



**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.

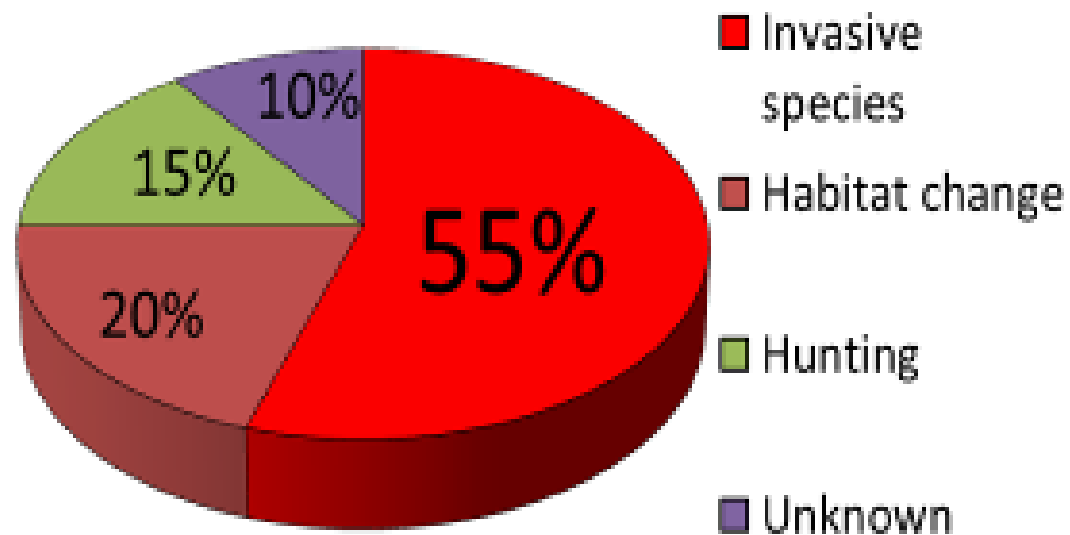


# IMPACTS OF IAS ON BIODIVERSITY

- 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

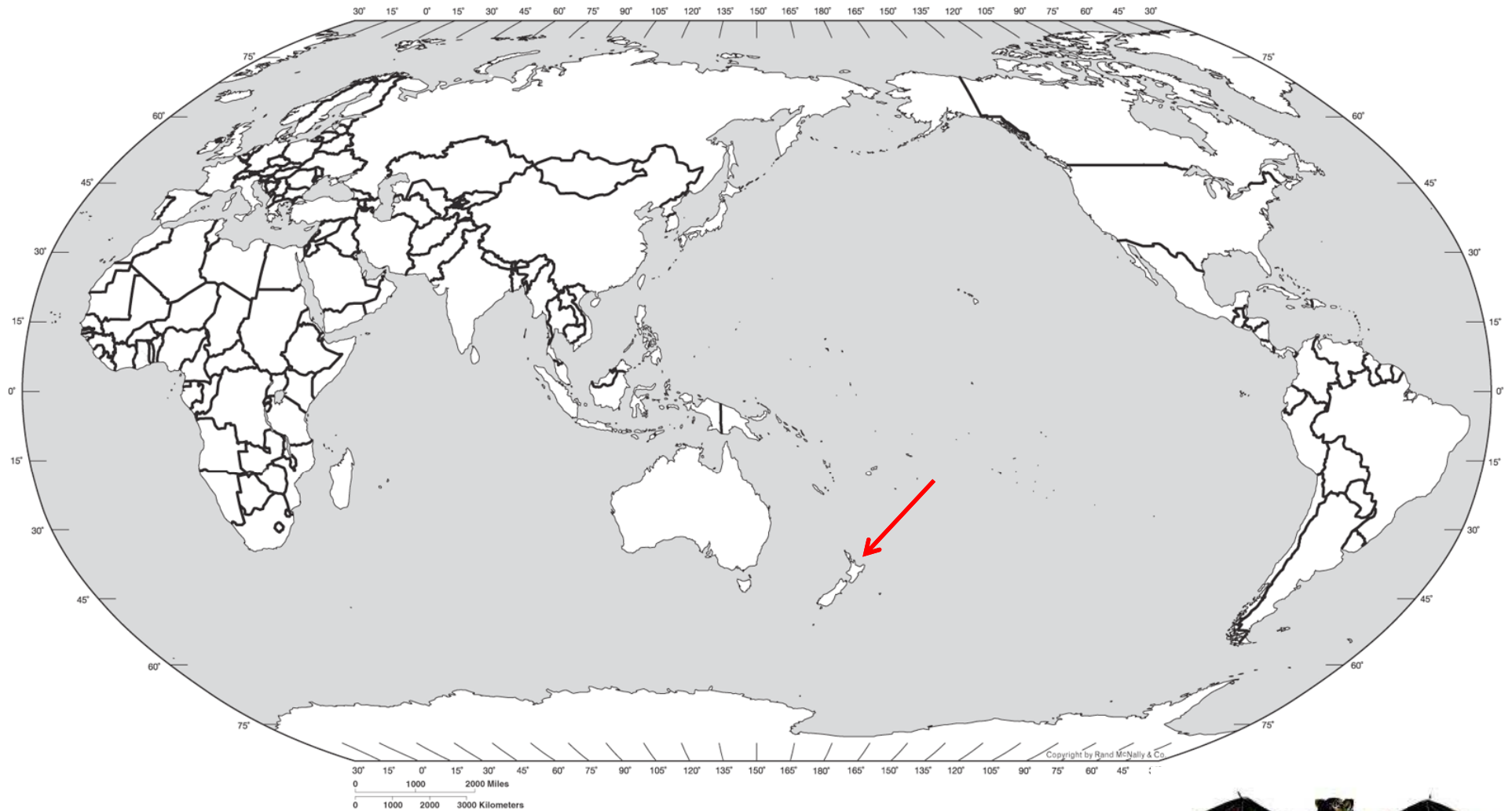


# ECONOMIC IMPACTS OF IAS

- 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



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# 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

