Prioritising threatened species and threatening processes across northern Australia

Anna Pintor, Mark Kennard

Griffith University
James Cook University Australia
Charles Darwin University
The University of Western Australia
Government of Western Australia
The University Of Queensland Australia
Wet Tropics
Threatened Species Recovery Hub
National Environmental Science Programme
Queensland Government
Northern Territory Government
Northern Australia Environmental Resources Hub
National Environmental Science Programme

Background

- Northern **biodiversity**:
  - Many threatened species (TS)
  - Less understood than many southern TS
- Further **development** of the north may increase exposure to threats
- Previously (NESP 3.1) identified **knowledge gaps** for TS management:
  - Northern taxa often less well studied & surveyed – distributions poorly understood
  - Spatial and temporal distribution of threatening processes and their intensity not well known
  - Interaction of threats with sensitive taxa poorly understood

Filling the knowledge gaps

Year 1:

Best knowledge 'maps' of **distributions of rare & threatened taxa**

Year 2:

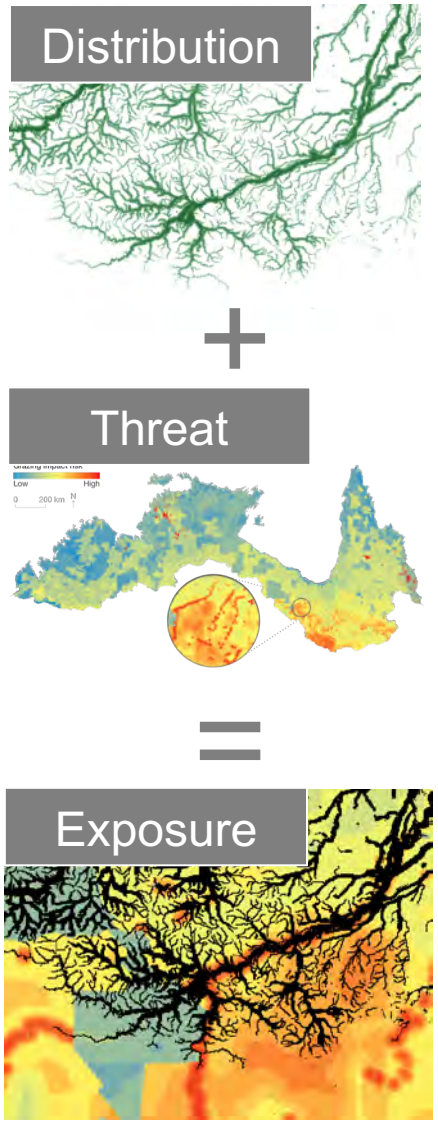
Spatiotemporal maps of **threatening processes**

Year 3:

exposure (1+2)
+ sensitivity
= vulnerability
– inform management

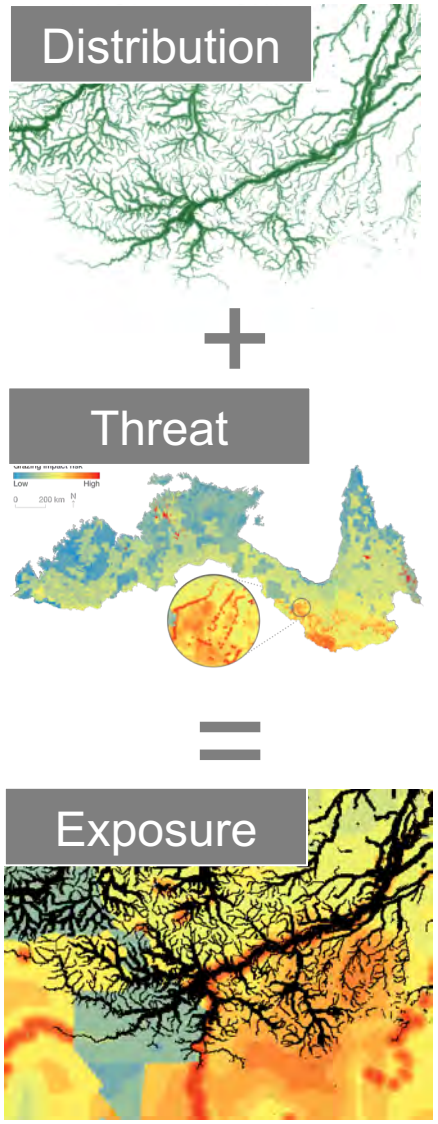
Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**

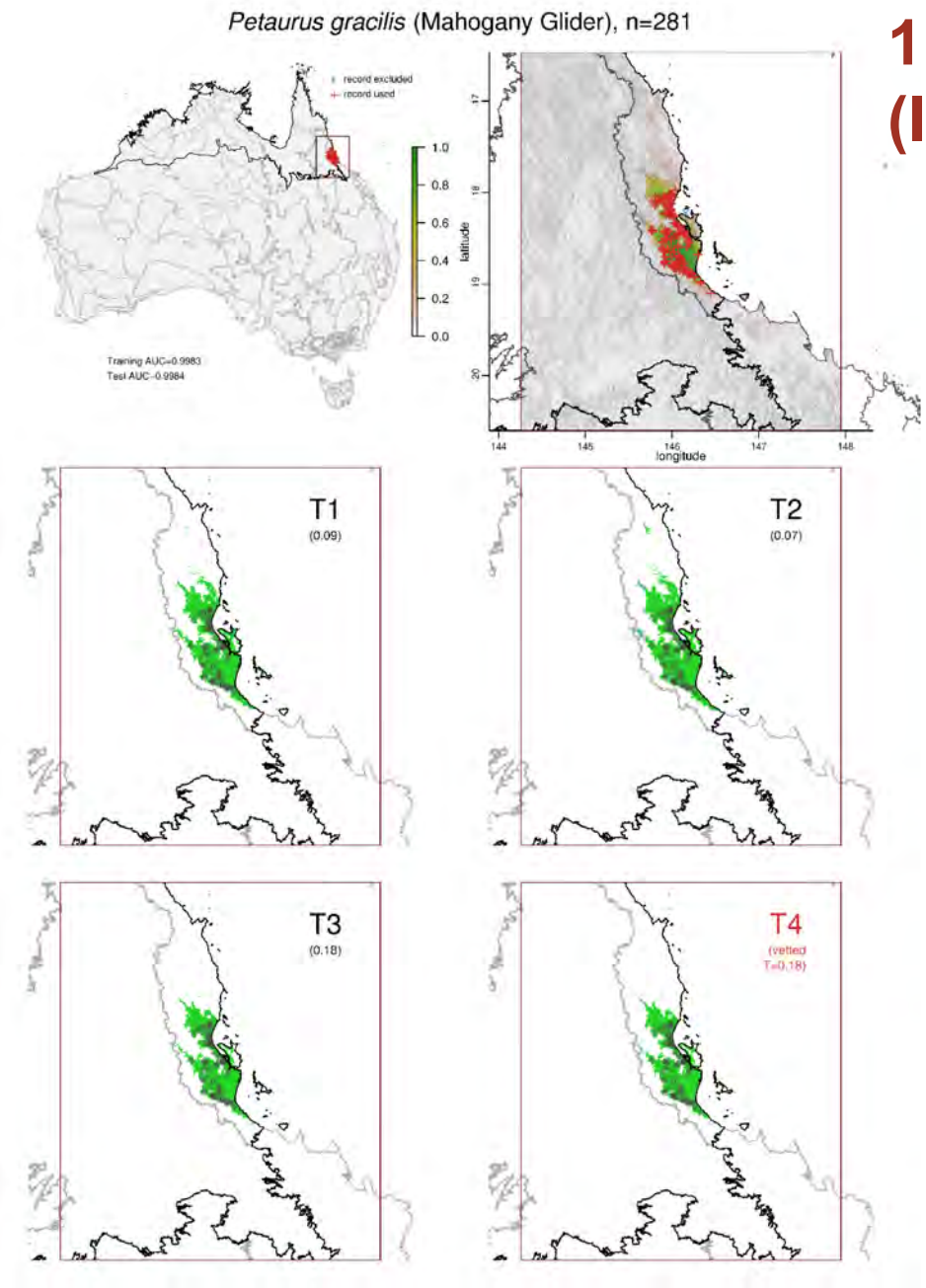


Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



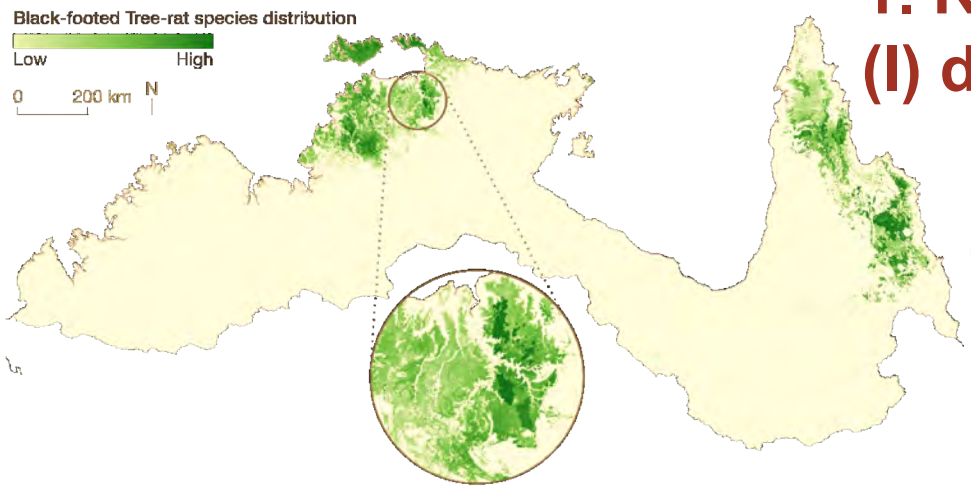
1. Rare & threatened species (I) distribution models



