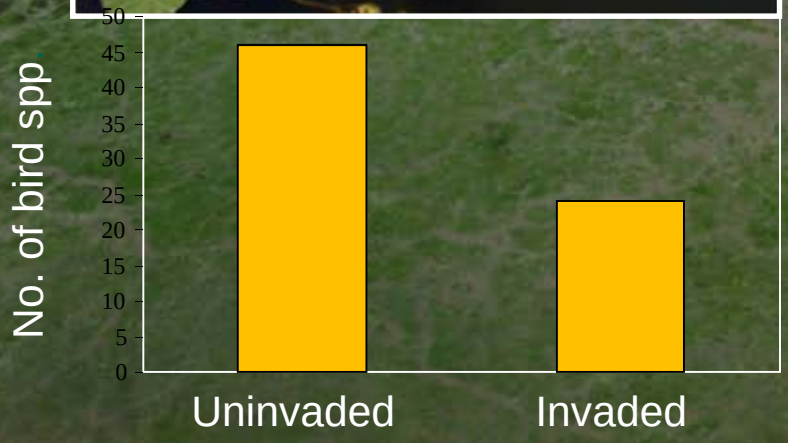


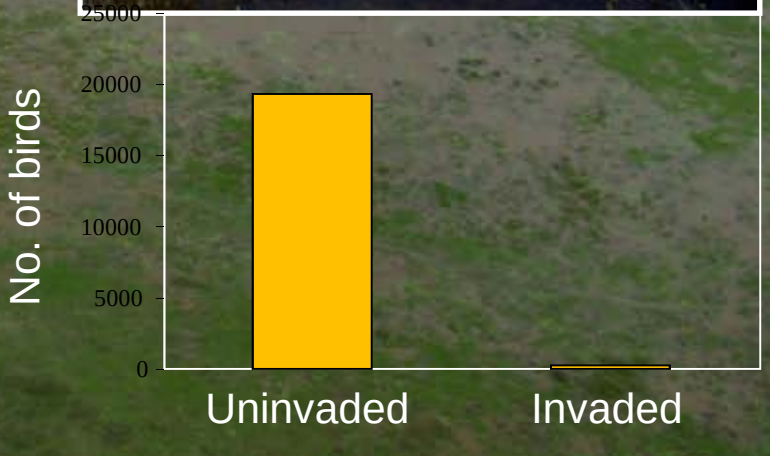
Skin deformation in Goat

- Prolonged skin contact gives allergenic eczematous contact dermatitis. Inhalation of pollen causes allergenic rhinitis which can become bronchitis or asthma.
- 1 to 10 years exposure to the weed, 10 – 20% of the population will develop severe allergenic reactions (McFadyen 1995)

(iv) Habitat & biodiversity impacts – *Kafue Flats, Zambia,*

Impacts *Mimosa pigra* on bird diversity and numbers





(iv) Habitat & biodiversity – Baluran NP, Indonesia

Acacia nilotica

- Introduced as firebreak in late 1970ties
- Spread to 60% of savanna
- ‘Protected’ Banteng population dropped from hundreds to just 26

CBD and where are we now

- IAS in most NBSAPs & 55% have national legislation, yet not enough ‘on-the-ground’ follow up
- Focus T9 on ‘pathways’ yet the problem already there & extensive
- IAS cross-cutting to most Aichi Targets!
- Lack of baseline data on scale of infestations and costs impacts
- Many still unaware or ignorant how serious this issue is

As a result countries and donors not motivated to invest in IAS

CBD targets – threats IAS to Protected Areas in SE Asia (*selected only*)

Indonesian Protected Areas (incl. WHS, MAB) infested :

- **Wasur NP; Lembah Anai NR; Rawa Aopa Watomohae NP;**
- **Gunung Gede Pangrango NP; Ujung Kulon NP; Meru Betiri NP;**
- **Alas Purwo NP; Baluran NP; Merapi NP; Pulau Mojo GR;**
- **Kamojang NR; Bogani Nani Wartabone NP, and many more...**

What is at stake?:

- Degradation by IAS leads to additional degradation – e.g. fire risks
- Their core conservation values, species and services may be lost;
- Natural habitat regeneration affected – seedlings of keystone species can not establish anymore
- Income from tourism down?
- Loss of support/motivation with local government and general public?

CBD - change needed !