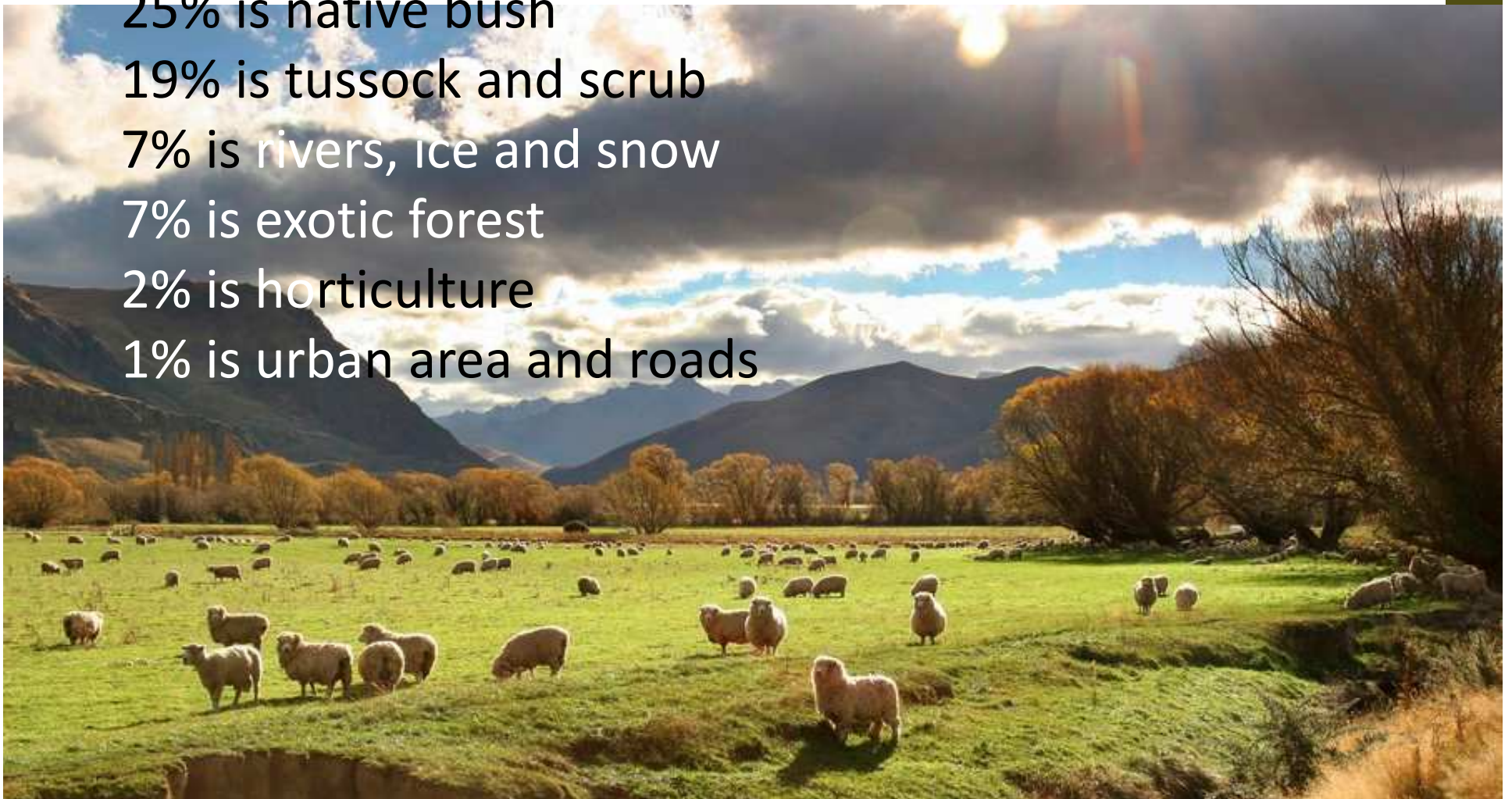
19% is tussock and scrub

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



# 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



# 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

