Protected Areas Resilient to Climate Change, PARCC West Africa

2015

PARCC Project Training Manual Module 4. Species Vulnerability Traits

ENGLISH

IUCN

2015

The United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.

PARCC Project Training Manual, prepared by UNEP-WCMC and all PARCC project technical partners (Met Office Hadley centre, IUCN Species Programme, BirdLife International, Durham University, and DICE University of Kent), with funding from Global Environment Facility (GEF) via UNEP.

Citation: IUCN. 2015. PARCC Project Training Manual. Module 4. Species Vulnerability Traits. *UNEP-WCMC technical report*.

Available From: UNEP World Conservation Monitoring Centre (UNEP-WCMC)
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Photo cover: River Number Two Beach, Freetown Peninsula, Sierra Leone. *Copyright: Elise Belle*.

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Chapter 1. IUCN's Climate Change Vulnerability Assessment Framework

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IUCN's Climate Change Vulnerability Assessment Framework

Guidelines for Contributing Experts

Jamie Carr, April 2012

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

IUCN | SSC Species Survival Commission

HOW IS THE CLIMATE EXPECTED TO CHANGE?

- **Changes in the average climatic conditions**
  - e.g. Warmer max/min temperatures; increased/decreased precipitation
- **Changes in the frequency and/or intensity of extreme climatic events**
  - e.g. Storms; droughts; floods
- **Changes in the timing of events**
  - e.g. Seasonal rains; snowmelt etc.
- **Numerous indirect effects**
  - e.g. Sea level rise; ocean acidification; changes to fire regimes
- **These changes are expected to vary geographically**

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Contents:

This document will explain the framework that IUCN uses to assess species' vulnerability to climate change, its structure, and how you IUCN hopes you can assist in its development and application. It includes the following sections:

1. **OVERVIEW**
2. **STRUCTURE OF THE FRAMEWORK**
3. **REQUIRED EXPERT INPUTS**

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WHY DO WE NEED THIS FRAMEWORK?

- **This framework aims to fill two main gaps in the common approaches to assessing the threat status of species:**

1. The recognised challenges faced by the Red Listing™ process in accounting for climate change impacts
2. The failure to account for species-specific biological and ecological information when using 'climatic envelope modelling' approaches

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1. OVERVIEW

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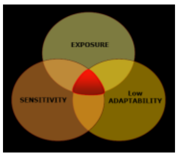
HOW DOES THE FRAMEWORK WORK?

- Assesses current vulnerability to climate change impacts of species within a given taxon
- Considers current climatic forecasts (2050 and 2090) and known species distributions (much as in modelling approaches)
- Uses expert knowledge and literature searches to consider species-specific biological and ecological traits
- Trait data may be quantitative, categorical or binary
- Vulnerability is considered according to 3 dimensions….

The Climate Change Vulnerability Framework

- **Exposure**
  - What climatic changes will a species be exposed to?
- **Sensitivity**
  - How strongly does the species depend upon current climate regimes to persist?
- **Low Adaptability**
  - If affected, can a species disperse? Can it adapt genetically *in-situ*?



- THESE 3 DIMENSIONS WILL BE EXPLAINED IN GREATER DETAIL IN THE FOLLOWING SECTION

HOW DOES THE FRAMEWORK WORK?

- Vulnerability criteria (traits) are developed under these 3 dimensions. Each species is assessed against these.
- A score-based system. Species fall into one of three categories for each trait:
  - 'Very High', 'High' or 'Low' risk
  - Scoring 'Very High' or 'High' in any trait = 'Very High or 'High' for that category.
- **An overall 'score' for each species can then be calculated, based on the outcomes under each category.**

2. STRUCTURE OF THE FRAMEWORK

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EXPOSURE - what changes will a species experience?

- This element combines species **distribution polygons** (from IUCN Red List assessments and elsewhere) with **climatic forecasts.**
- For terrestrial and freshwater species, it aims to determine the changes (monthly means and variability) in temperature and precipitation, between now and 2050/2090, throughout the species' **current range.**
- Species with the greatest changes accross their range, compared with current values will score highly in this category.

EXPOSURE – continued....

- Following review and 'cleaning'* of distribution polygons, **this element of the assessment process requires little input from taxonomic experts**

** Cleaning process involves a review of habitat and elevation data, and removal of unsuitable areas from the distribution maps.*

SENSITIVITY - How dependent is this species on current climates to persist *in-situ*?

- We place 'Sensitivity' traits under **5 main categories:**
  - **Habitat/microhabitat specialists**
    - Species dependent upon (micro)habitats that may be affected by climate change.
  - **Low climatic thresholds**
    - Species that can only tolerate a narrow range of some climatic factor.
  - **Dependence on a climatic trigger**
    - e.g. Breeding upon rainfall
  - **Dependence on climatically sensitive interspecific interactions**
    - e.g. A food source or keystone species that is climatically sensitive
  - **Rarity**
    - Rare species are considered less likely to recover from perturbations

Trait Group	Trait			
	SENSITIVITY	Very High	High	Low
A. Specialised habitat and/or microhabitat requirements	Think of ways that habitat specialisms may be affected by climate change			
B. Narrow environmental tolerances or thresholds that are	Consider all life stages of your taxon - Are there any examples where a narrow climatic range is required for survival?			
C. Dependence on a specific environmental trigger that's likely to be disrupted by climate change	Think of ways that a climatic event may trigger an important activitity or behaviour in your taxa			
D. Dependence on interspecific interactions which are likely to be disrupted by climate change.	Think of important food species, habitat modifiers, competitors and predators etc. - Will any of these be affected by climate change?			
E. Rarity	What level of rarity might increase climate change vulnerability compared with other species?			

The attached spreadsheet contains a blank copy of this table.

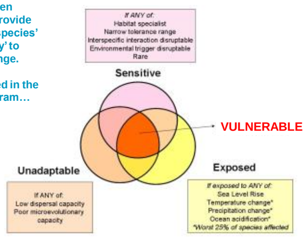
We ask experts to consider taxon-specific traits that fall into these categories.

We also ask you to consider thresholds that could constitute the three categories across the top

Examples of sensitivity traits are given in the attached spreadsheet

Data are then combined to provide indication of a species' 'vulnerability' to climate change.

This is illustrated in the following diagram…



UNADAPTABILITY – Can this species disperse? Can it adapt through microevolution?

- Here we consider two ways that a species may adapt to climatic changes: by dispersing, or by adapting genetically
  - **Low dispersability**
    - Species whose life-history makes them unable to disperse
    - Species for which barriers (physical, ecological etc.) prevent dispersal
  - **Low 'evolvability'**
    - Species for which genetic adaptation is difficult (e.g. due to known genetic deficiencies or low breeding capacity)

3. REQUIRED EXPERT INPUTS

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Trait Group	Trait			
	LOW ADAPTABILITY	Very High	High	Low
A. Poor dispersability	Think about barriers to dispersal - What sort of barriers may restrict a reptile from dispersal?			
	Think about the species themselves - what sort of traits might restrict a species ' dispersal ability?			
B. Poor Evolvability	Think about generation times and clutch sizes etc. Also known genetic bottlenecks etc.			

Much like the 'Sensitivity' aspect, blank examples of these categories are also given as part of the attached spreadsheet

Here, we ask you to consider traits that could make species within your taxa less able to adapt to climate change

Again, we ask you to consider thresholds that could constitute the three categories across the top

Examples of 'Low Adaptability' traits are given in the attached spreadsheet

Required Expert Inputs:

As we hope has been made clear so far, our assessment process relies as much on the knowledge and contribution of species experts as it does on modelling approaches. This is how we are able to consider the specific traits of each species. The contribution that we require from experts is divided into two parts:

1) **Consultation on the traits selected for inclusion in the framework**

2) **Individual species assessments, applying the framework developed during stage 1**

Stage 1 – Construction of a taxon-specific framework:

Before we are able to assess individual species we need to ensure that the traits used are wholly applicable.

Although the traits selected will be based around the existing framework, we are asking you to think of further traits that will make one species more susceptible to climate change impacts than another.

We are also asking you to think of thresholds that would allow placement of a species into one of the three categories described earlier.

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Stage 1 – Constructing the framework:

- Full instructions on how to complete this task are given on the first page of the associated spreadsheet (Available here).
- Here are a couple of examples of the sort of inputs that we are looking for, but remember, **these are just ideas, which are subject to change based on your suggestions**……

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Example 1 – 'SENSITIVITY' – 'Habitat Specialisation'

Trait Group	Trait	Low	High	Very High
SENSITIVITY				
A. Specialised habitat and/or microhabitat requirements	Habitat specialist	Occurs in >1 habitat (uses IUCN classifications)	Occurs in 1 habitat only	n/a

This is the main trait group

This is one example of a trait that might fall into this group

All species occurring in more than one habitat type would be considered 'Low Sensitivity' under this trait

Specialist species, living in one habitat only, would be considered 'High Sensitivity under this trait'.

