



Landcare Research
Manaaki Whenua

OVERVIEW OF INVASIVE SPECIES MANAGEMENT



WHAT IS AN INVASIVE ALIEN SPECIES?

A non-native species
that causes, or is likely to cause,
harm to the environment,
the economy, people's health, and/or
their way of life.

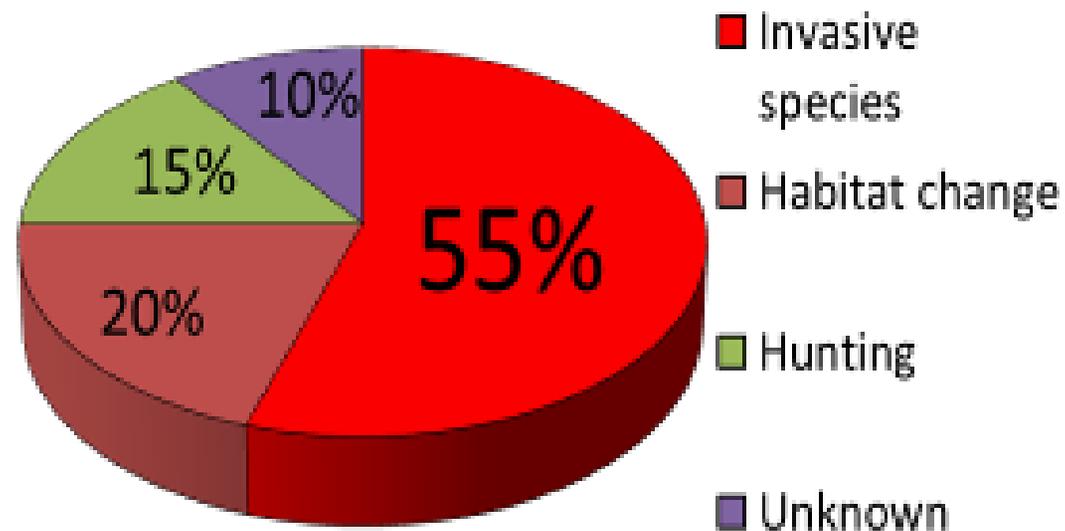


IMPACTS OF IAS ON BIODIVERSITY

- Declines in species populations
- Local extirpations
- Extinctions
- Changes to ecosystem functioning



IMPACTS OF IAS ON BIRD SPECIES



Causes of recent bird extinctions on Islands
(Bird Life International)



IMPACTS OF IAS ON ECONOMIES

- Losses to production systems (agriculture, forestry, fisheries)
- Damage to infrastructure
- Damage to trade
- Management costs



IMPACTS OF IAS ON PEOPLE'S HEALTH AND WAY OF LIFE

- Increased incidence of injury/disease
- Decreased access to food
- Changes to cultural practices
(religious recreational, cropping)
- Decreased/loss of access to natural resources
- Increased hardship especially to rural communities