1. **National inventories** – what and where, anticipated spread (climate models)
2. **Full national costs benefit analysis** (CBA) of both the monetary and non-monetary impacts of invasives on production systems, human health and ecosystem services; plus PA networks
3. Extensive **global & national communications campaigns :**
   (i) impacts, (ii) control measures, (iii) stop promoting IAS (national pride/indigenous species campaign)
4. Getting countries, donor agencies and others such as CBD, FAO, UNDP, UNEP, IUCN, CABI etc **to work together under a kind of 'International Protocol'(?)**
5. **Control is possible IF combined with habitat rehabilitation**
6. **Adopt and promote bio-control**, as safest and most cost efficient

Challenges habitat restoration

1. **Many exotic species suitable are invasive**
    - E.g: *Austroeupatorium inufolium* (South America) – introduced Indonesia for control Alang Alang grass – now invasive Sumatra island
    - *Prosopis juliflora* – introduced many sites for firewood and desert control, now noxious weed with extreme impacts and human costs
    - *Mimosa pigra* – soil improvement Wonogiri watershed, Central Java, severe invasive in wetlands
    - *Acacia nilotica* – firebreak Baluran NP, now leading to destruction grass savanna & Banteng population
    - *Acacia mangium* is now an invasive in Borneo

Lessons:

- Ideally go for native species
- Conduct full Risk Analysis (RA) of any introduced species – build upon existing RA/quarantine systems in countries

2. Degraded habitat often already with or susceptible to IAS

- E.g logged over Dipterocarp forests or former agriculture land – e.g. *Merremia peltata* (Indonesia); *Acacia diplotricha* (Vietnam); *Piper aduncum* (Philippines); *Mikania* or *Chromoleana* on plantations – East Java or Timor Leste
- **Lesson: We can not rehabilitate without dealing with invasives!**

3. IAS control - cost & time considerations key!

- Choice of chemical, mechanical and bio-control
- Chemical/mechanical removal of *Acacia* in Baluran NP - takes tens of years, IF without further infestations. Winning this battle too costly and long!
- Cost Zambia approximately USD 450,000 to clear 900 Ha *Mimosa pigra* infestation on the Kafue Flats (USD 500/ha)
- **Mechanical control costs range USD 500 - 20,000/ha/yr**
- Fifteen years of mechanical plus chemical control in South Africa cost USD 457 million, yet invasions still increasing!

Chemical and mechanical control useful for containment, yet very expensive, and - on their own, can never treat the millions of Hectares already invaded!

4. IAS control must go hand in hand with habitat restoration

- Stimulate native vegetation recovery – e.g. good canopy cover can suppress IAS
- Remove competition by IAS for light, nutrients and toxic effects
- Prevent re-growth or new IAS
- Restoration of water quality or hydrology (e.g. lakes, swamps) helps suppressing IAS

- FORIS project: integrated habitat management – combined w. IAS control (*see video*);
  various treatments: manual-versus-chemical & support to adopt bio-control

5. Elements for successful restoration

- Multi-facetted (it's certainly not just # seedlings planted)
- Clarifying land-titles & providing income for local communities
- Make economic case with corporate and government on benefits large scale restoration: think about - (i) ecosystem services value; (ii) reduction of disasters, (iii) reducing financial risk for businesses of degraded natural capital like water
- Integrated habitat management plans include IAS & restoration
- IAS control – can be mix of chem./mech. & bio-control
- Species selection – non invasives!
- Assisted natural regeneration
- Artificial restoration, re-forestation, re-vegetation
- Benefit sharing of improved local environment (monetary and non-monetary)

‘The Big Push’ – Case for stepping up Bio-Control

Background:

- Biological control - the use of host-specific natural enemies (pathogens, mites, and insects) to control invasives
- The control agent can and will not spread to other plants or systems
- Been practiced for many decades by especially USA, Australia, South Africa, Canada, New Zealand, but also Indonesia, Vietnam, Philippines (mostly in agriculture sector).