The 'Very High' category is not applicable to this trait.

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Example 2 – 'SENSITIVITY' – 'Temperature dependent gender determination'

Trait Group	Trait	Low	High	Very High
SENSITIVITY				
B. Narrow environmental tolerances or thresholds that are likely to be exceeded due to climate change at any stage in the life cycle	Temperature dependent gender determination	No temperature dependency for determination of gender	Known temperature dependency for determination of gender	

All species without temperature dependent gender determination would be considered 'Least Concern' under this trait

Species with temperature dependent gender determination would be considered Highly Sensitive

This trait does not contain a 'Very High' threshold

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Example 3 – 'LOW ADAPTABILITY' – 'Low Potential Dispersal Distance'

Trait Group	Trait	Low	High	Very High
LOW ADAPTABILITY				
A. Poor 'Dispersability'	Low potential dispersal distance	1 individual can move > 10 km/year	1 individual can move only 1 - 10 km/year	1 individual can only move ≤1 km/year

These thresholds are given only as an example. It will be necessary to decide and reach consensus on these thresholds before species can be assessed for this trait.

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Stage 1 – Important Notes

These are important notes that you need to know before attempting to complete the associated spreadsheet:

1) **We do not expect you to complete all blank cells on the spreadsheet – Only where you have specific suggestions of how climate change may affect your taxonomic group.**

2) **The traits list provided in the associated spreadsheet is a draft. We would very much like to hear your comments, ideas and suggestions.**

3) **This is quite a complex task. If you have any questions on any matter, then please do not hesitate to ask.**

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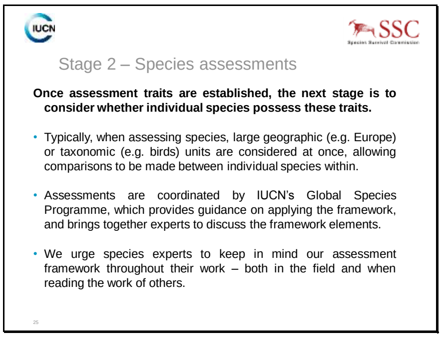
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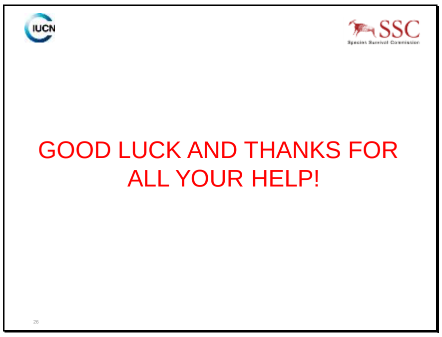
Stage 2 – Species assessments
Once assessment traits are established, the next stage is to consider whether individual species possess these traits.
Typically, when assessing species, large geographic (e.g. Europe) or taxonomic (e.g. birds) units are considered at once, allowing comparisons to be made between individual species within.
Assessments are coordinated by IUCN's Global Species Programme, which provides guidance on applying the framework, and brings together experts to discuss the framework elements.
We urge species experts to keep in mind our assessment framework throughout their work – both in the field and when reading the work of others.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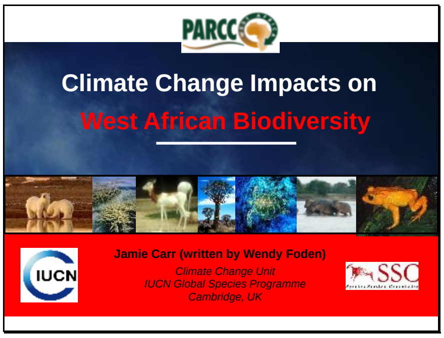
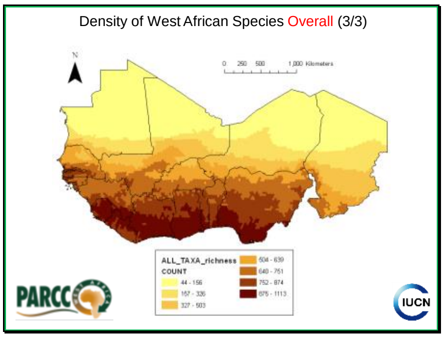
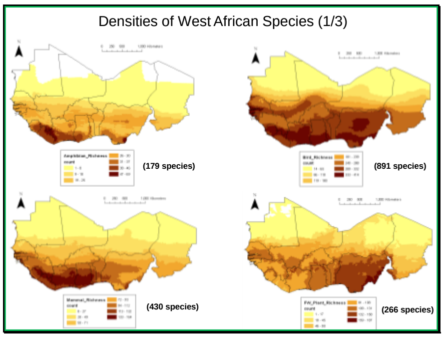
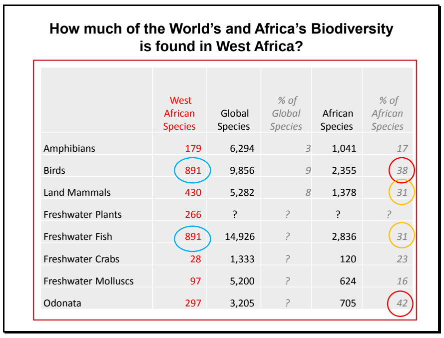
SSC
GOOD LUCK AND THANKS FOR ALL YOUR HELP!

Chapter 2. Climate change impacts on West African Biodiversity

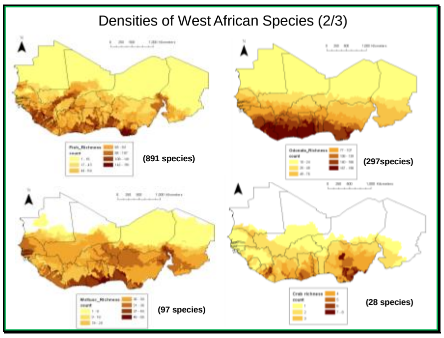


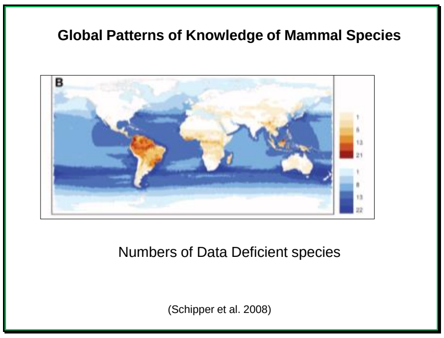


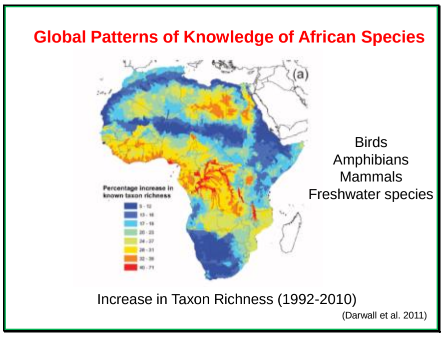


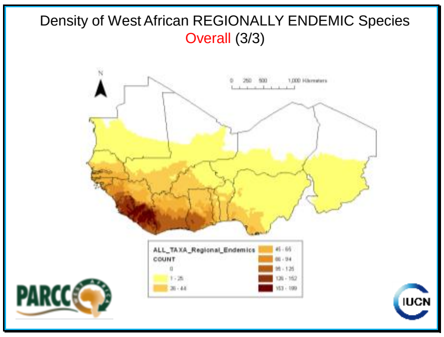

How much of the World's and Africa's Biodiversity is found in West Africa?