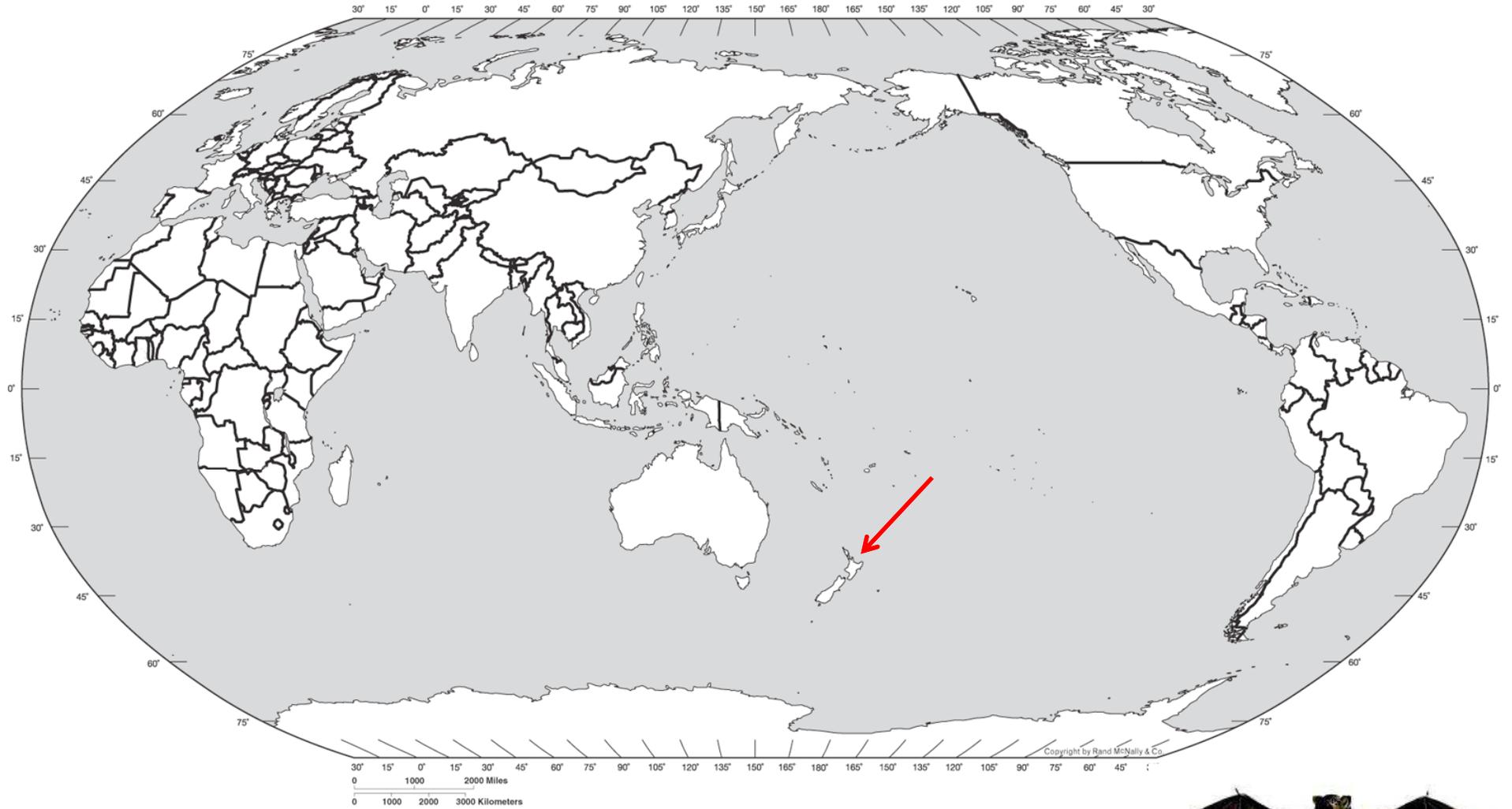


ECONOMIC IMPACTS OF IAS

- Global: \$1.4 trillion US per year
- USA: \$120 billion/yr
- UK, Aus, S. Africa, India & Brazil: \$48 billion/yr
- SE Asia: \$33.5 billion/yr
- Canada: \$12-31 billion/yr
- Great Britain: \$2.5 billion/yr
- South Pacific: ?
- New Zealand: \$3+ billion US per year (2.3% of GDP)



NEW ZEALAND: BIODIVERSITY



NEW ZEALAND: BIODIVERSITY

- Highest rate of endemism in the world
- 80% of all vascular plants
- 70% of all native terrestrial and freshwater birds
- All bats
- All native amphibians
- All reptiles
- 90% of freshwater fish