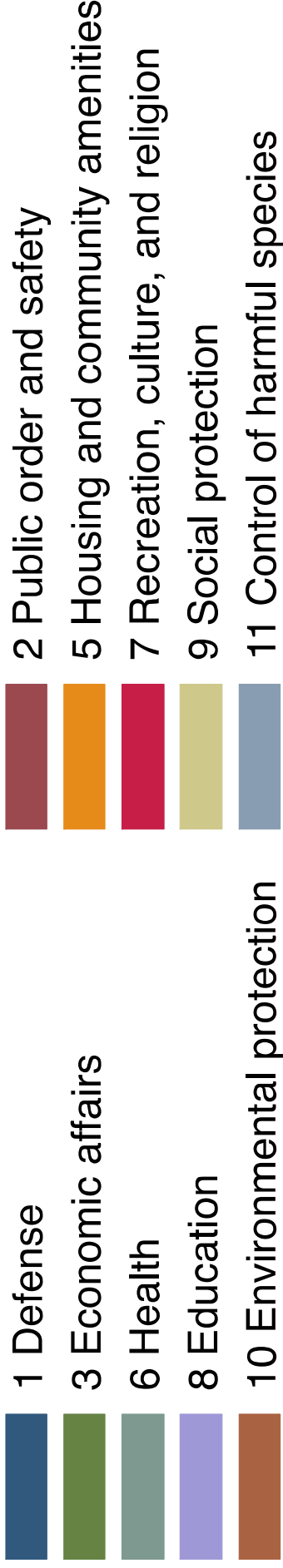
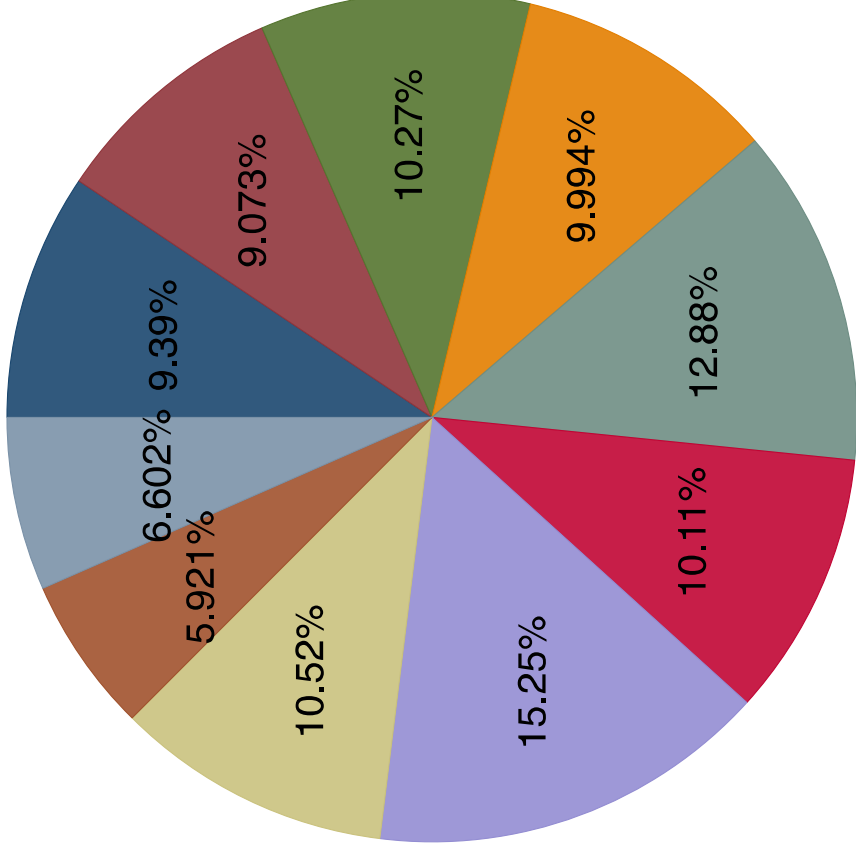
“Imagine that you decided how much money the government can spend on defence, transportation, environmental protection, controlling IAS, etc.