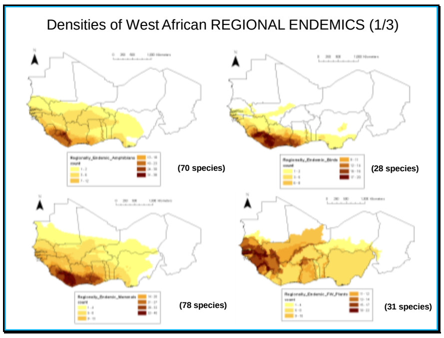
	West African Species	Global Species	% of Global Species	African Species	% of African Species
Amphibians	179	6,294	3	1,041	17
Birds	891	9,856	9	2,355	38
Land Mammals	430	5,282	8	1,378	31
Freshwater Plants	266	?	?	?	?
Freshwater Fish	891	14,926	?	2,836	31
Freshwater Crabs	28	1,333	?	120	23
Freshwater Molluscs	97	5,200	?	624	16
Odonata	297	3,205	?	705	42





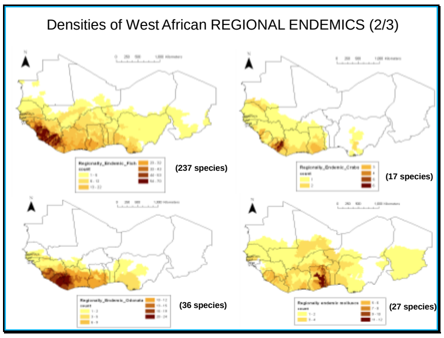


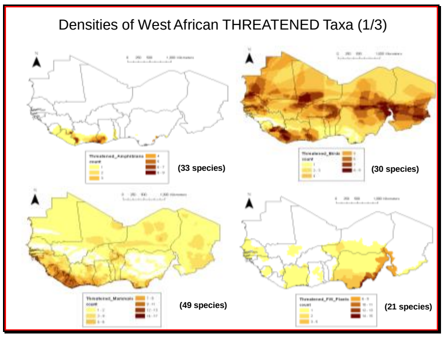


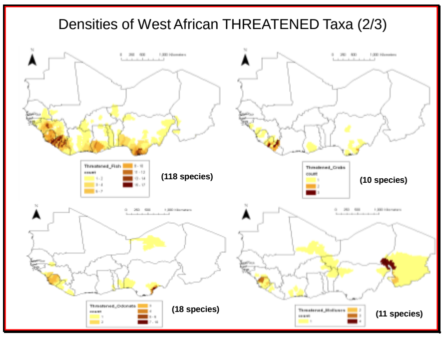


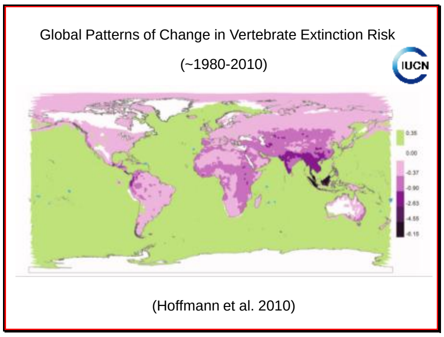
Which Taxonomic Groups have Highest Endemism in West Africa?

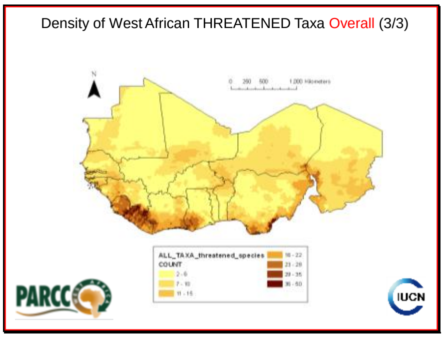
	West African Species	Regional Endemics	%
Amphibians	179	70	39
Birds	891	28	3
Land Mammals	430	78	18
Freshwater Plants	266	31	12
Freshwater Fish	891	237	27
Freshwater Crabs	28	17	61
Freshwater Molluscs	97	27	28
Odonata	297	36	12

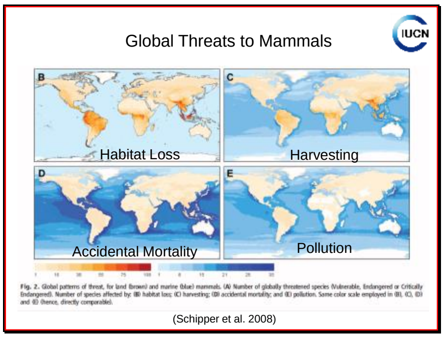


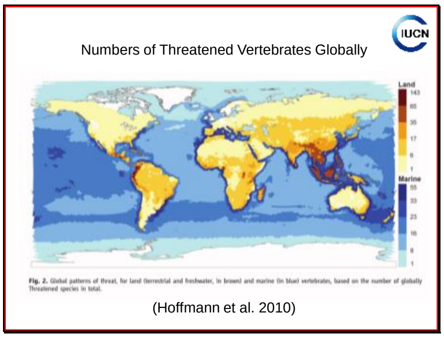


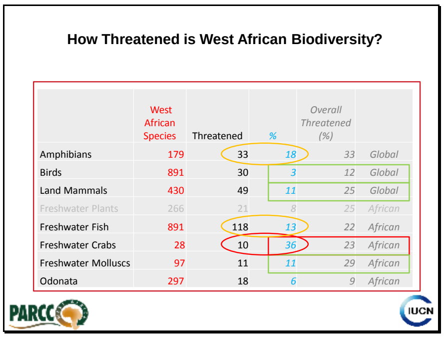




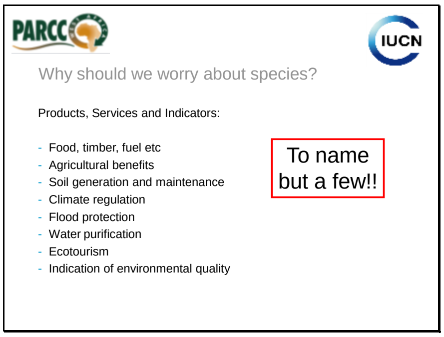







How Threatened is West African Biodiversity?

	West African Species	Threatened	%	Overall Threatened (%)	
Amphibians	179	33	18	33	Global
Birds	891	30	3	12	Global
Land Mammals	430	49	11	25	Global
Freshwater Plants	266	21	8	25	African
Freshwater Fish	891	118	13	22	African
Freshwater Crabs	28	10	36	23	African
Freshwater Molluscs	97	11	11	29	African
Odonata	297	18	6	9	African


PARCC
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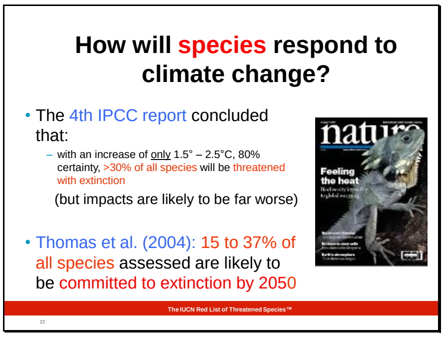
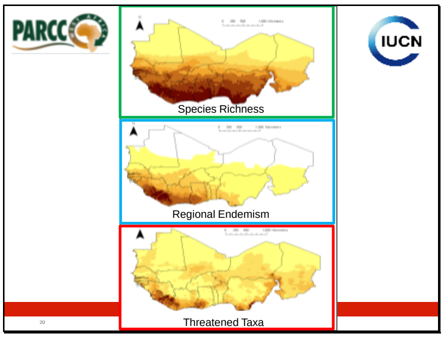
Why should we worry about species?
Products, Services and Indicators:
- Food, timber, fuel etc
- Agricultural benefits
- Soil generation and maintenance
- Climate regulation
- Flood protection
- Water purification
- Ecotourism
- Indication of environmental quality
To name but a few!!


How will species respond to climate change?
• The 4th IPCC report concluded that:
– with an increase of only 1.5° – 2.5°C, 80% certainty, >30% of all species will be threatened with extinction
(but impacts are likely to be far worse)
• Thomas et al. (2004): 15 to 37% of all species assessed are likely to be committed to extinction by 2050
nature
Feeling the heat
The IUCN Red List of Threatened Species™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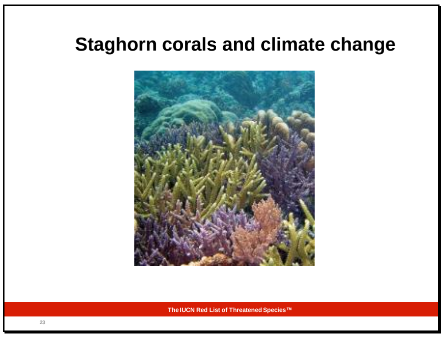
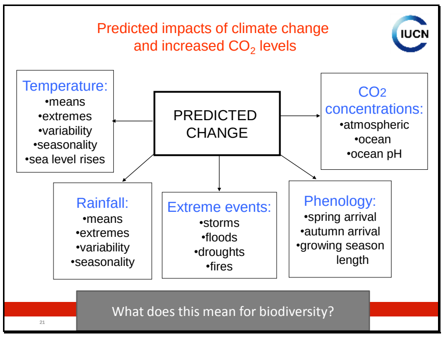
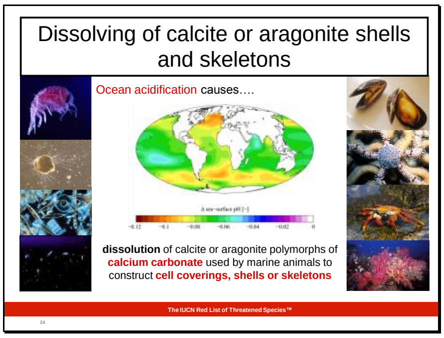
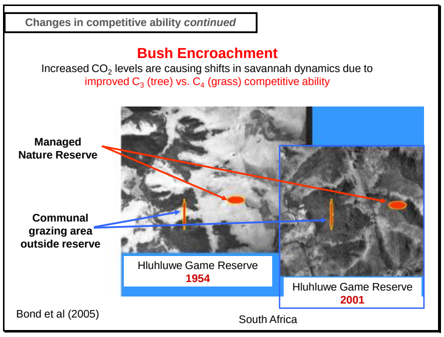
Species Richness
Regional Endemism
Threatened Taxa