NEW ZEALAND: BIODIVERSITY



NEW ZEALAND: BIODIVERSITY



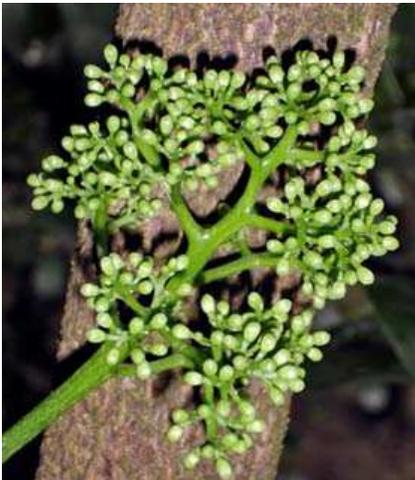
NEW ZEALAND: BIODIVERSITY



NEW ZEALAND: BIODIVERSITY



Pennantia baylisiana
Known population: 1



NEW ZEALAND: BIODIVERSITY

Chatham Island Black Robin

Population of birds in 1980:

Population of females in 1980:

Population of birds in 2014:



NEW ZEALAND: PRIMARY INDUSTRY

39% of the country is covered in grass

25% is native bush

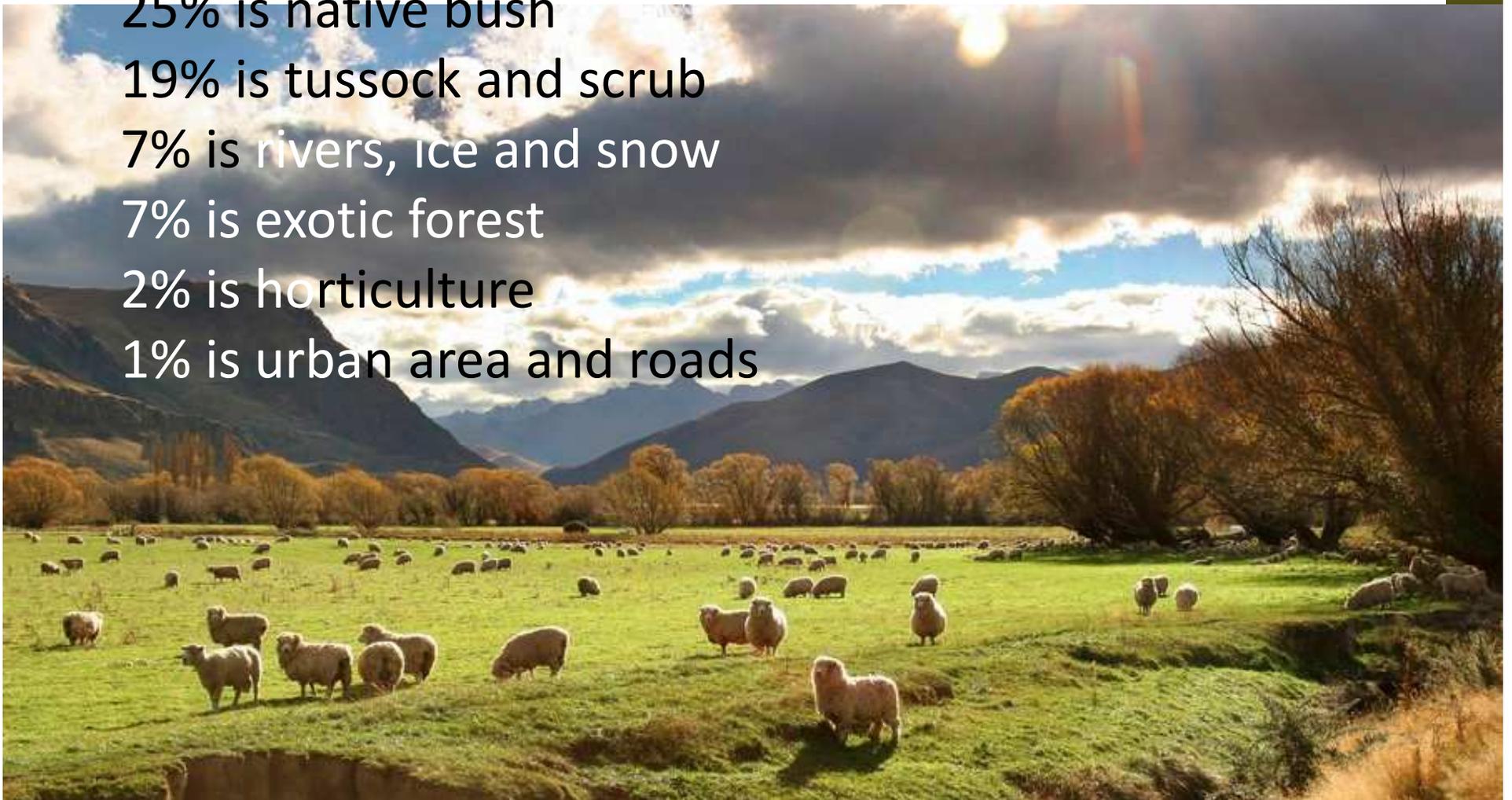
19% is tussock and scrub

7% is rivers, ice and snow

7% is exotic forest

2% is horticulture

1% is urban area and roads



NEW ZEALAND: PRIMARY INDUSTRY

15% of GDP

50% of exports



NEW ZEALAND: TOURISM

- 6% of international visitors (150,000 people) cited The Lord of the Rings as one of the main reasons that they visited New Zealand in 2004
- 1% cited the film as their only reason
- This 1% spend \$32.8 million

THE
LORD OF THE RINGS
THE MOTION PICTURE TRILOGY

NEW ZEALAND: TOURISM



NEW ZEALAND: TOURISM

- \$24 billion, 6% of workforce
- “clean, green” image
- Birdwatching, hiking, sightseeing
- Adventure sports

100% PURE NEW ZEALAND

NEW ZEALAND

For all of these reasons...
and many more...

**IAS are a major threat to
New Zealand**



COSTS/IMPACTS: WEEDS

- 25,000 exotic plants
- 2500 are naturalised
- 300 are of conservation concern
- Pastoral weeds are conservatively estimated to cost the economy \$1.2 billion per year in lost animal production and control costs
- Weeds pose a threat to 1/3 of nationally threatened plant species
- Could potentially degrade 7% of the conservation estate in next 10 years



COSTS/IMPACTS: INVERTEBRATES