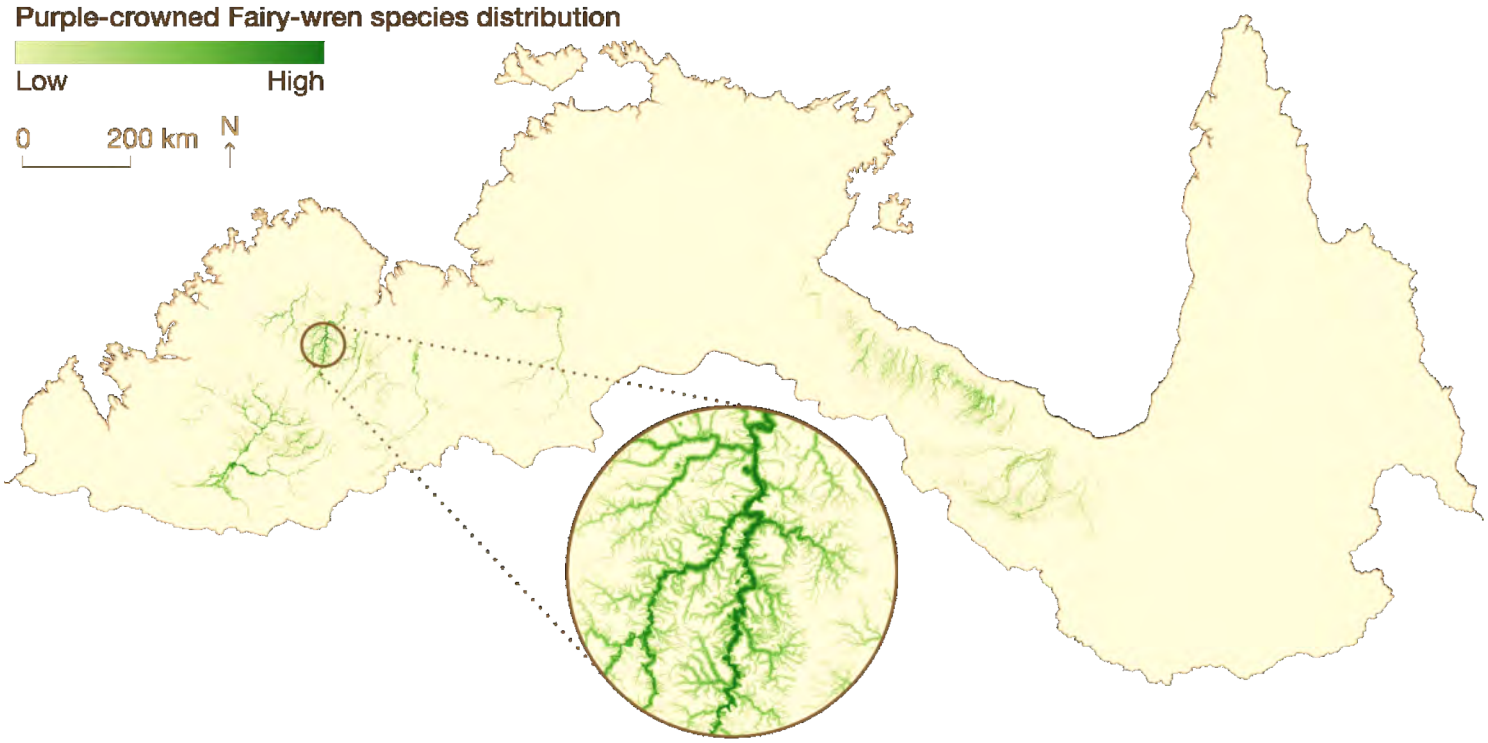
~1400 species; 250m resolution
Climate + soil + vegetation (+water)
MaxEnt + variable selection

Expert vetting

1. Rare & threatened species (I) distribution models

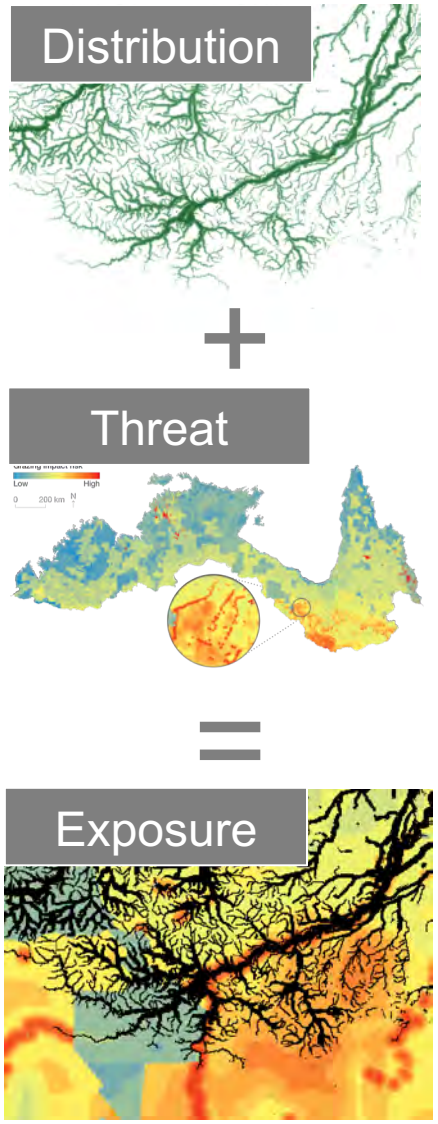


~1500 species; 250m resolution
Climate + soil + vegetation (+water)
MaxEnt + variable selection



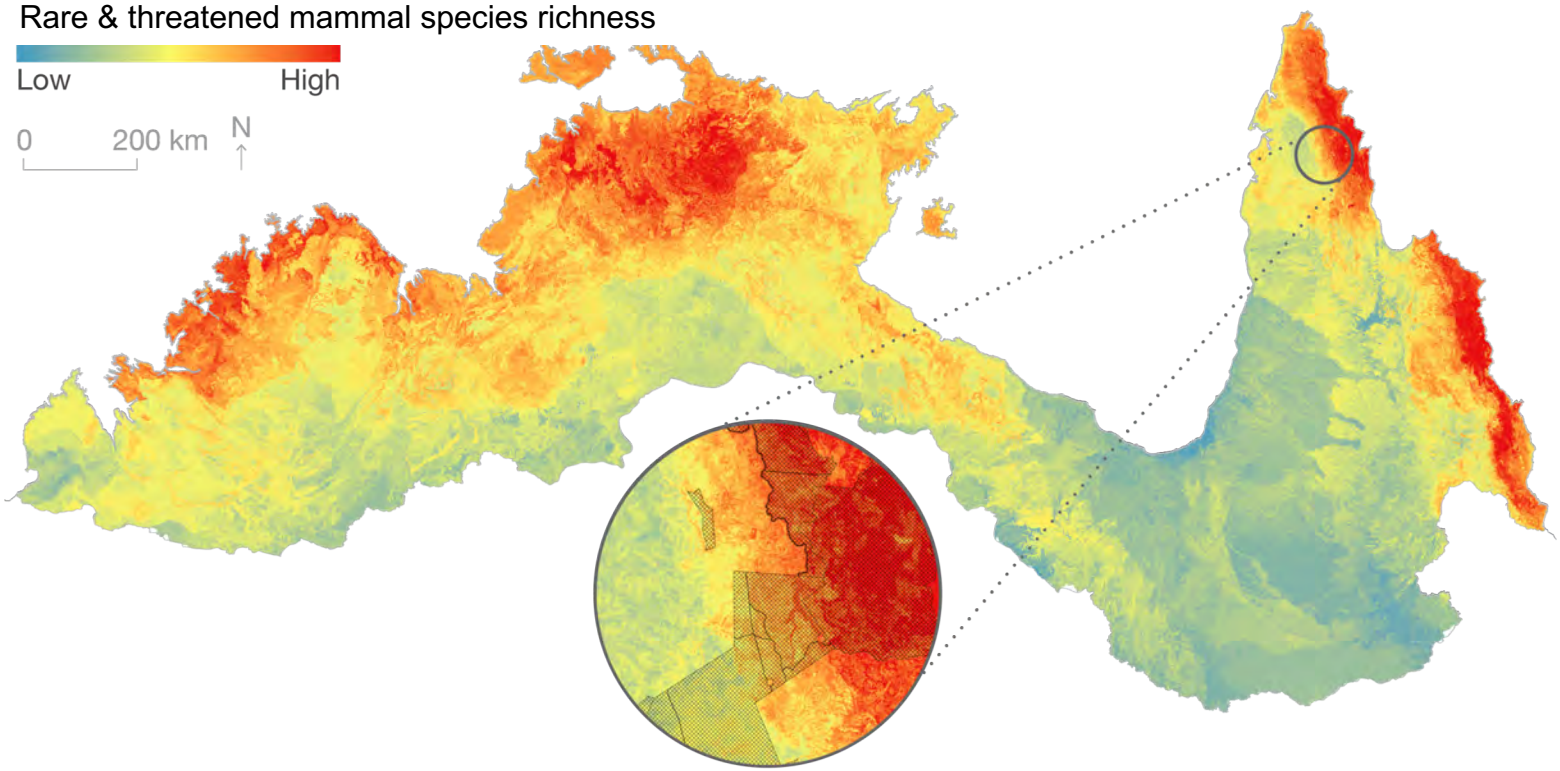
Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**