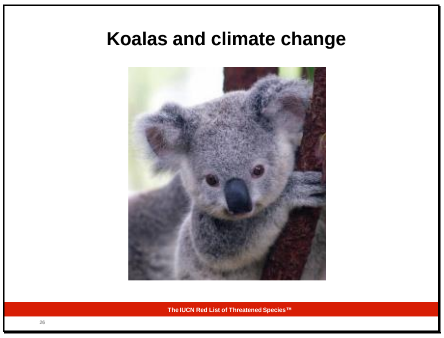

Staghorn corals and climate change
The IUCN Red List of Threatened Species™


Predicted impacts of climate change and increased CO2 levels
IUCN
Temperature:
•means
•extremes
•variability
•seasonality
•sea level rises
PREDICTED CHANGE
CO2 concentrations:
•atmospheric
•ocean
•ocean pH
Rainfall:
•means
•extremes
•variability
•seasonality
Extreme events:
•storms
•floods
•droughts
•fires
Phenology:
•spring arrival
•autumn arrival
•growing season length
What does this mean for biodiversity?

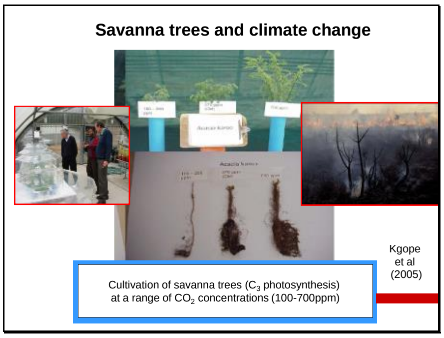

Dissolving of calcite or aragonite shells and skeletons
Ocean acidification causes….
dissolution of calcite or aragonite polymorphs of calcium carbonate used by marine animals to construct cell coverings, shells or skeletons
The IUCN Red List of Threatened Species™

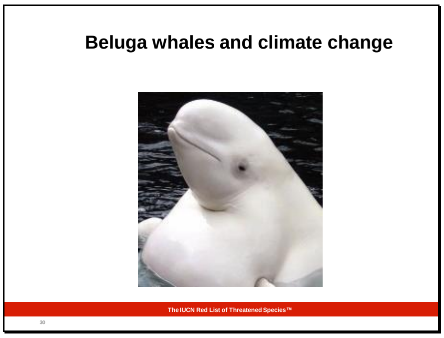

Leatherback Turtles and climate change
The IUCN Red List of Threatened Species™

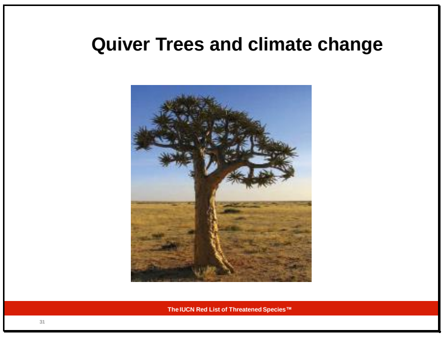

Changes in competitive ability continued
Bush Encroachment
Increased CO_2 levels are causing shifts in savannah dynamics due to
improved C_3 (tree) vs. C_4 (grass) competitive ability
Managed Nature Reserve
Communal grazing area outside reserve
Hluhluwe Game Reserve
1954
Hluhluwe Game Reserve
2001
Bond et al (2005)
South Africa

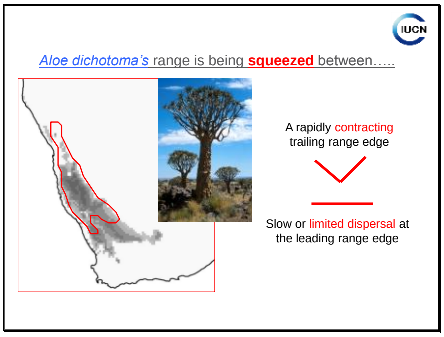

Koalas and climate change
The IUCN Red List of Threatened Species™

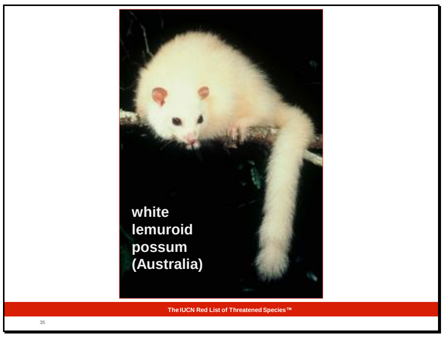

Arctic Foxes and climate change
Out-foxed by Arctic warming?
The IUCN Red List of Threatened Species™

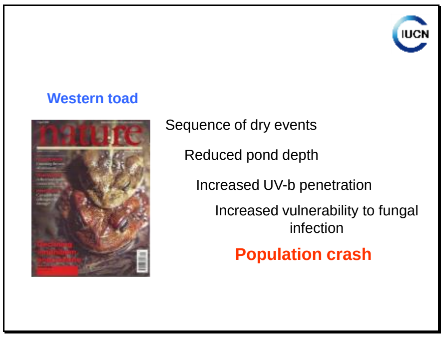

Savanna trees and climate change
Kgope et al (2005)
Cultivation of savanna trees (C_3 photosynthesis)
at a range of CO_2 concentrations (100-700ppm)

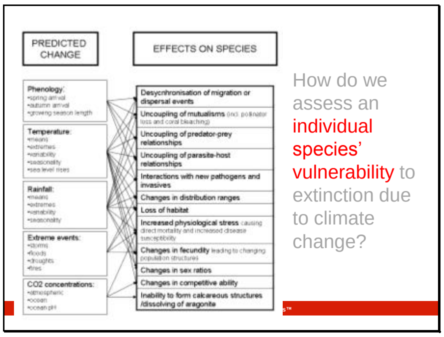

Beluga whales and climate change
The IUCN Red List of Threatened Species™

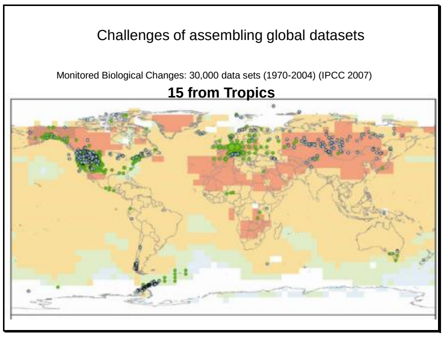

Quiver Trees and climate change
The IUCN Red List of Threatened Species™

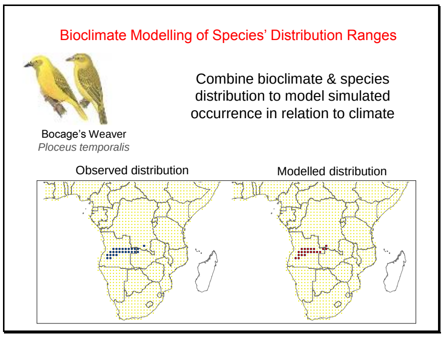

IUCN
Aloe dichotoma's range is being squeezed between…..
A rapidly contracting trailing range edge
Slow or limited dispersal at the leading range edge

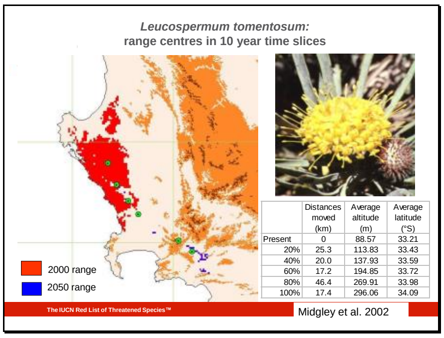

white lemuroid possum (Australia)
The IUCN Red List of Threatened Species™


IUCN
Western toad
nature
Sequence of dry events
Reduced pond depth
Increased UV-b penetration
Increased vulnerability to fungal infection
Population crash