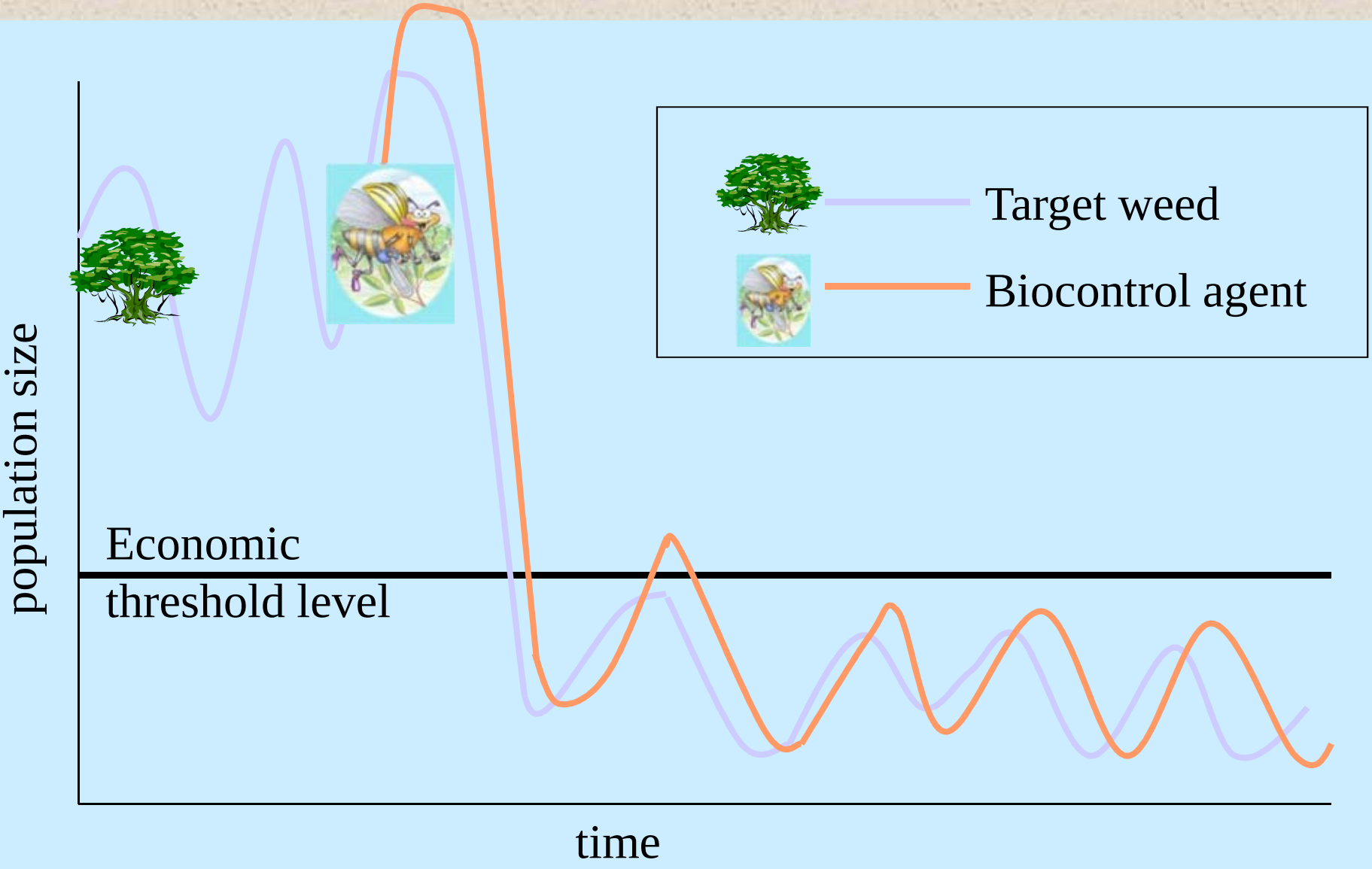
- Compared to chemical and mechanical control – being the most cost efficient – at medium to long term (only start-up investment)
- Entirely safe for environment – following extensive tests and safety regulations
- Unfortunately mixed up with alien introductions such as mice, rabbit etc which got out of hand (those were not bio-control!)

Bio-control - *continued*

- Very good cost-benefit ratio
- Self-perpetuating populations and often establish throughout the range of the target weed
- Suppresses in natural ways the IAS targeted – avoids fallow land
- **Biggest risk – 'Doing nothing'!**

Bukit Barisan National Park

Successful biocontrol does not eradicate the target weed



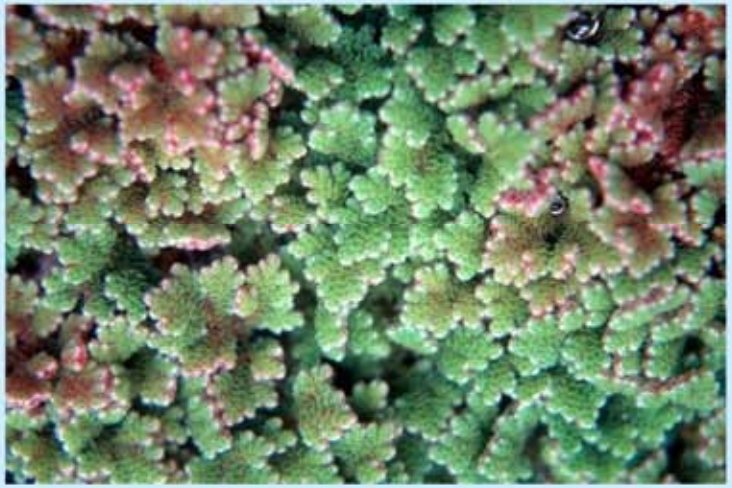
Some examples of successful biocontrol

Prickly pear
(***Opuntia ficus-indica***)