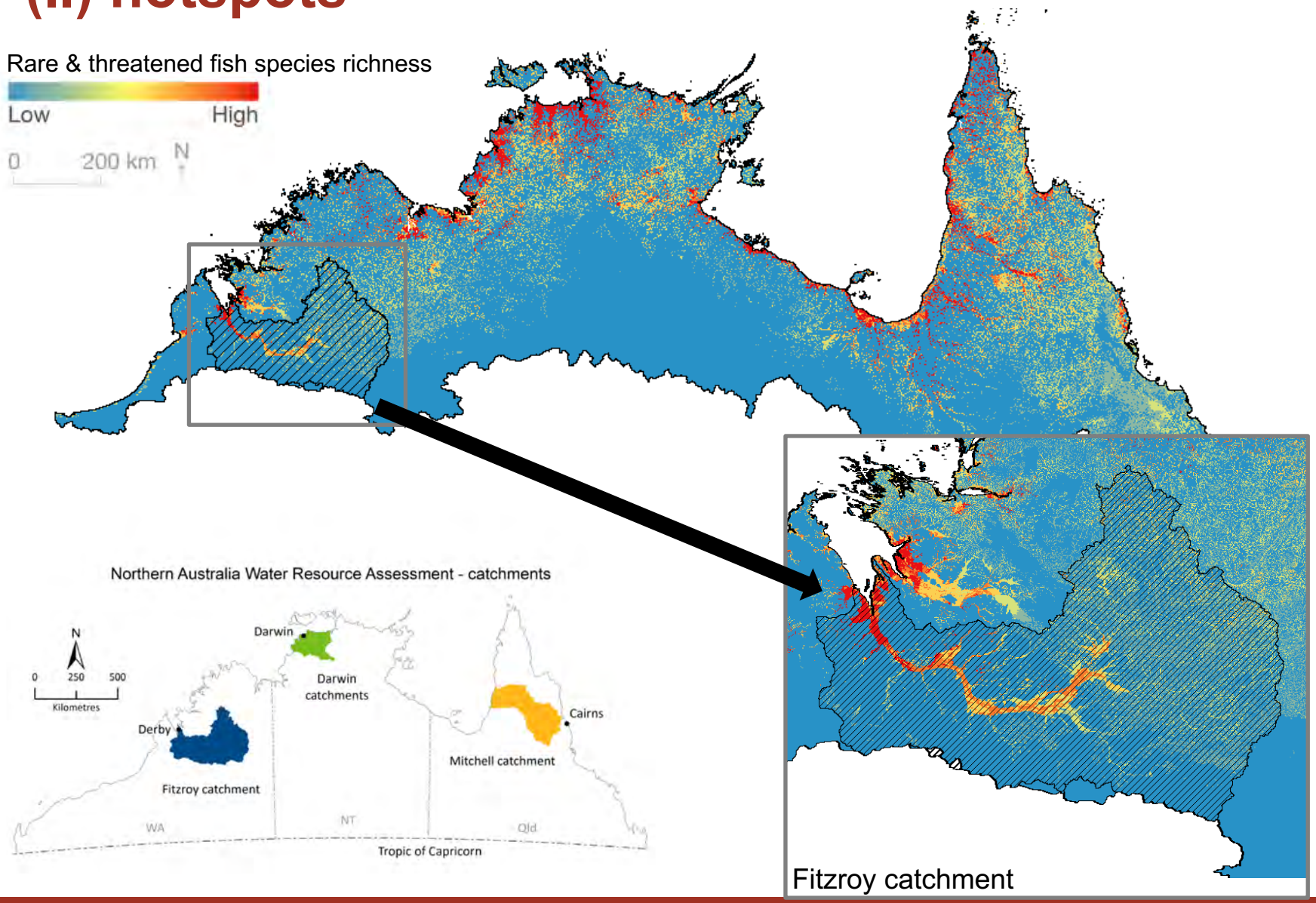


1. Rare & threatened species
(II) hotspots

For different taxonomic / functional groups
& threatened species categories

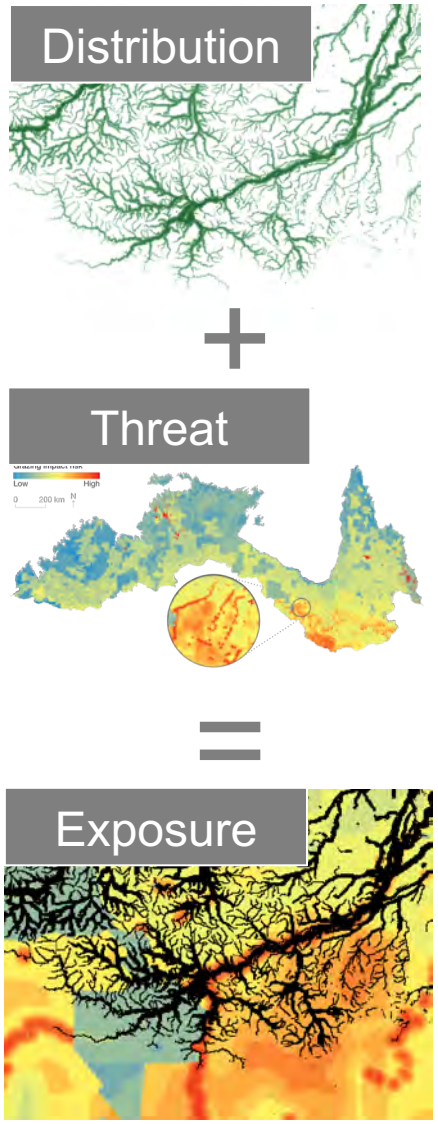


1. Rare & threatened species (II) hotspots



Project progress

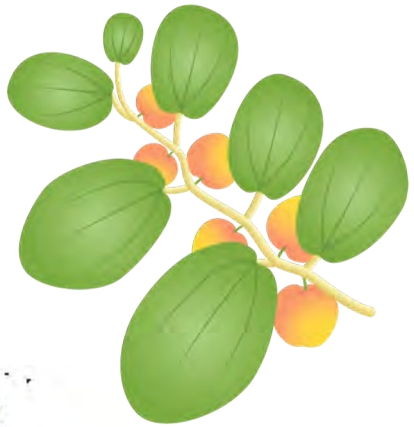
1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



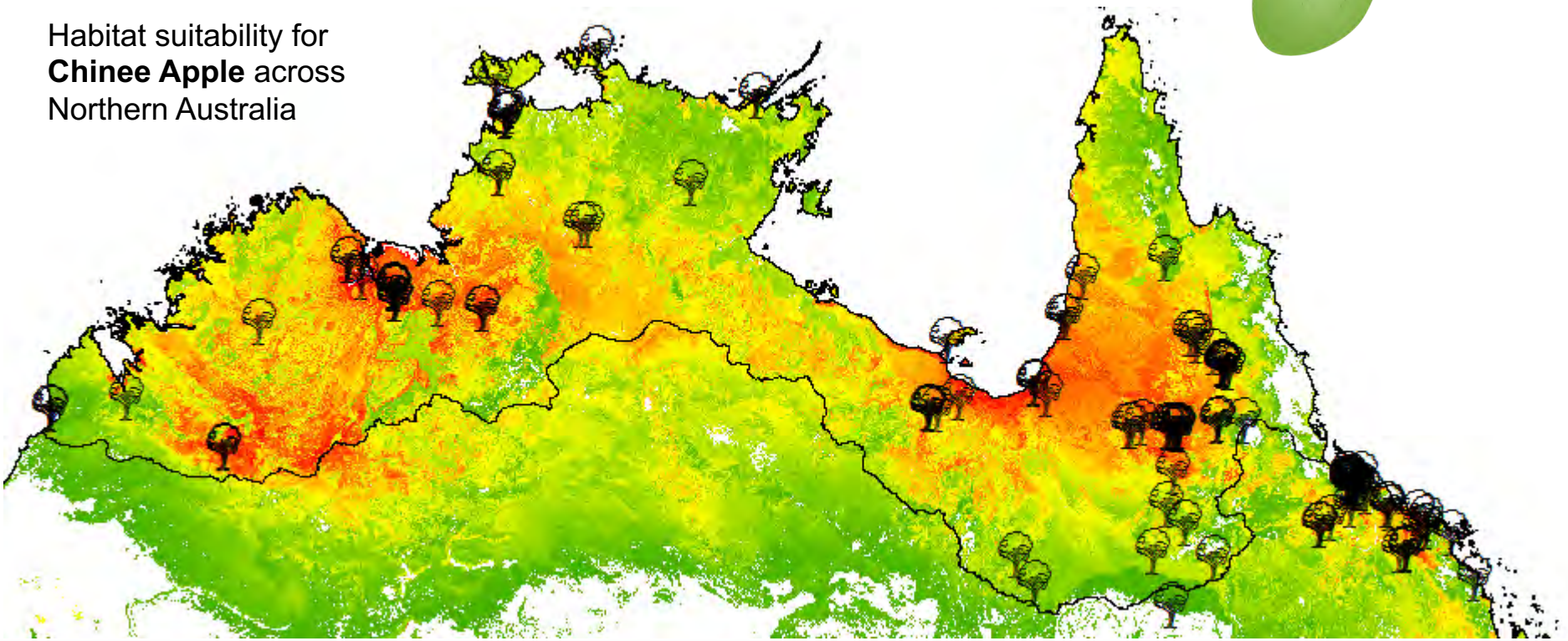
2. Threats
(I) Invasive weeds

Distribution models of **habitat suitability**

- global occurrence data
- climate, soil, geography & vegetation
- ~1km resolution - ~ 220 weeds
- variable selection - current & future

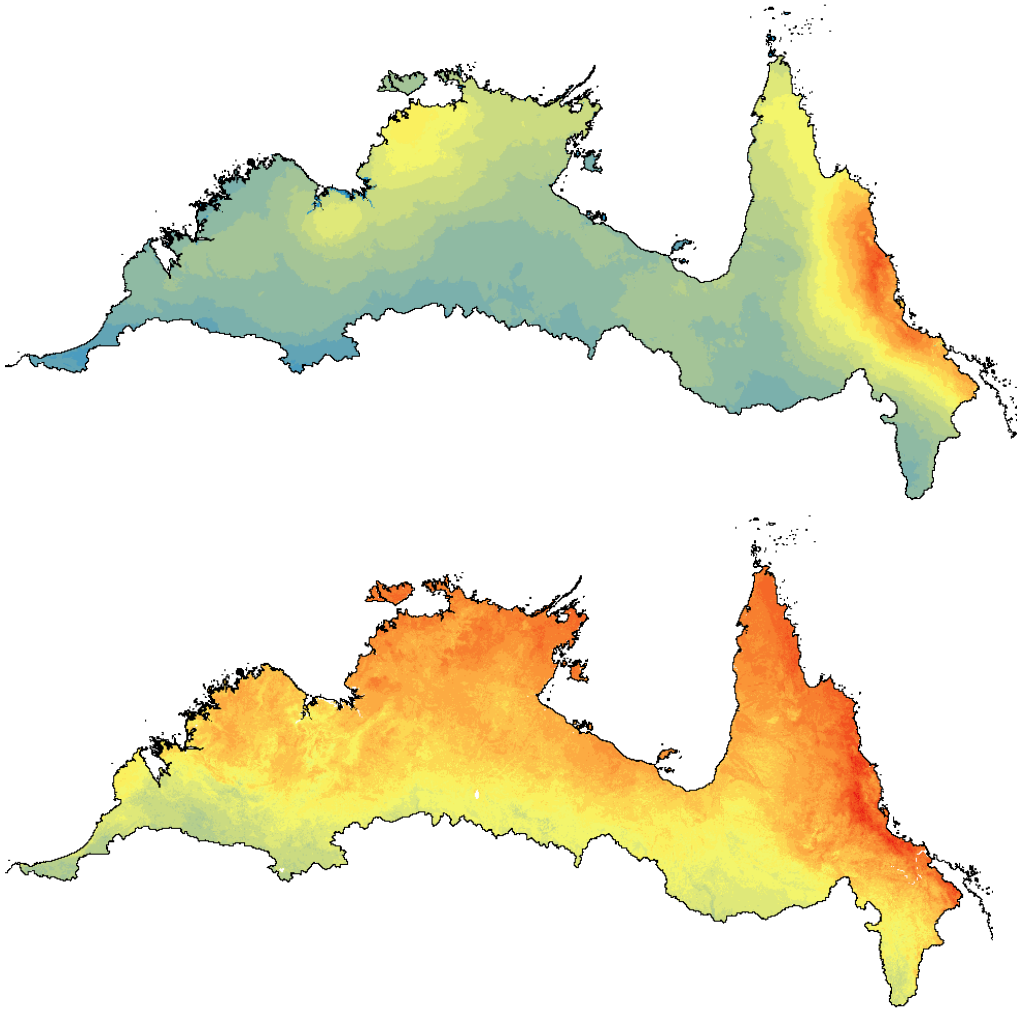


Habitat suitability for **Chinee Apple** across Northern Australia



2. Threats
(I) invasive weeds

Hotspots of invasive weeds (species richness)



- **Current** northern weed species richness
- **'Weediness'**

- **Potential** northern weed species richness (current & future)
- **'Weediness'** if all northern weeds occupied their suitable habitat