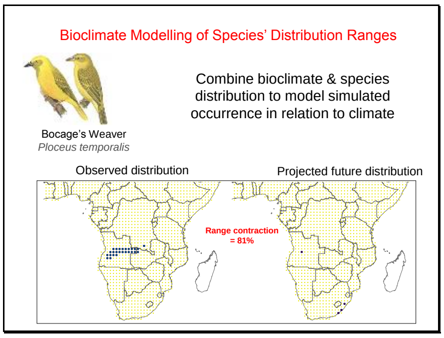


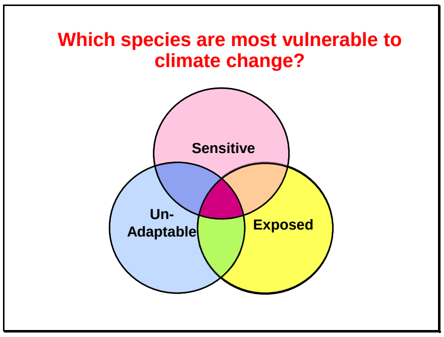


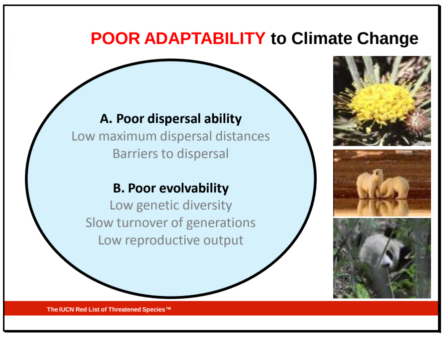


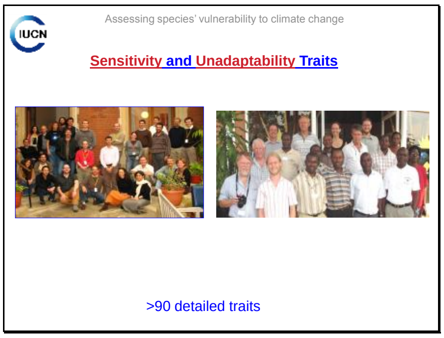


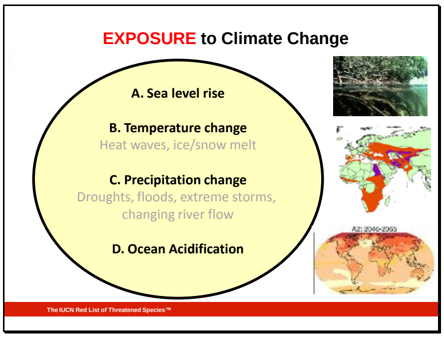
	Distances moved (km)	Average altitude (m)	Average latitude (°S)
Present	0	88.57	33.21
20%	25.3	113.83	33.43
40%	20.0	137.93	33.59
60%	17.2	194.85	33.72
80%	46.4	269.91	33.98
100%	17.4	296.06	34.09

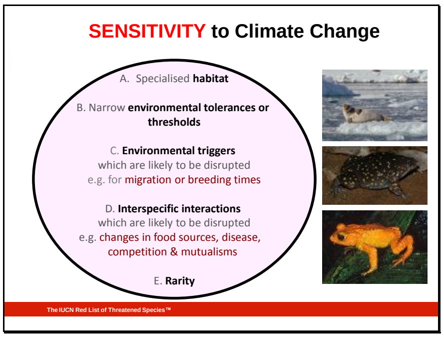


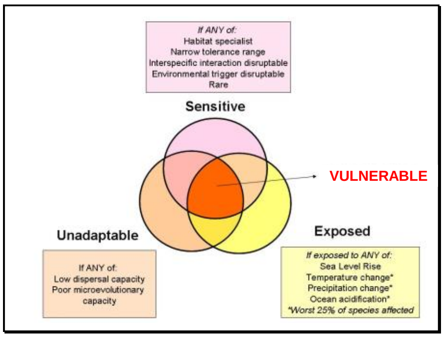

Which species are most vulnerable to climate change?
Sensitive
Un-
Adaptable
Exposed

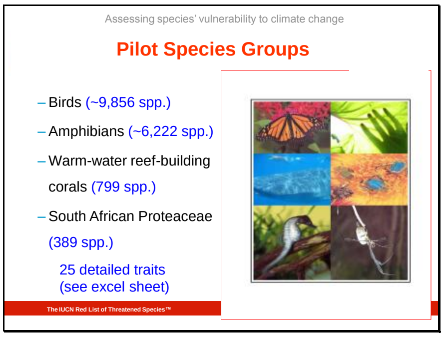

POOR ADAPTABILITY to Climate Change
A. Poor dispersal ability
Low maximum dispersal distances
Barriers to dispersal
B. Poor evolvability
Low genetic diversity
Slow turnover of generations
Low reproductive output

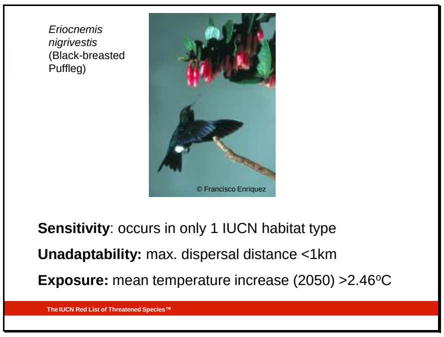

Assessing species' vulnerability to climate change
IUCN
Sensitivity and Unadaptability Traits
>90 detailed traits

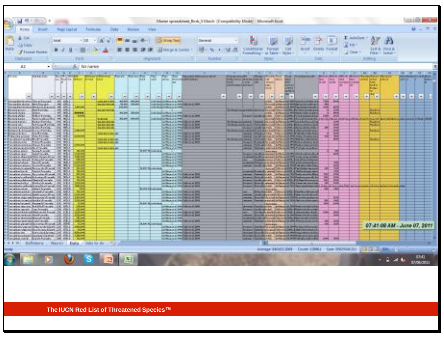

EXPOSURE to Climate Change
A. Sea level rise
B. Temperature change
Heat waves, ice/snow melt
C. Precipitation change
Droughts, floods, extreme storms,
changing river flow
D. Ocean Acidification

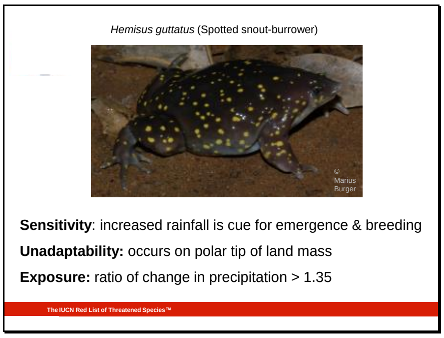

SENSITIVITY to Climate Change
A. Specialised habitat
B. Narrow environmental tolerances or thresholds
C. Environmental triggers
which are likely to be disrupted
e.g. for migration or breeding times
D. Interspecific interactions
which are likely to be disrupted
e.g. changes in food sources, disease, competition & mutualisms
E. Rarity

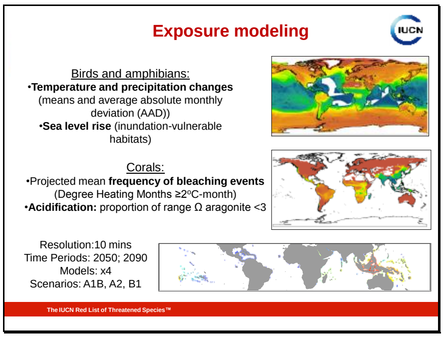

If ANY of:
Habitat specialist
Narrow tolerance range
Interspecific interaction disruptable
Environmental trigger disruptable
Rare
Sensitive
VULNERABLE
Unadaptable
Exposed
If ANY of:
Low dispersal capacity
Poor microevolutionary capacity
If exposed to ANY of:
Sea Level Rise
Temperature change*
Precipitation change*
Ocean acidification*
*Worst 25% of species affected

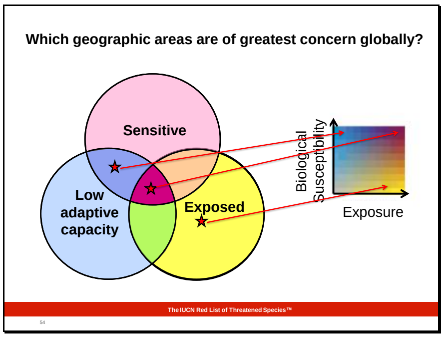

Assessing species' vulnerability to climate change
Pilot Species Groups
– Birds (~9,856 spp.)
– Amphibians (~6,222 spp.)
– Warm-water reef-building corals (799 spp.)
– South African Proteaceae (389 spp.)
25 detailed traits (see excel sheet)
The IUCN Red List of Threatened Species™