If you were the budget minister...

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

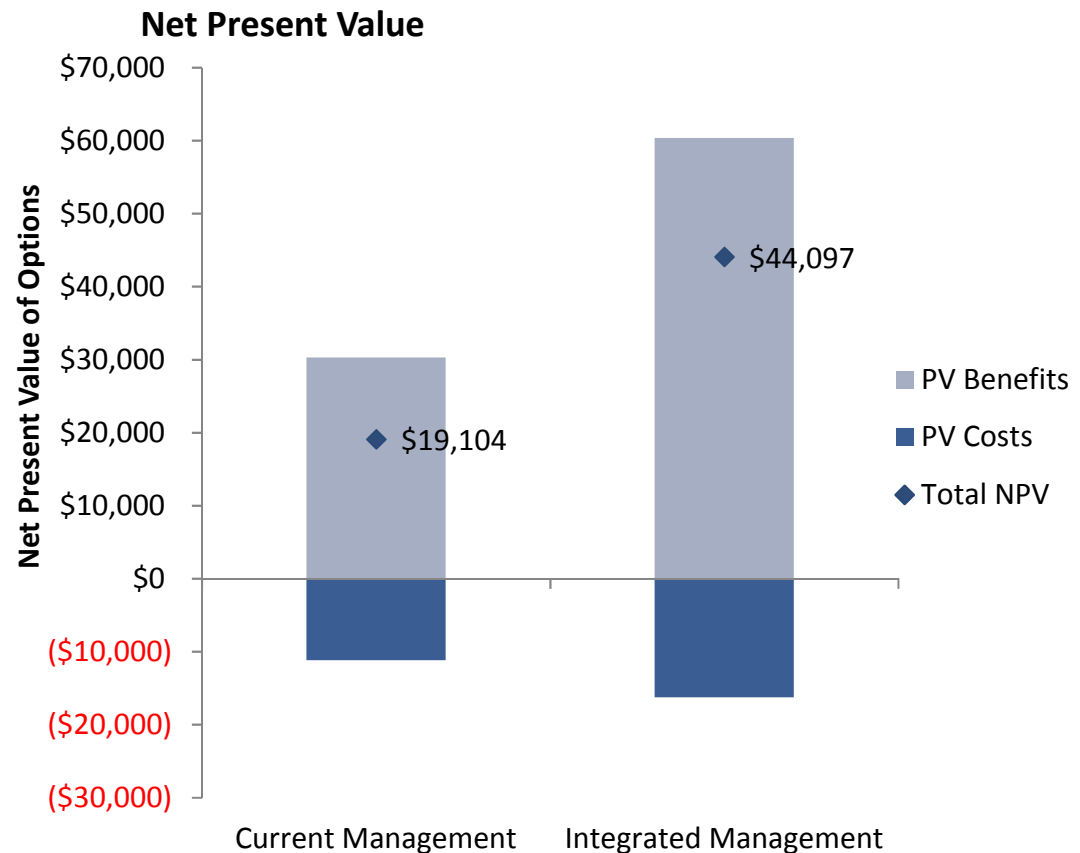


# Preferred Budget Allocation



# 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