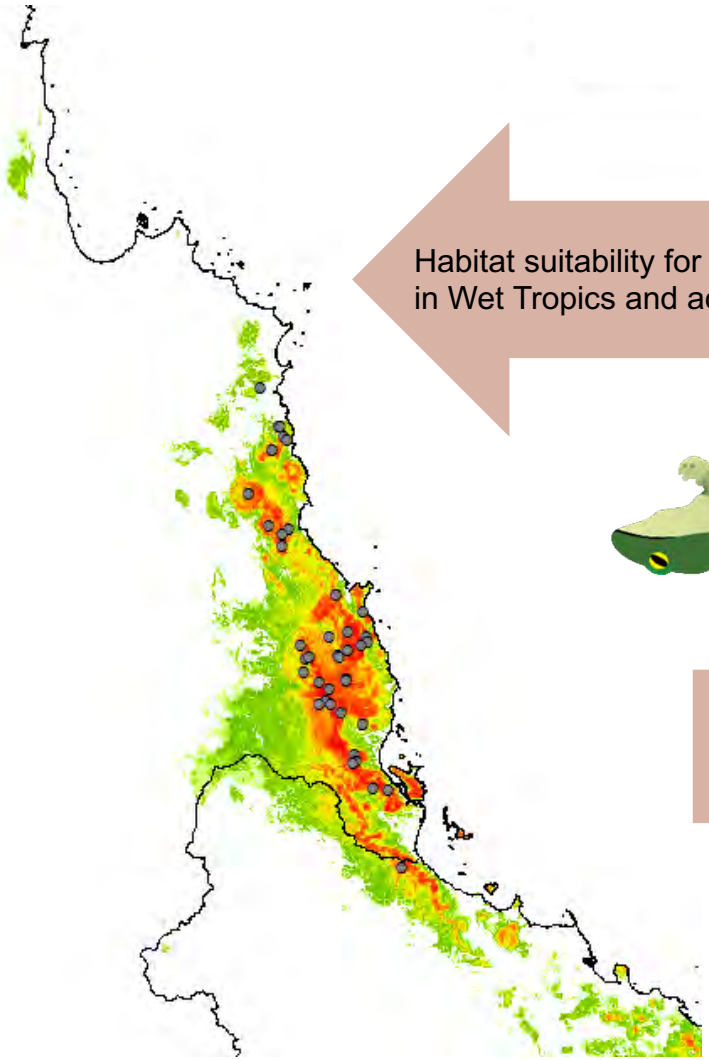
2. Threats
(II) feral animals

Distribution models of **habitat suitability**

- global occurrence data
- climate, soil, geography & vegetation
- ~1km resolution; ~ 40 ferals
- variable selection

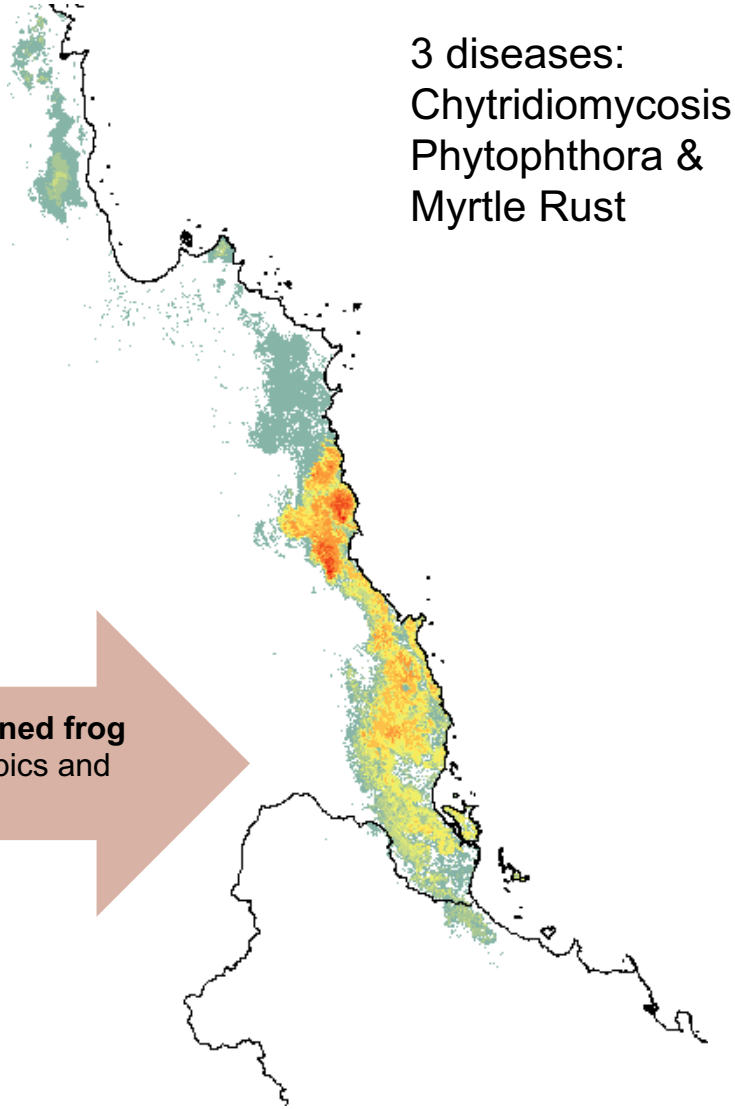
Habitat suitability for **feral pigs** across Northern Australia

2. Threats
(III) diseases



Habitat suitability for **Chytrid fungus** in Wet Tropics and across Cape York

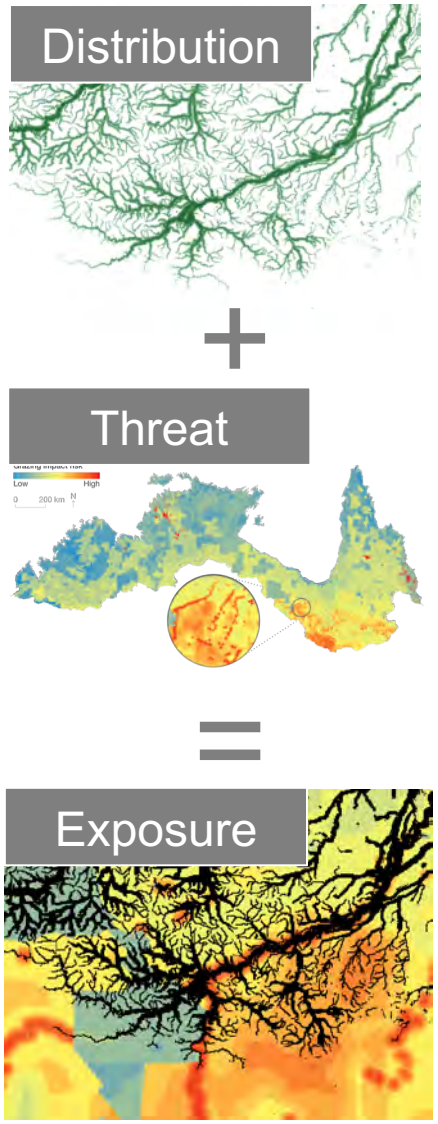
Hotspots of **threatened frog species** in Wet Tropics and across Cape York



3 diseases:
Chytridiomycosis,
Phytophthora &
Myrtle Rust

Project progress

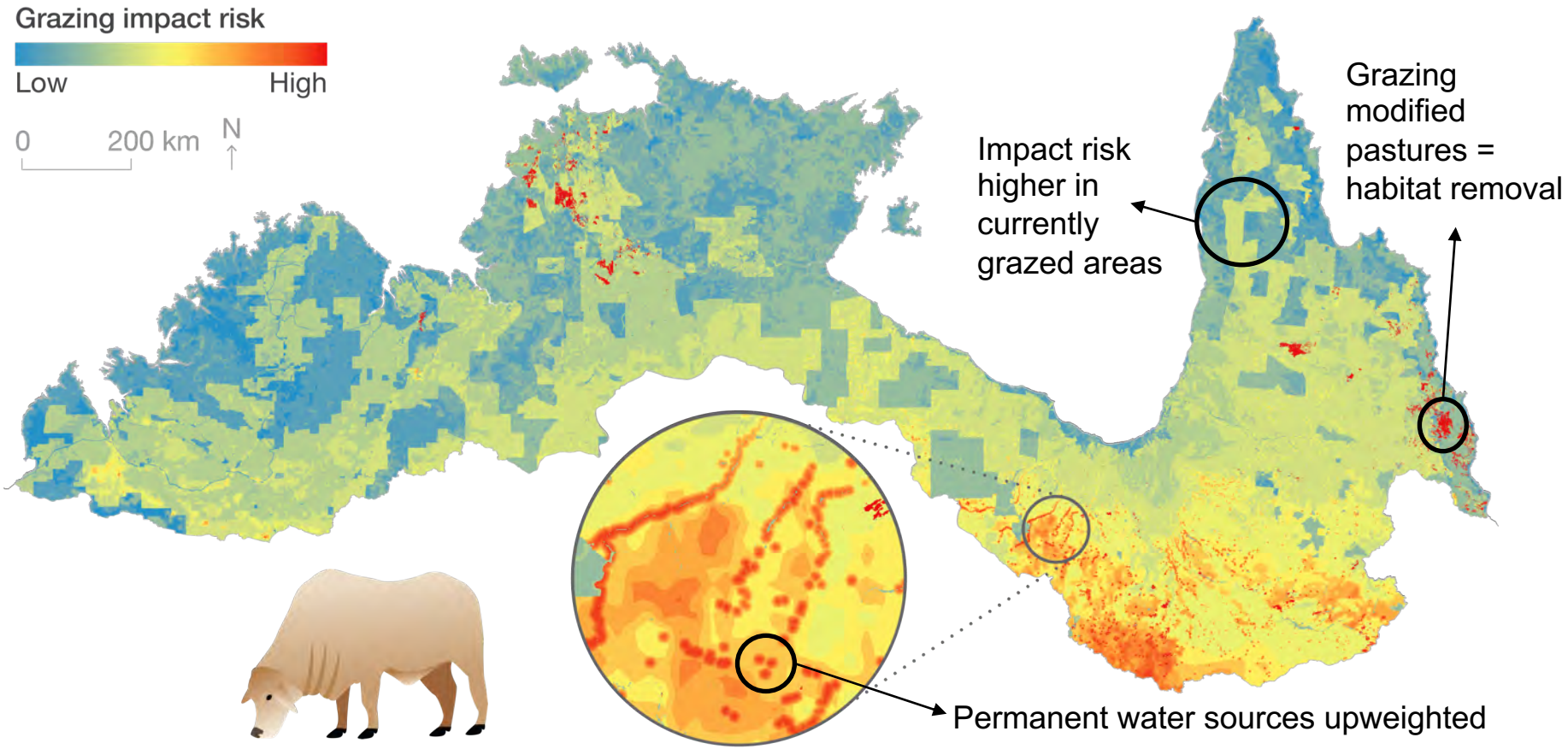
1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



2. Threats
(IV) overgrazing

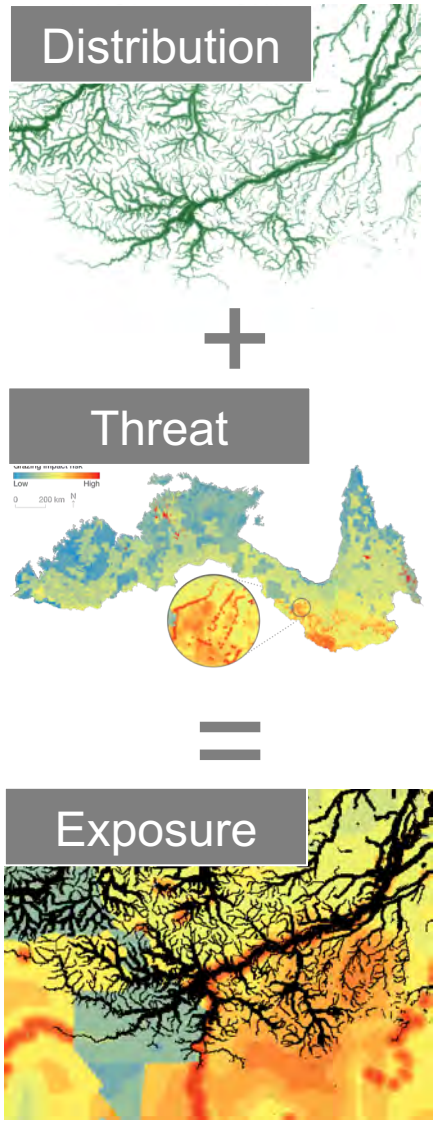
High **grazing potential** & pronounced interannual **variability in pasture growth**