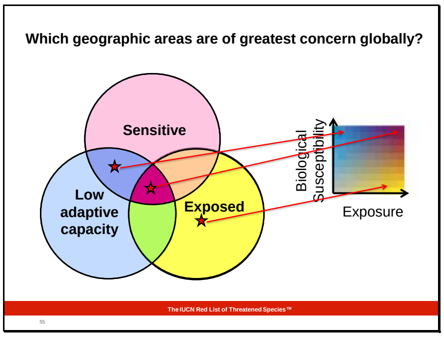

Eriocnemis nigrivestis (Black-breasted Puffleg)
© Francisco Enriquez
Sensitivity: occurs in only 1 IUCN habitat type
Unadaptability: max. dispersal distance <1km
Exposure: mean temperature increase (2050) >2.46ºC
The IUCN Red List of Threatened Species™


The IUCN Red List of Threatened Species™


Hemisus guttatus (Spotted snout-burrower)
© Marius Burger
Sensitivity: increased rainfall is cue for emergence & breeding
Unadaptability: occurs on polar tip of land mass
Exposure: ratio of change in precipitation > 1.35
The IUCN Red List of Threatened Species™


Exposure modeling
IUCN
Birds and amphibians:
•Temperature and precipitation changes (means and average absolute monthly deviation (AAD))
•Sea level rise (inundation-vulnerable habitats)
Corals:
•Projected mean frequency of bleaching events (Degree Heating Months ≥2ºC-month)
•Acidification: proportion of range Ω aragonite <3
Resolution:10 mins
Time Periods: 2050; 2090
Models: x4
Scenarios: A1B, A2, B1
The IUCN Red List of Threatened Species™


Which geographic areas are of greatest concern globally?
Sensitive
Low adaptive capacity
Exposed
Biological Susceptibility
Exposure
The IUCN Red List of Threatened Species™


Which geographic areas are of greatest concern globally?
Sensitive
Low adaptive capacity
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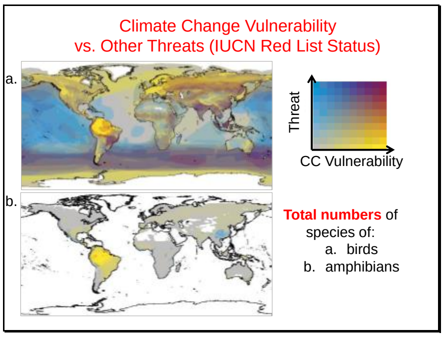
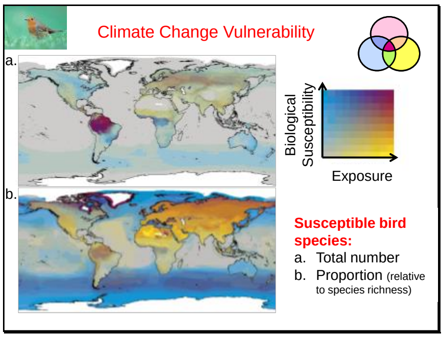
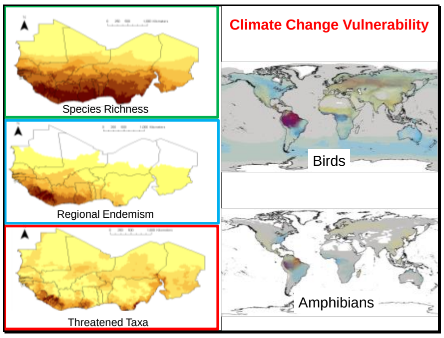
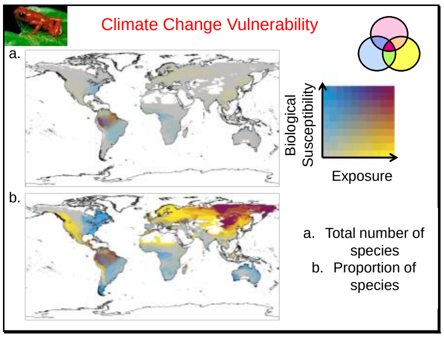
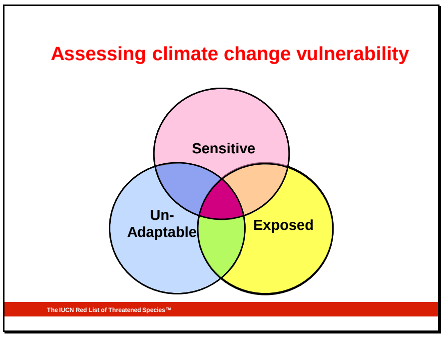
Biological Susceptibility
Exposure
The IUCN Red List of Threatened Species™

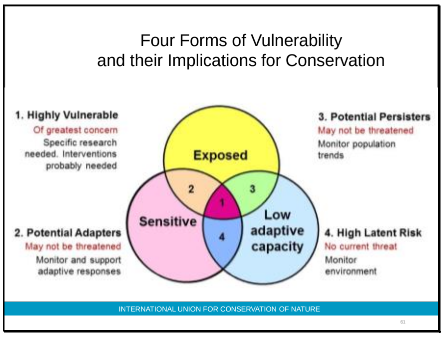

Climate Change Vulnerability
vs. Other Threats (IUCN Red List Status)
a.
b.
Threat
CC Vulnerability
Total numbers of species of:
a. birds
b. amphibians


Climate Change Vulnerability
a.
b.
Biological Susceptibility
Exposure
Susceptible bird species:
a. Total number
b. Proportion (relative to species richness)


Species Richness
Regional Endemism
Threatened Taxa
Climate Change Vulnerability
Birds
Amphibians


Climate Change Vulnerability
a.
b.
Biological Susceptibility
Exposure
a. Total number of species
b. Proportion of species


Assessing climate change vulnerability
Sensitive
Un-Adaptable
Exposed
The IUCN Red List of Threatened Species™


Four Forms of Vulnerability
and their Implications for Conservation
1. Highly Vulnerable
Of greatest concern
Specific research needed. Interventions probably needed
3. Potential Persisters
May not be threatened
Monitor population trends
Exposed
2
3
1
Sensitive
4
Low adaptive capacity
2. Potential Adapters
May not be threatened
Monitor and support adaptive responses
4. High Latent Risk
No current threat
Monitor environment
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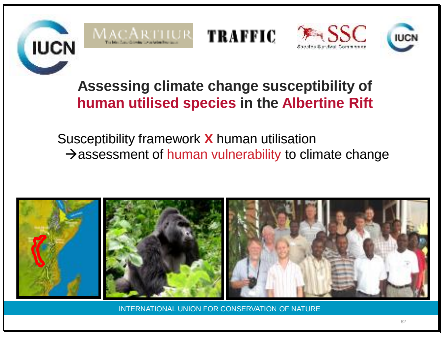
IUCN
MACARTHUR
TRAFFIC
SSC
IUCN
Assessing climate change susceptibility of
human utilised species in the Albertine Rift
Susceptibility framework X human utilisation
→assessment of human vulnerability to climate change
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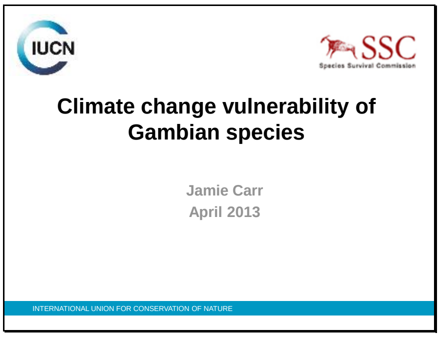
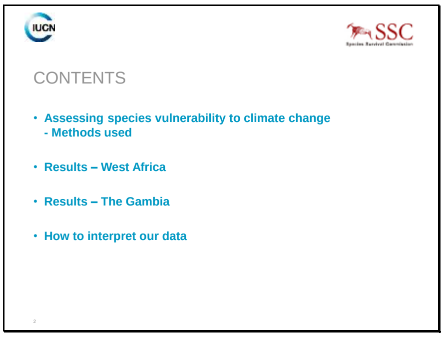
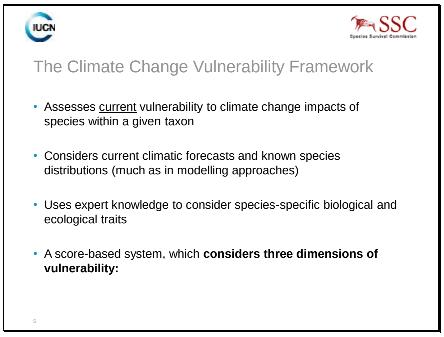
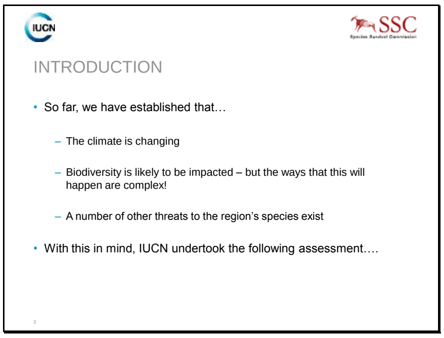
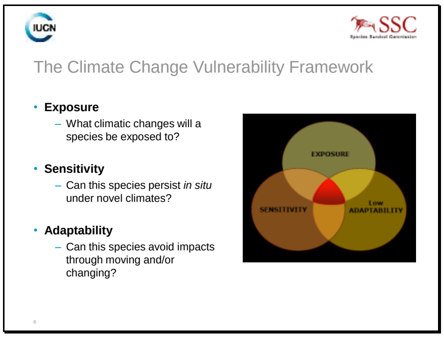
Chapter 3. Climate change vulnerability of Gambian species