- Direct economic cost of invertebrate pests to the primary sector is \$1-\$3.3 billion per year
- Annual production losses to aquaculture from a single species of sea squirt were estimated to be \$15 million per year in 2005



©Alex Wild

COSTS/IMPACTS: VERTEBRATE PESTS

- 32 mammals and 35 birds have become established since human arrival
- Vertebrate fauna has been nearly halved
 - 1 bat
 - 3 frogs
 - 3 lizards
 - 1 freshwater fish
 - 4 plant species
 - 51+ birds
- 3 bird extinctions since 1960s
- Uncounted losses of populations and species of invertebrates



COSTS/IMPACTS: VERTEBRATE PESTS

What should be done?



PREVENTION

**Eradication
Control**

Pre-border	At the border	Post-border
Permits/certification (Risk assessments)	Permits/certification (Risk assessments)	Preparedness (Risk assessments)
Inspection (e.g. visual)	Inspections (e.g. profiling, visual, X-ray machines, dogs)	Surveillance/Detection
Intervention (e.g. fumigation, cleaning, invasive-proof packaging, etc.)	Interventions (e.g. seizing and disposal, cleaning, fumigation, fines)	Response (i.e. immediate eradication, if feasible)
Pre-quarantine for live plants and animals	Post-quarantine for live plants and animals	Monitoring
Audit	Audit	Audit

ERADICATION

- Removing every individual of an invasive species population (continent, country or island level)
- Permanent solution, permanent benefits
- One-off cost for operation(s)
- Requires on-going biosecurity (and associated costs)



CONTROL

- Keeping the invasive species population to a prescribed level
- On-going solution, benefits will last as long as control is maintained
- Control can be targeted to get maximum benefit from specific timing (pulsing)
- On-going costs, forever