High **risk** of use for life stock & getting stocking rates wrong

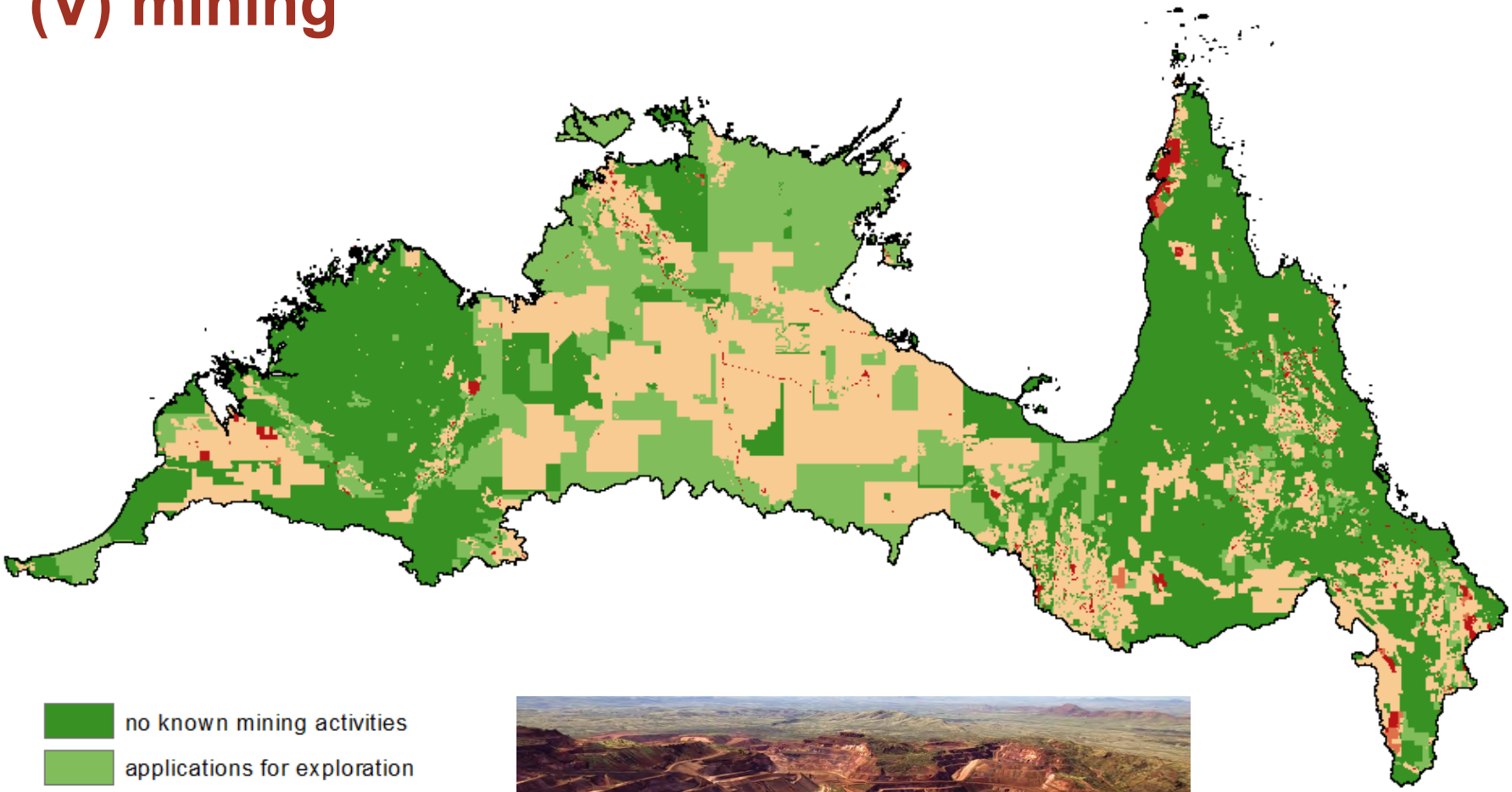


Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



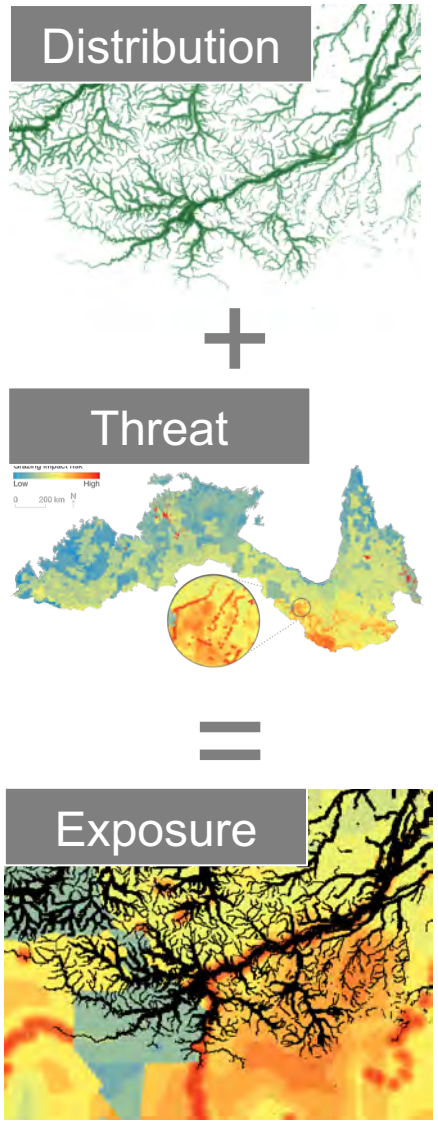
2. Threats
(V) mining



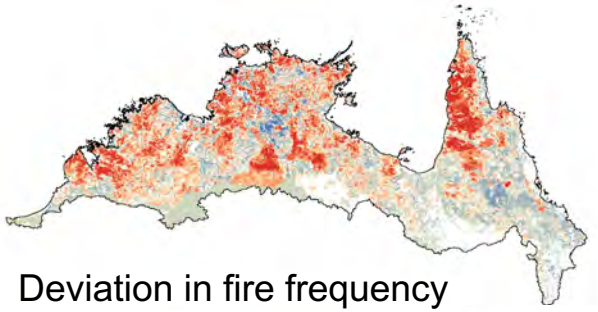
- no known mining activities
- applications for exploration
- known resource presences
- exploration permits
- proposed mines
- active mines

Project progress

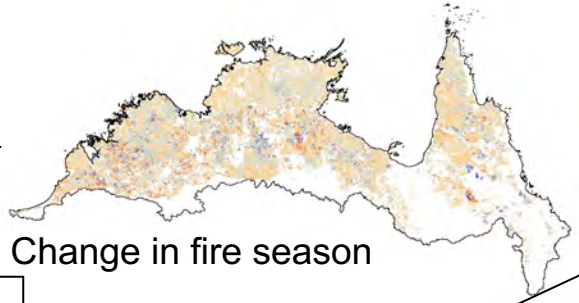
1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



2. Threats
(VI) fire regimes



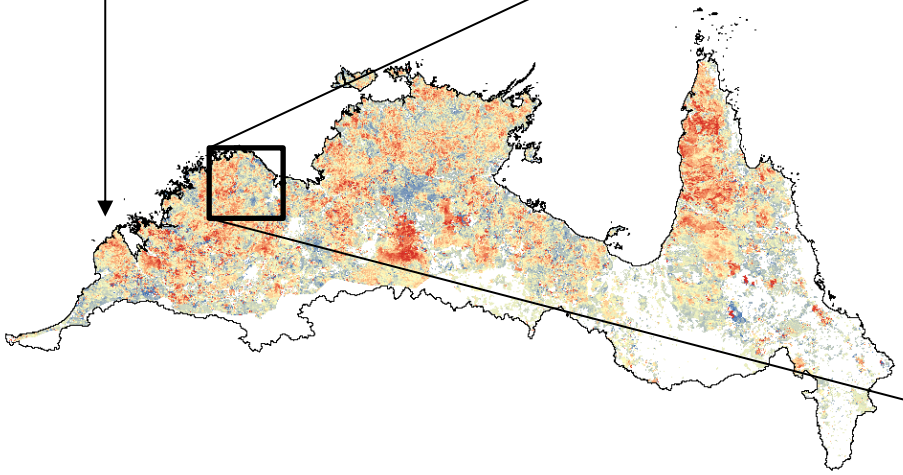
Deviation in fire frequency



\+

Change in fire season

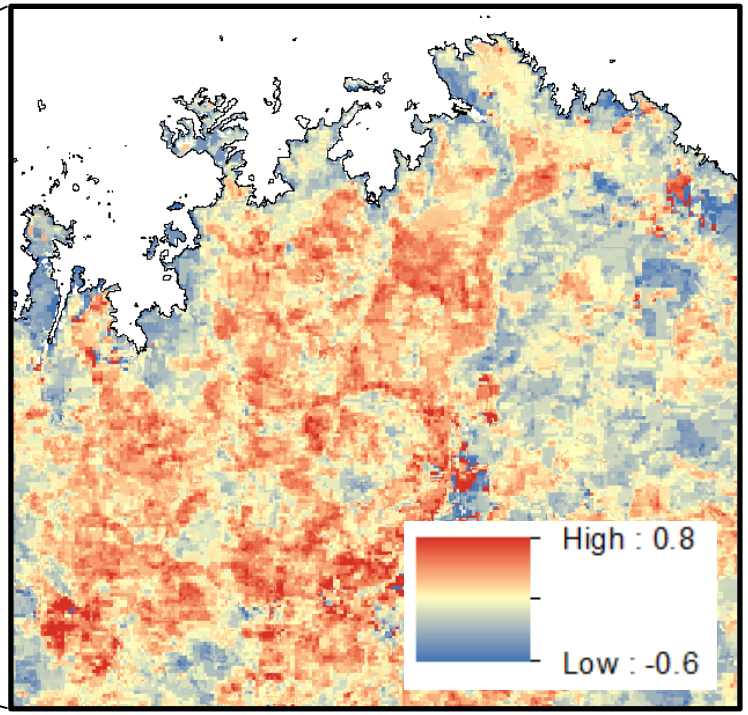
=



Fire Change index

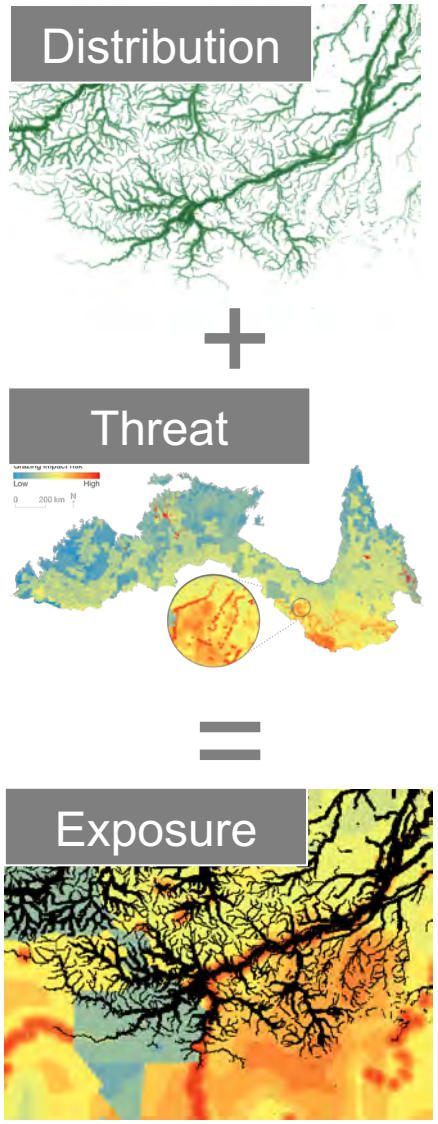
Recent (last 10 years) vs long-term (median 1988–2018)
compared to typical fire regimes for NVIS vegetation types