EXPOSURE MODELLING

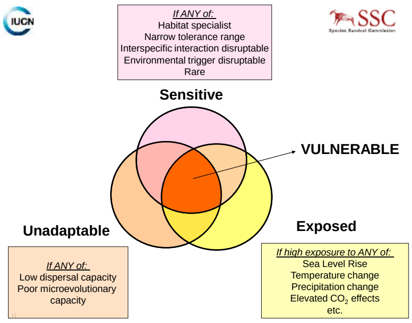
- Uses the latest climate forecasts
- Projected changes in monthly temperature and precipitation (means and variability) across species' refined ranges (adapted from IUCN distribution polygons)
- **Integrated within the framework with 'sensitivity' and 'adaptability' information**

- Recall that we have collected data for five groups: amphibians, birds, freshwater fish, mammals and reptiles.
- Reptile assessments are not yet complete, so will not be considered at this workshop.
- **Please see your handouts for a list of the Sensitivity and Low Adaptability traits used for the other four groups.**

SENSITIVITY

Considers biological, ecological and autecological traits:

- **Habitat** and **Microhabitat** dependencies
- Narrow **environmental tolerances**
- Dependence on a specific **environmental trigger** that is likely to be disrupted by climate change
- Dependence on **interspecific interactions** which are likely to be disrupted by climate change.
- **Rarity**

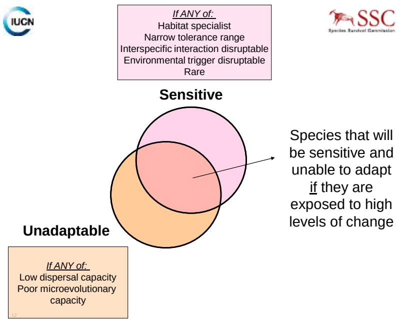


ADAPTABILITY

Again, considers biological and ecological traits:

- **Ability to disperse**
  - Intrinsically poor?
  - Prevention by barriers?

- **Capacity to 'evolve'**
  - Breeding capacity
  - Known genetic deficiencies



RESULTS - WEST AFRICA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	183			
Birds	1172			
Fish	517			
Mammals	405			

RESULTS - WEST AFRICA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	183	121	70	49
Birds	1172	584	610	318
Fish	517	374	432	327
Mammals	405	290	155	115

RESULTS - WEST AFRICA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	183	121		
Birds	1172	584		
Fish	517	374		
Mammals	405	290		

RESULTS – GAMBIA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	23			
Birds	523			
Fish	72			
Mammals	113			

RESULTS - WEST AFRICA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	183	121	70	
Birds	1172	584	610	
Fish	517	374	432	
Mammals	405	290	155	

RESULTS – GAMBIA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	23	18		
Birds	523	182		
Fish	72	40		
Mammals	113	54		

RESULTS – GAMBIA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	23	18	6	
Birds	523	182	295	
Fish	72	40	53	
Mammals	113	54	41	

SPECIES EXAMPLE 1 – *Afrixalus vittiger*

RESULTS – GAMBIA

Group	Total considered	Total Sensitive	Total Low Adaptability	Total Sensitive and Low Adaptability
Amphibians	23	18	6	5
Birds	523	182	295	101
Fish	72	40	53	29
Mammals	113	54	41	16

SPECIES EXAMPLE 1 – *Afrixalus vittiger*

- Larvae dependent on non-forest, aquatic habitats
- Breeds 'explosively' during rains

= Sensitive

- Very short intrinsic dispersal distance
- Very slow genetic turnover

= Poorly able to adapt

SPECIES EXAMPLE 1 – *Afrixalus vittiger*

SPECIES EXAMPLE 2 – *Nicator chloris*

SPECIES EXAMPLE 2 – *Nicator chloris*

SPECIES EXAMPLE 3 – *Amphilius platychir*

SPECIES EXAMPLE 2 – *Nicator chloris*

- Likely to only tolerate a narrow range of temperatures (calculated from distribution)

= Sensitive

- Small clutch size

= Poorly able to adapt

SPECIES EXAMPLE 3 – *Amphilius platychir*

- Dependent on rapids.
- Also dependent on shallow waters for egg laying

= Sensitive

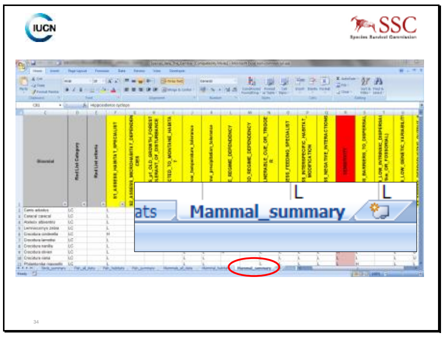
- Has a poor intrinsic ability to disperse

= Poorly able to adapt

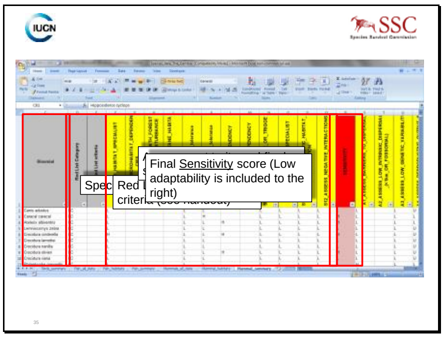
SPECIES EXAMPLE 3 – *Amphilius platychir*

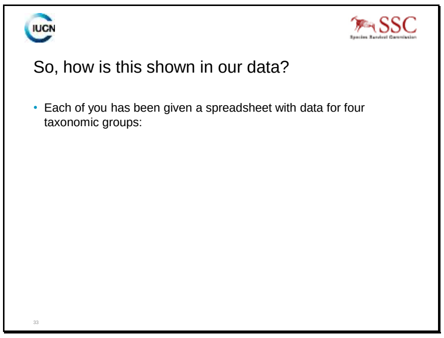
SPECIES EXAMPLE 4 – *Hipposideros cyclops*

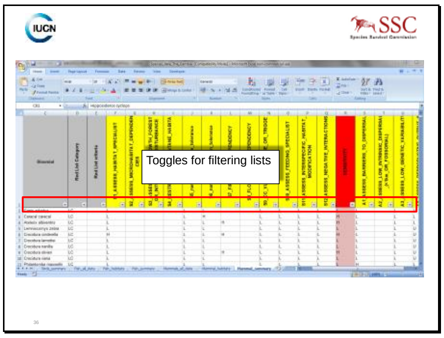

SSC
SPECIES EXAMPLE 4 – *Hipposideros cyclops*

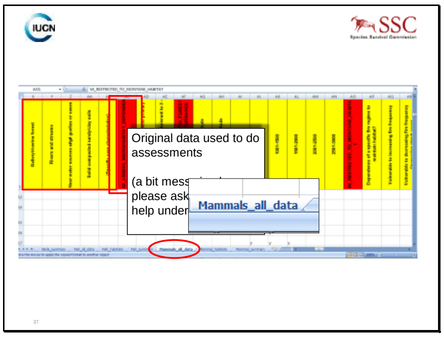

SSC
Mammal_summary


SSC
SPECIES EXAMPLE 4 – *Hipposideros cyclops*
• Dependent on tree hollows.
• Breeding is triggered by seasonal climatic changes
= Sensitive
• Dispersal is limited by a lack of available microhabitats (tree hollows)
= Poorly able to adapt

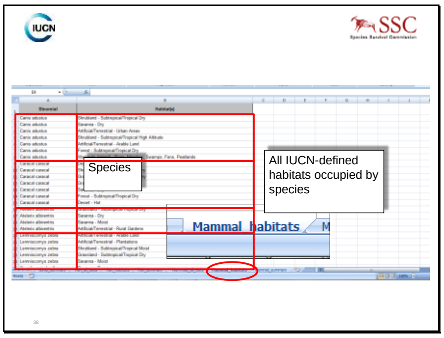

SSC
Final Sensitivity score (Low adaptability is included to the right)


SSC
So, how is this shown in our data?
• Each of you has been given a spreadsheet with data for four taxonomic groups:


SSC
Toggles for filtering lists



And now, a short quiz....