Cochineal

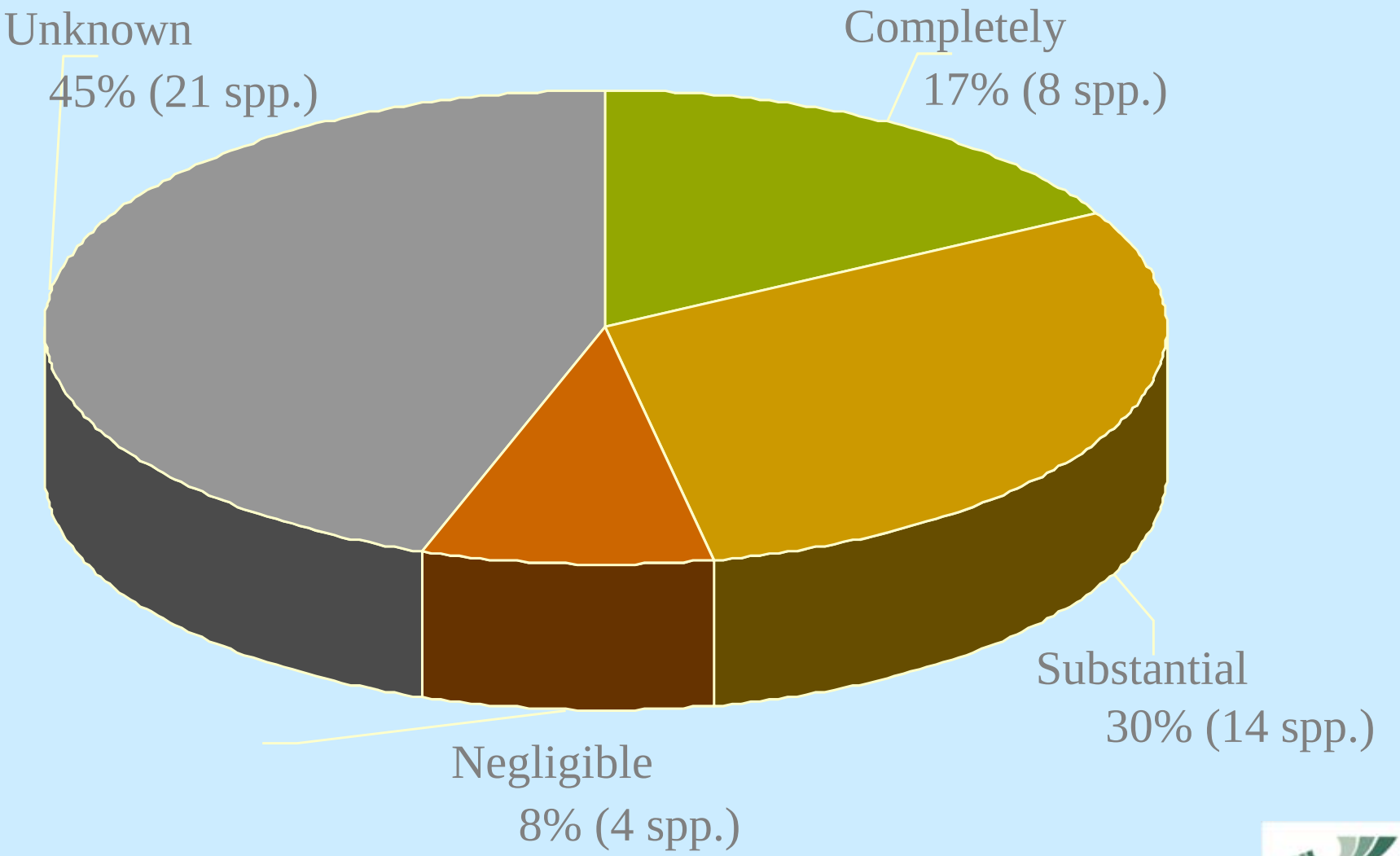
Cactus moth

Red water fern *(Azolla filiculoides)*



Stenopelmus rufinasus

How effective has biocontrol of invasive plants been in South Africa ?



ARC • LNR

Economic benefits and costs of biocontrol

‘between the initiation of research until the estimated date at which weed populations would cover all available habitat’

Species	Benefit : Cost ratio
Jointed cactus	1 154 : 1
Red sesbania	45 : 1
Lantana	34 : 1
Long-leaved wattle	1 465 : 1
Golden wattle	4 333 : 1
Silky hakea	611 : 1

B. W. van Wilgen et al., (2002)

The alternative ?…pesticides and human health

Poisoning:

Worldwide > 3 million metric tons of pesticides applied/year - 26 million cases of non-fatal pesticide poisonings, 220,000 fatalities & 750,000 chronic illnesses/year

Pesticide resistance:

About 520 insect and mite species, nearly 150 plant pathogens and about 273 weed species are now resistant to pesticides