INTERVENTIONS & INVESTMENTS

- \$500 million spent annually on biosecurity
 - 65% response
 - 13% prevention
 - 11% surveillance
 - 5% research
- Bertram (1999): *NZ's experience on border controls and quarantine systems are akin to payment of insurance premiums for catastrophic events*



INTERVENTIONS & INVESTMENTS

- In 2014, New Zealand faced a 1-in-15 year beech mast, expected to drop around a million tonnes of seed
- This triggered a plague of an additional 30 million rats and tens of thousands of stoats, which could potentially annihilate endangered bird populations
- Department of Conservation spent \$21 million toward this programme alone



INTERVENTIONS & INVESTMENTS

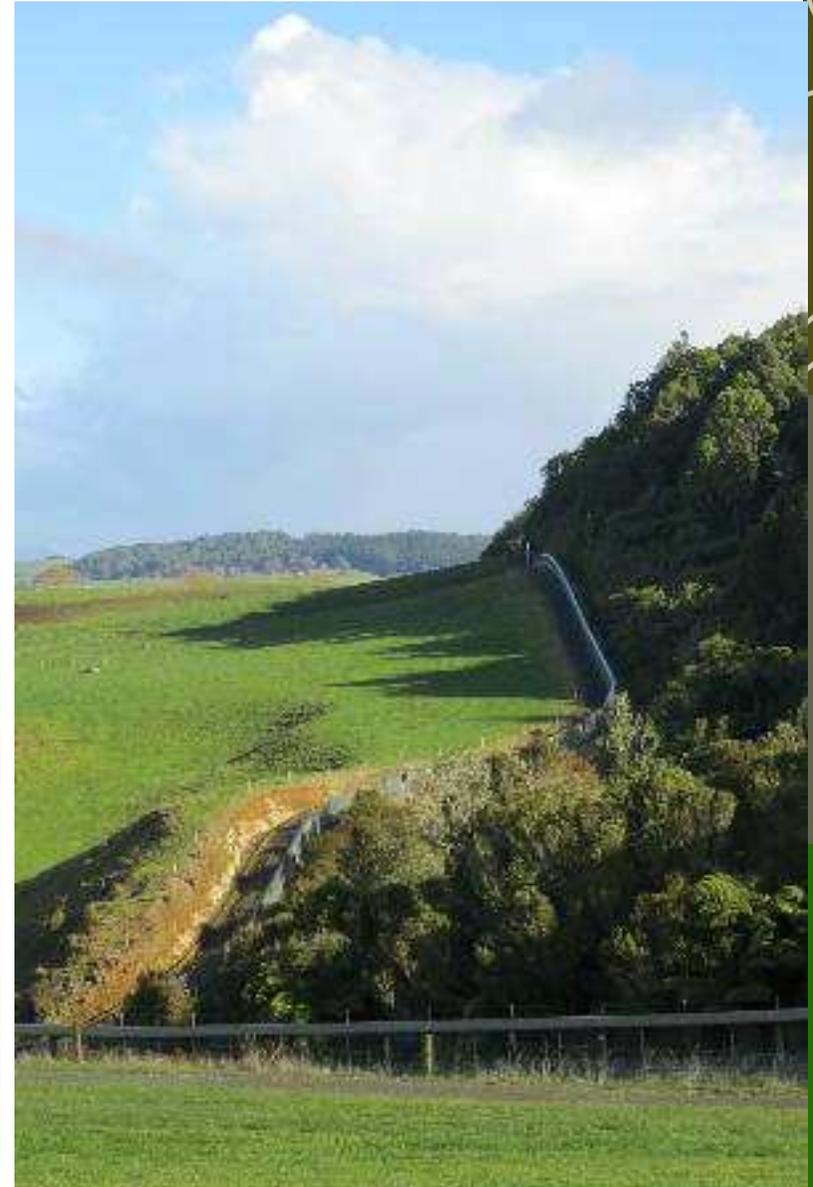
- Public education campaigns to prevent spread of aquatic weeds
- Bans on felt-soled waders