High index = more frequent & later fires, compared with typical conditions for NVIS vegetation subgroup

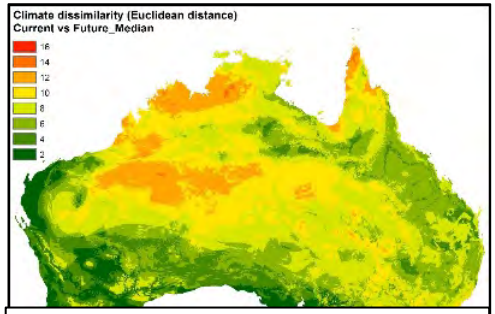


Project progress

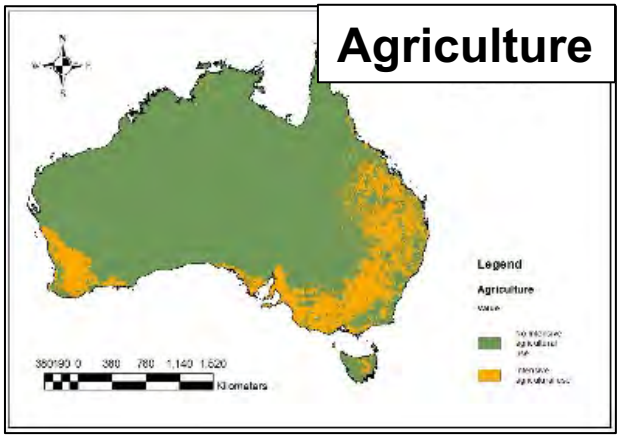
1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**

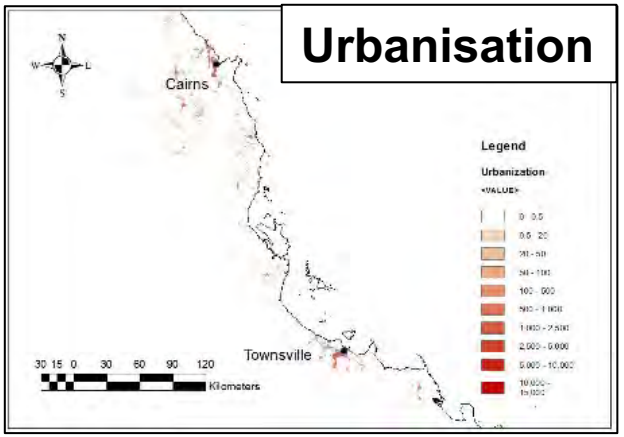


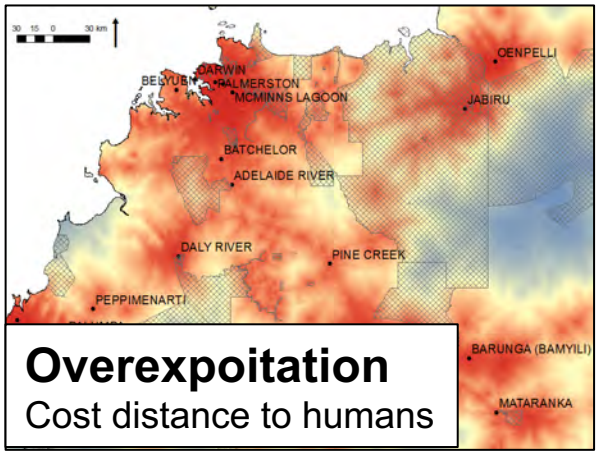
2. Threats – additional outputs



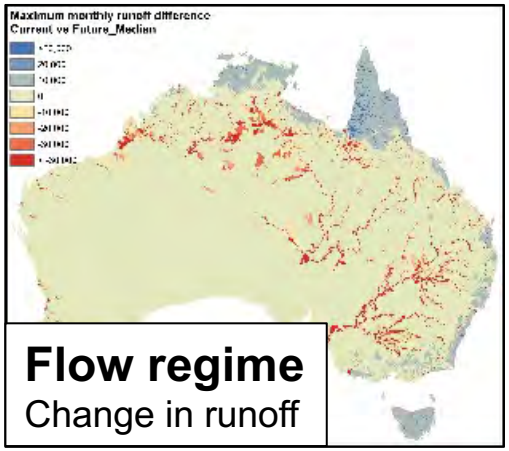
Climate change
Change in heat & drought



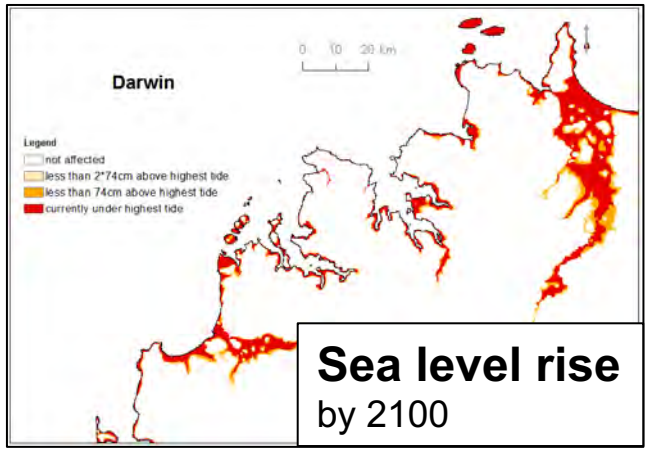




Overexpoitation
Cost distance to humans



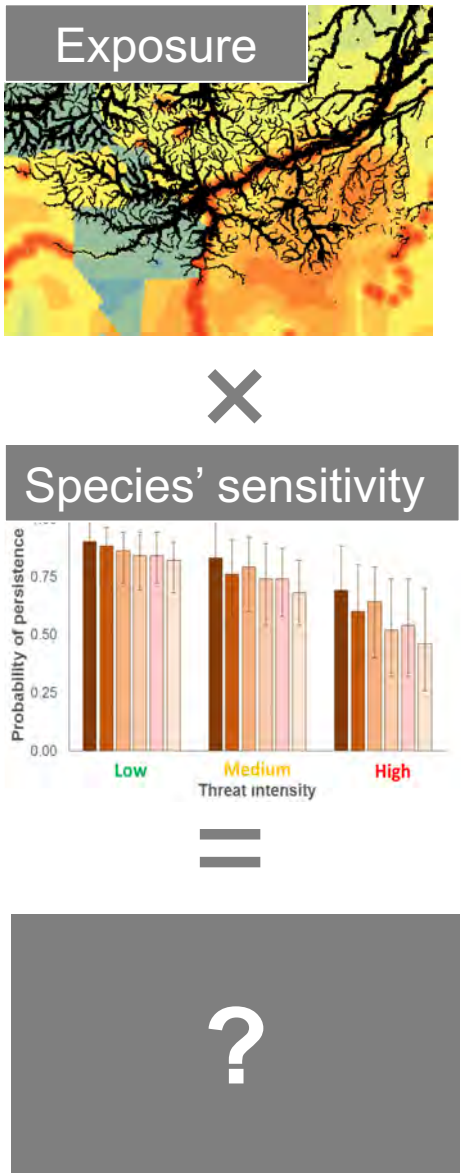
Flow regime
Change in runoff



Sea level rise
by 2100

Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**

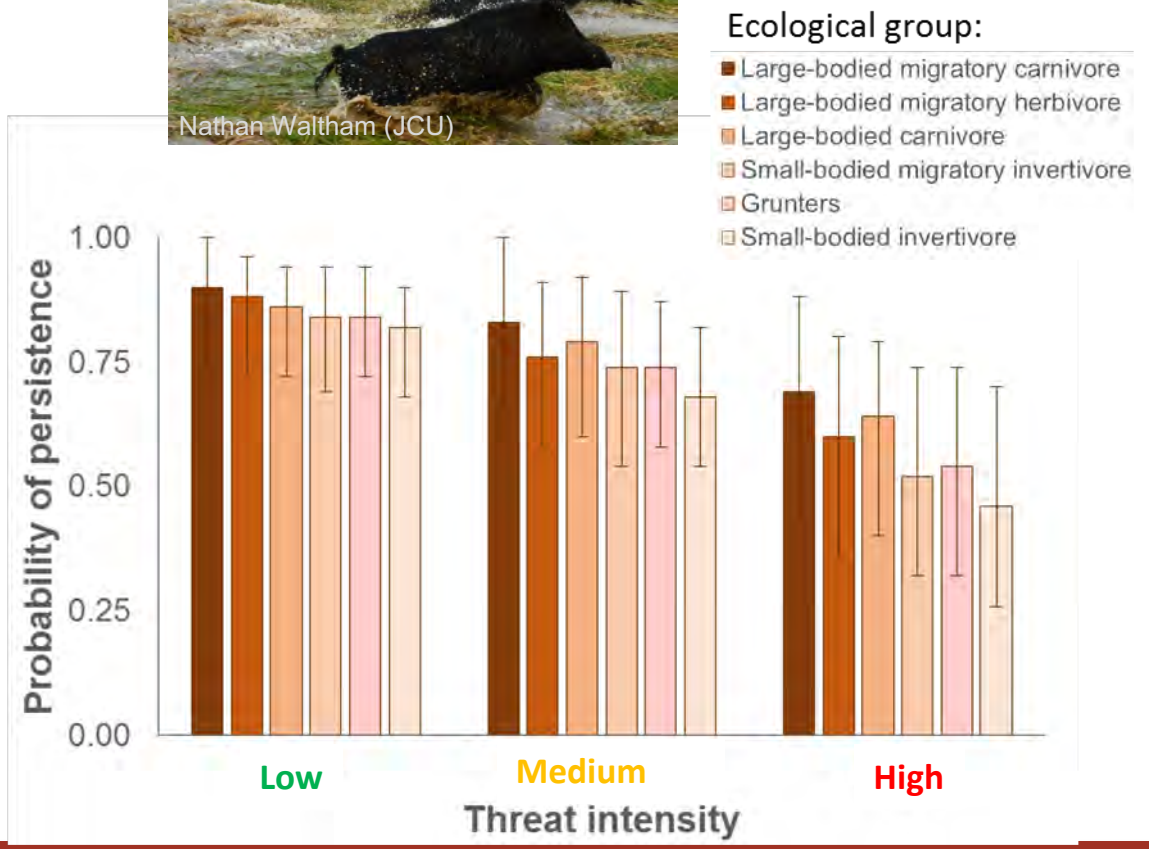


3. Vulnerability: exposure * sensitivity
(I) Sensitivity matrix

- Estimated using expert elicitation
- For ecological groups of species within:
  - mammals
  - birds
  - reptiles
  - amphibians
  - turtles
  - fish
  - vegetation
- Informed by knowledge of species traits conferring resistance/resilience to threats (i.e. ecology, life history, tolerance, dispersal)