BETWEEN WATERWAYS

INTERVENTIONS & INVESTMENTS

- Predator-free islands
 - 11,200 hectare Campbell Island
- Inland “island” preserves
 - 47 km of predator-proof fencing
 - 3400 hectares



INTERVENTIONS & INVESTMENTS

- Deer introduced for sport in the mid 19th century
- The environment proved ideal and wild populations grew uncontrolled, becoming a pest by 1950
- Export of venison from wild deer started in the 1960s, turning this pest into an export earner
- In the 1970s, DOC caught live deer from the wild to begin farms
- A new industry was born
- Today, there are 1.1 million farmed deer



INTERVENTIONS & INVESTMENTS

- NZ is world's largest user of sodium fluoroacetate (1080)
- DOC pioneered helicopter hunting of ungulates
- DOC developed traps used throughout Pacific
- NZ has developed traps that achieve same effectiveness as 1080



INTERVENTIONS & INVESTMENTS

All of these policy decisions were
made on the basis of
cost-benefit analysis



FUTURE DIRECTIONS

- Biocontrol of plants
 - Wide-host-range bioherbicide fungi
 - herbivorous insects



FUTURE DIRECTIONS

- Games and social media to raise awareness & find solutions to problems



FUTURE DIRECTIONS

- Branding



FUTURE DIRECTIONS

- Social research

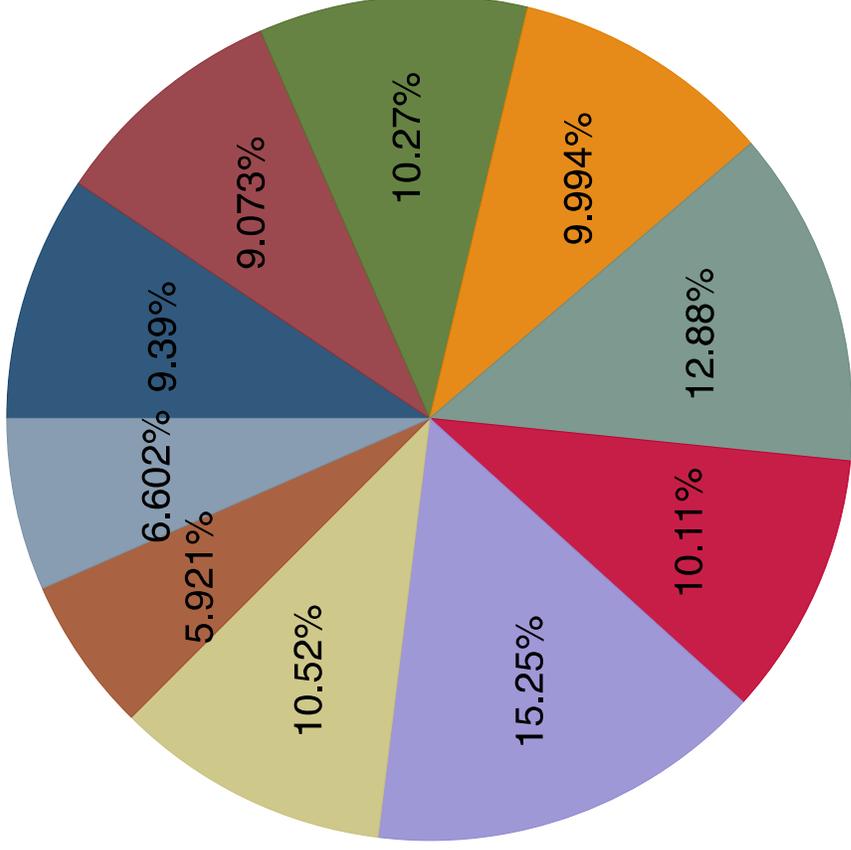
“Imagine that you decided how much money the government can spend on defence, transportation, environmental protection, controlling IAS, etc.

If you were the budget minister...

how much would you allocate to each of these categories?”



Preferred Budget Allocation



1 Defense

3 Economic affairs

6 Health

8 Education

10 Environmental protection

2 Public order and safety

5 Housing and community amenities

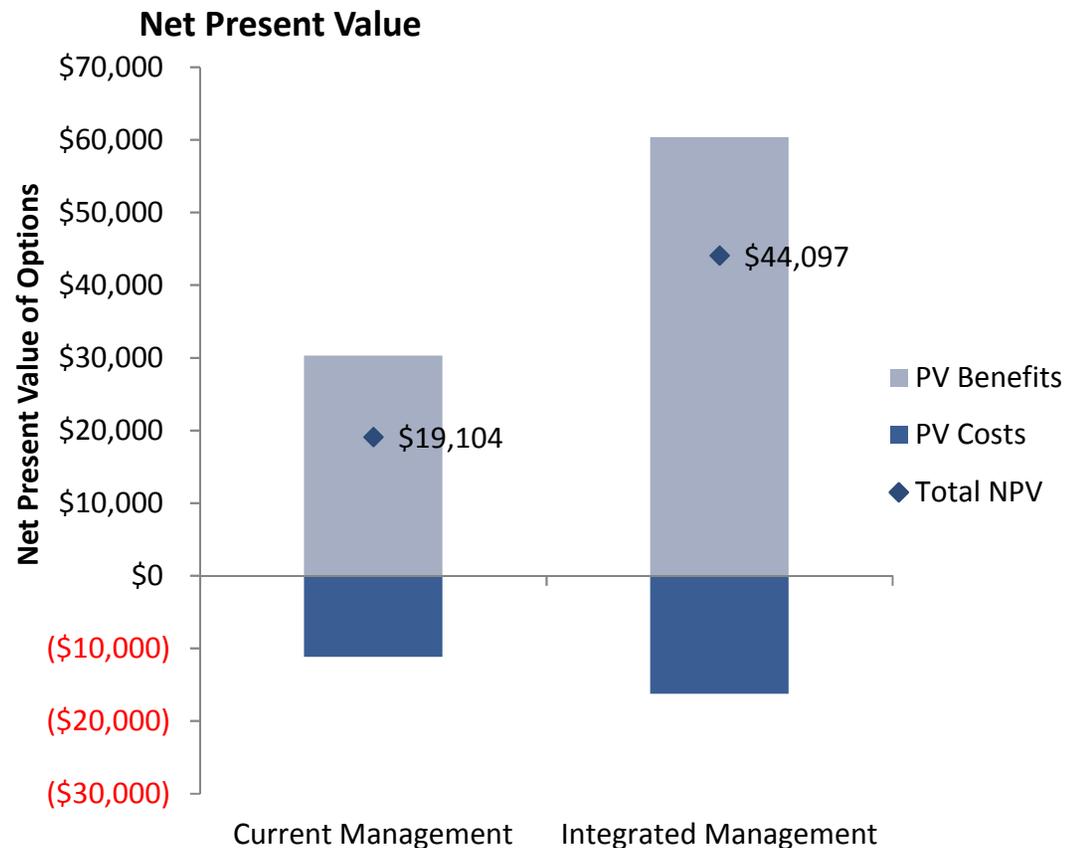
7 Recreation, culture, and religion

9 Social protection

11 Control of harmful species

FUTURE DIRECTIONS

- Cost-benefit analysis to ensure economic efficiency in managing IAS in island countries



ECONOMIC BENEFITS TO MANAGING IAS

- **African Tulip Tree:** Net benefits of \$600+ million US over lifetime of managing this tree in Fiji (\$12+ million per year)
- **Taro Beetle:** Net benefits of \$240+ million US over lifetime of managing this pest in Fiji (\$5+ million per year)
- **Cassuarina:** Benefits of \$21 per \$1 spent managing this tree in the Bahamas
- **Giant African Snail:** Benefits of \$4 per \$1 spent managing this invertebrate in Trinidad