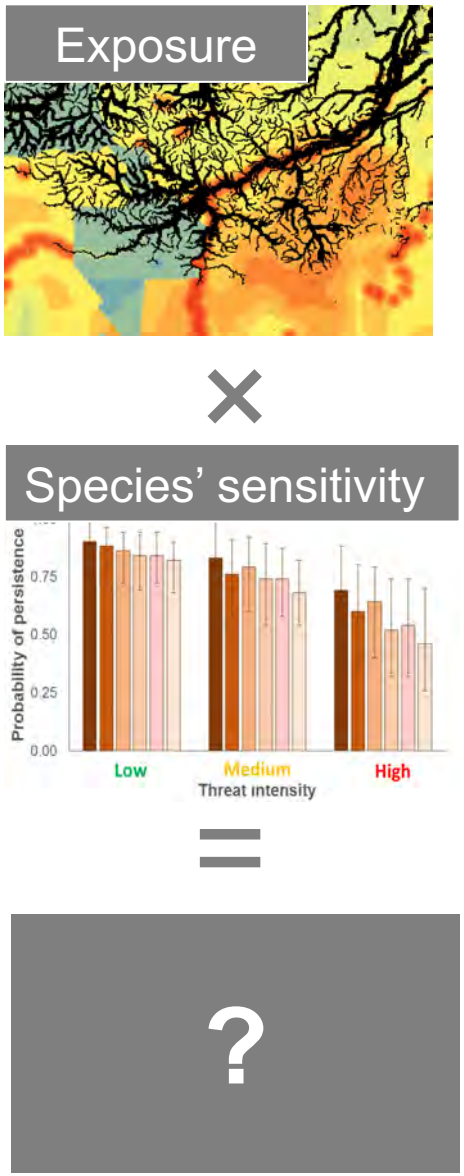
Fish sensitivity to feral pigs

(riparian & wetland habitat degradation)



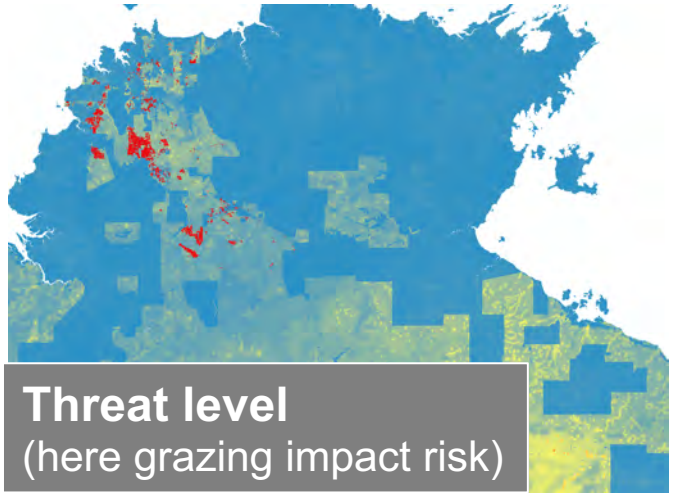
Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**



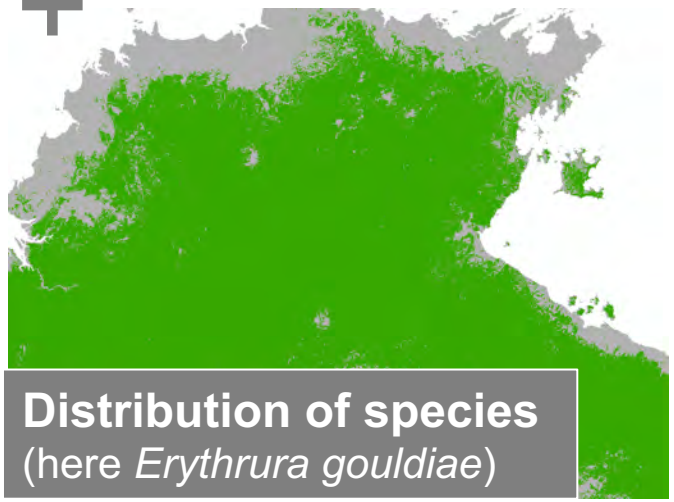
3. Vulnerability: exposure × sensitivity
(II) vulnerability hotspot maps

(To be finalised in the next few months)



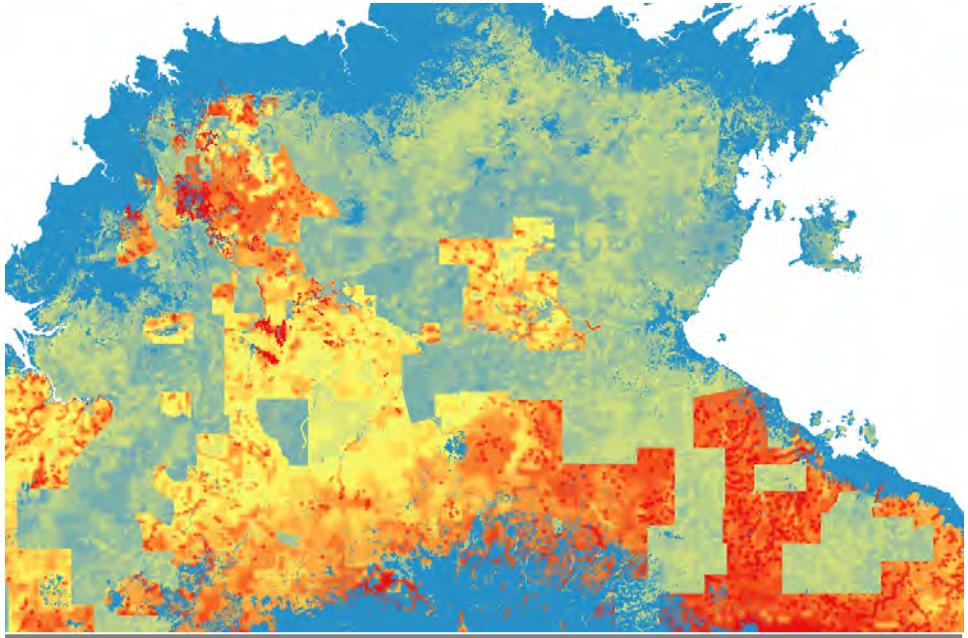
Threat level
(here grazing impact risk)

+



Distribution of species
(here *Erythrura gouldiae*)

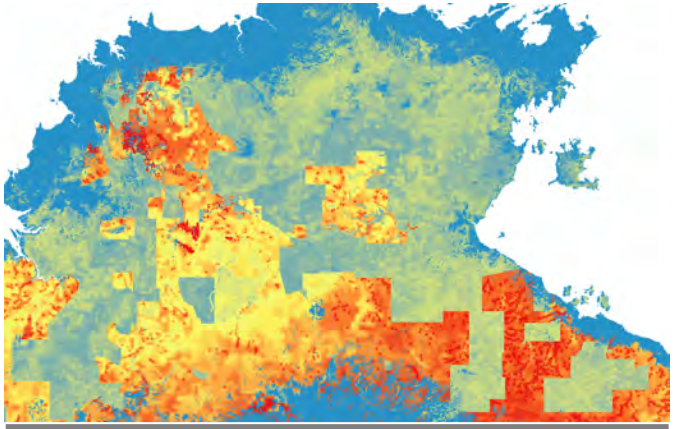
=



Relative exposure to threat within range

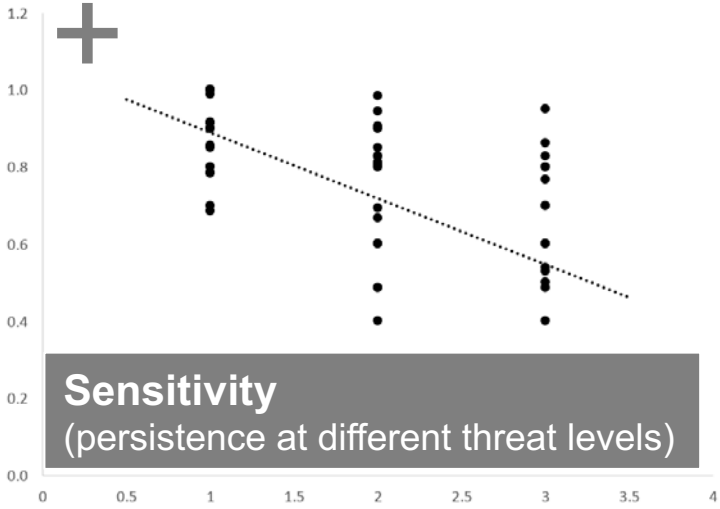
3. Vulnerability: exposure × sensitivity
(II) vulnerability hotspot maps

(To be finalised in the next few months)



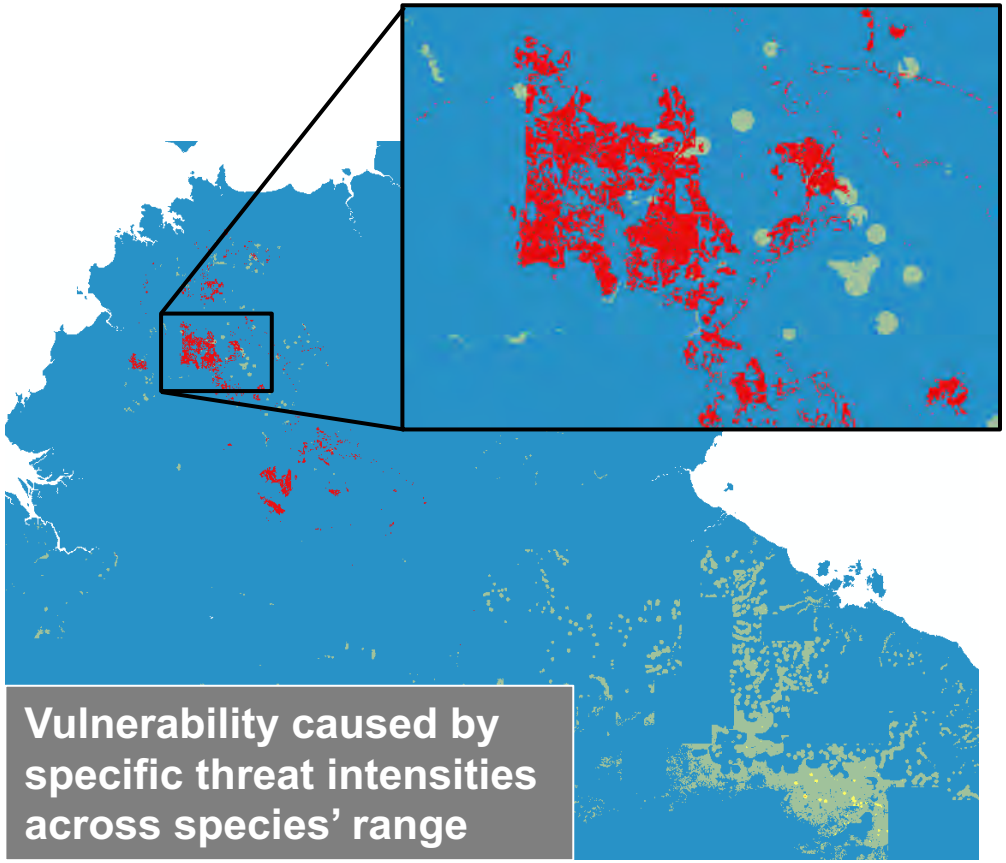
Relative exposure within range

+



Sensitivity
(persistence at different threat levels)

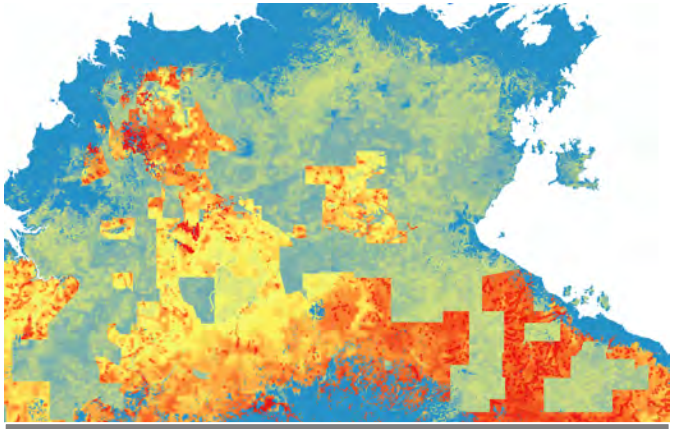
=



Vulnerability caused by specific threat intensities across species' range

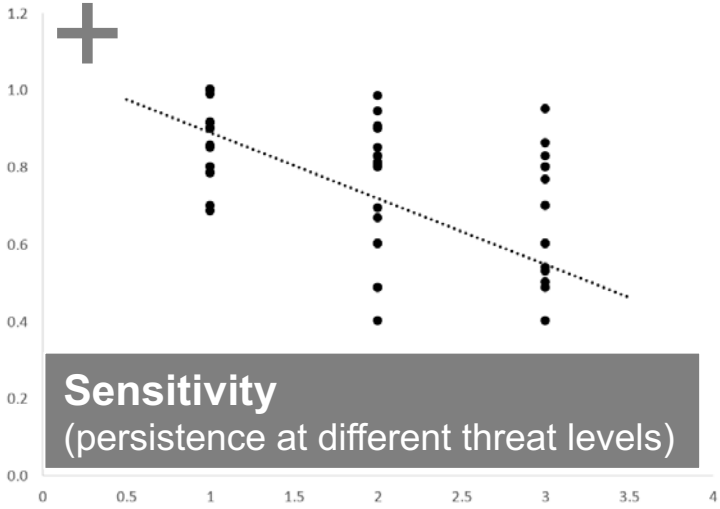
3. Vulnerability: exposure × sensitivity
(II) vulnerability hotspot maps

(To be finalised in the next few months)



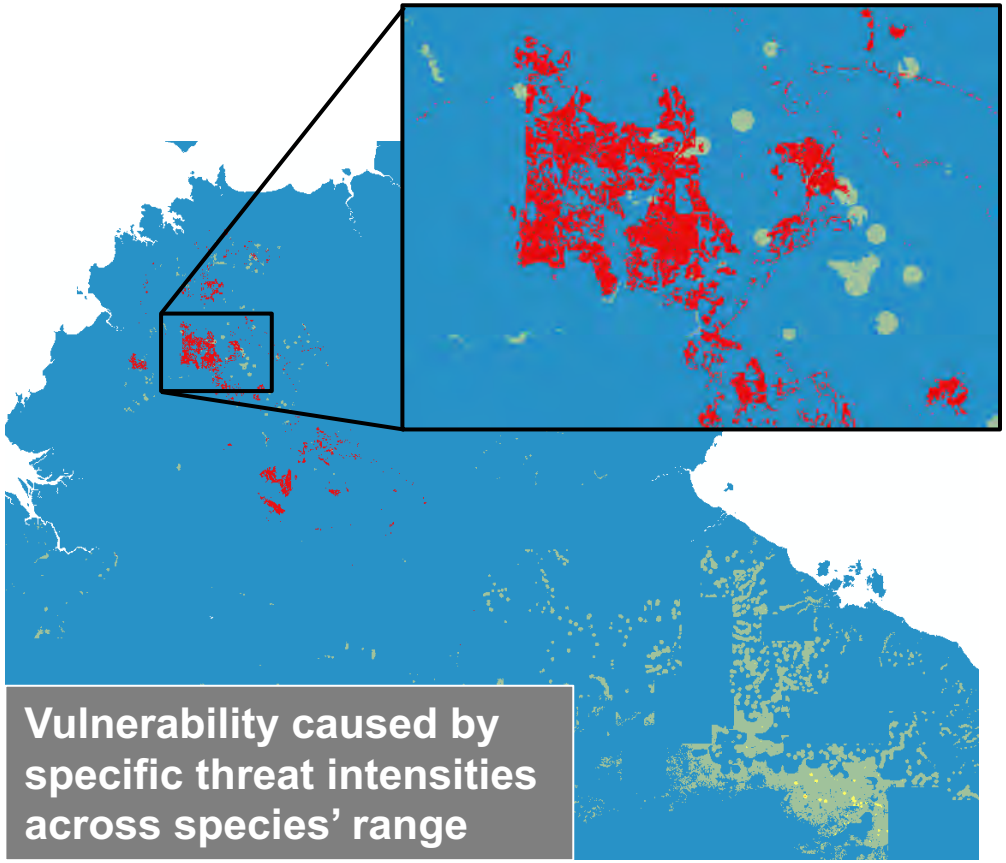
Relative exposure within range

+



Sensitivity
(persistence at different threat levels)

=



Vulnerability caused by specific threat intensities across species' range

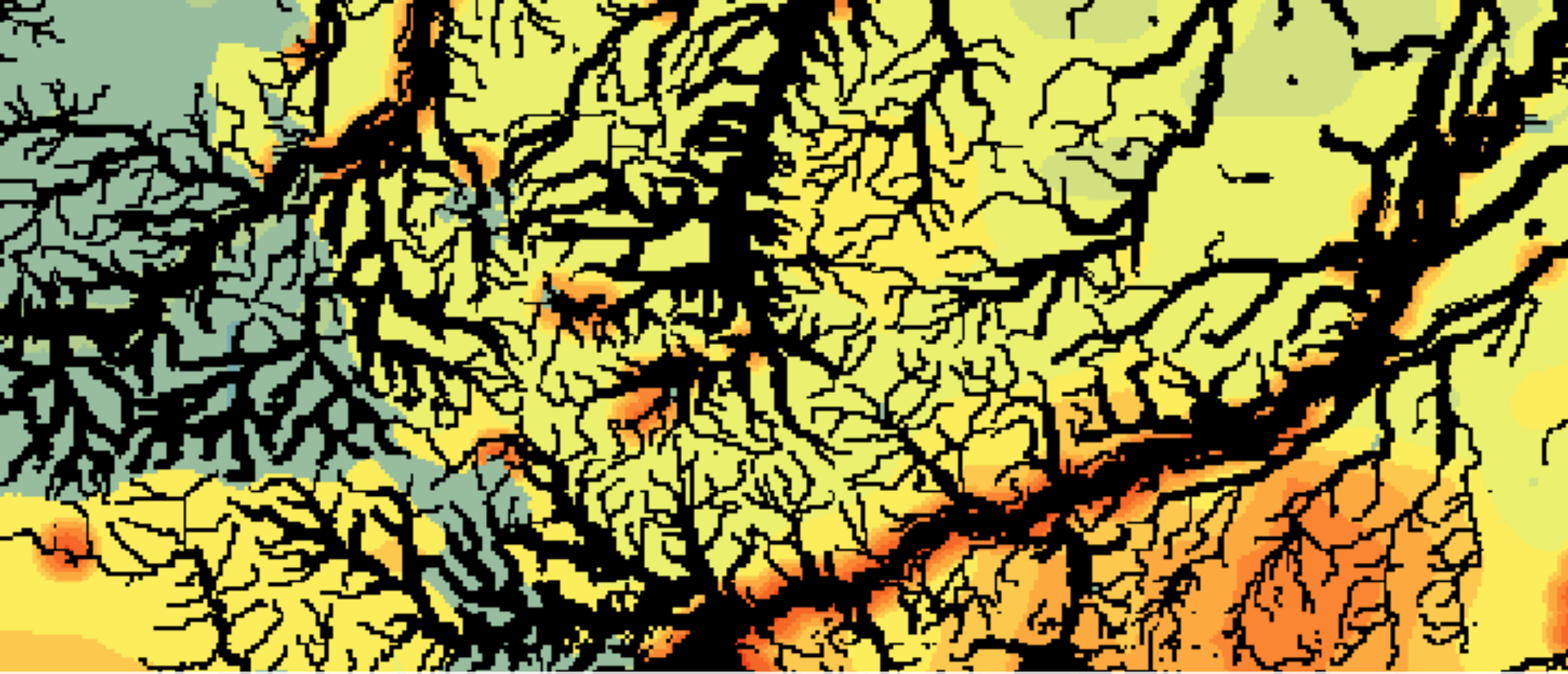
Cumulative vulnerabilities? Across threats & across species groups…

Project progress

1. **Rare & threatened species (year 1)**
   I. Expert vetted species distribution models
   II. Hotspot maps of threatened species richness
2. **Threats (year 2)**
   I. Weeds
   II. Feral animals
   III. Diseases
   IV. Overgrazing
   V. Mining
   VI. Changes in fire regimes
   VII. Climate change
   VIII. Changes in flow regime
   IX. Overexploitation
   X. Urbanization
   XI. Agricultural areas
3. **Vulnerability: Exposure × sensitivity (year 3)**
   I. Sensitivity matrix
   II. Vulnerability hotspot maps
4. **Guide & report**

Impact pathway & planned outputs

1. **Integration into federal, state & territory departments' workflows**
   - Use existing platforms & workflows to distribute outputs to stakeholders
   - Directly inform policy & management
   - Collaboration & Research User Agreements with state/ territory departments
2. **Case studies**
   - Integrate outputs into example case studies
   - Fitzroy multi-objective planning
   - NT floodplains
3. **Guide + examples + report**
   - Practical guide on how to use/how to not use outputs
   - Detailed final technical report
4. **Public awareness**
   - Integration of generalised versions of outputs into a public platform: The Atlas of Living Australia



For further information:

Anna Pintor
0450452605
anna.pintor1@jcu.edu.au

Stephanie Hernandez
stephanie.hernandez@my.jcu.edu.au