Practical Session:

- Please see the handout entitled 'Species and Climate Change Risk Assessment Form'.
- We would like you to choose one species from the spreadsheet you have been given, and complete **part 1** of the form (we will do part 2 tomorrow).
- Feel free to choose a species that you already have good knowledge about.
- We will ask for your feedback afterwards about the species you have chosen and why.

Chapter 3. Climate change adaptation strategies – a species conservation perspective

Climate change adaptation strategies - a species conservation perspective

Jamie Carr
April 2013

INTERNATIONAL UNION FOR CONSERVATION OF NATURE

CONTENTS

INTRODUCTION

- Understanding climate change impacts on species remains important – responding to these is the logical next step
- A number or adaptive actions or strategies are available to conservationists
- Many of these are identical to existing strategies for conserving biodiversity more generally
- Managers will need to use existing tools in novel and innovative ways
- Integrating climate change into existing conservation efforts is called 'Climate-smart Conservation'

1. CLIMATE SMART CONSERVATION

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INTRODUCTION

Each strategy has distinct strengths and weaknesses, and varies in appropriateness depending on the context

Choosing the right strategy and remaining 'climate-smart' can be a tricky process!

Overcoming these complexities is the main topic of today

CLIMATE-SMART CONSERVATION

"…The intentional and deliberative consideration of climate change in natural resource management, realized through forward looking goals and linking actions to key climate impacts and vulnerabilities."

- Stein *et al.* 2013

CLIMATE-SMART CONSERVATION

Has four overarching themes:

1. Act with intentionality
2. Manage for change, not just persistence
3. Reconsider goals, not just strategies
4. Integrate adaptation into existing work

Examples of climate-smart conservation – Great Lakes, USA

- Restoration of polluted waterways and riparian habitat
- Already experiencing heavier rainfalls, and periods of drought
- Fish shelves (flat areas for fish to spawn on) are being created at different levels to provide suitable habitat irrespective of water levels
- Waterside plant species are being carefully selected to ensure that they are able to tolerate increasing temperatures and fluctuating water levels

CLIMATE-SMART CONSERVATION

Key Characteristics:

1. Link actions to climate impacts
2. Embrace forward looking goals
3. Consider broader landscape context
4. Adopt strategies robust in an uncertain future
5. Employ agile and informed management

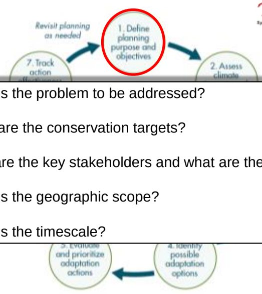
Examples of climate-smart conservation – Tortuguero, Costa Rica

- Sea level rise is resulting in loss of beaches, including important turtle nesting habitat
- 'Setback regulations' prevent development that can help reduce habitat loss
- Native vegetation planted in nesting areas is a non-intrusive means to allow balanced gender ratios of turtles – also stabilising dunes, benefiting wildlife and maintaining beach tourism

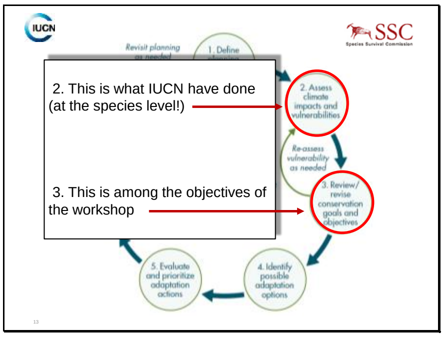
CLIMATE-SMART CONSERVATION

Key Characteristics:

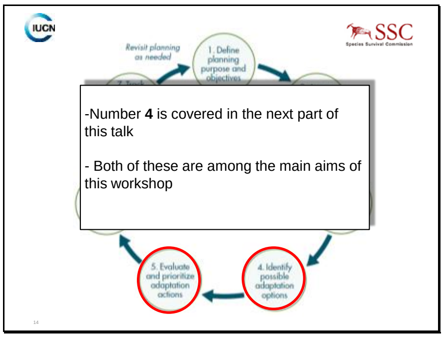
6. Minimize carbon footprint
7. Account for climate influence on project success
8. Safeguard people and wildlife
9. Avoid maladaptation

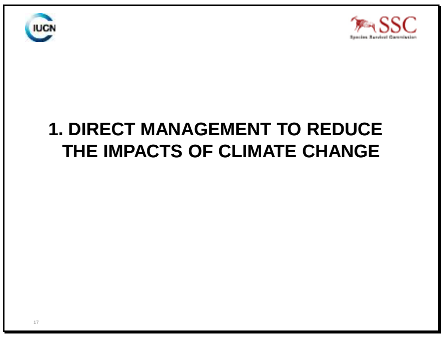


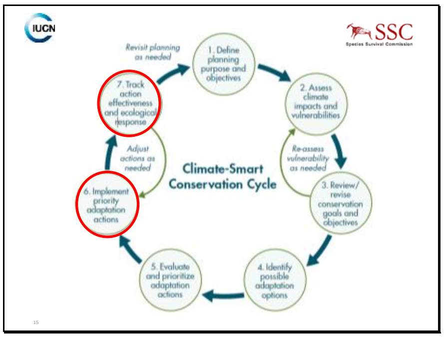
- What is the problem to be addressed?
- What are the conservation targets?
- Who are the key stakeholders and what are their needs?
- What is the geographic scope?
- What is the timescale?


IUCN
SSC
Species Survival Commission
2. This is what IUCN have done (at the species level!)
3. This is among the objectives of the workshop
2. Assess climate impacts and vulnerabilities
Re-assess vulnerability as needed
3. Review/ revise conservation goals and objectives
4. Identify possible adaptation options
5. Evaluate and prioritize adaptation actions


IUCN
SSC
Species Survival Commission
2. OPTIONS AVAILABLE TO CONSERVATION PRACTITIONERS
INTERNATIONAL UNION FOR CONSERVATION OF NATURE


IUCN
SSC
Species Survival Commission
Revisit planning as needed
1. Define planning purpose and objectives
-Number 4 is covered in the next part of this talk
- Both of these are among the main aims of this workshop
5. Evaluate and prioritize adaptation actions
4. Identify possible adaptation options


IUCN
SSC
Species Survival Commission
1. DIRECT MANAGEMENT TO REDUCE THE IMPACTS OF CLIMATE CHANGE


IUCN
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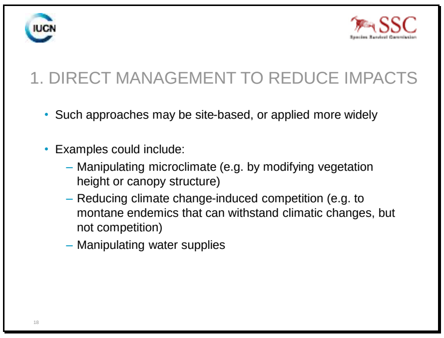
Revisit planning as needed
1. Define planning purpose and objectives
2. Assess climate impacts and vulnerabilities
Re-assess vulnerability as needed
3. Review/ revise conservation goals and objectives
4. Identify possible adaptation options
5. Evaluate and prioritize adaptation actions
6. Implement priority adaptation actions
Adjust actions as needed
7. Track action effectiveness and ecological response
Climate-Smart Conservation Cycle


IUCN
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1. DIRECT MANAGEMENT TO REDUCE IMPACTS
• Such approaches may be site-based, or applied more widely
• Examples could include:
– Manipulating microclimate (e.g. by modifying vegetation height or canopy structure)
– Reducing climate change-induced competition (e.g. to montane endemics that can withstand climatic changes, but not competition)
– Manipulating water supplies

1. DIRECT MANAGEMENT TO REDUCE IMPACTS

- Advantages:
  - Directly addresses the mechanism resulting in threat
- Disadvantages:
  - Requires good ecological knowledge of the nature of the threat
  - Could have undesired effects on non-target species (requires preliminary testing at a small scale)
  - Can be expensive – requires cost-benefit analysis
  - Not always feasible!

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  - Manipulating water supplies
  - Management or manipulation of fire regimes

2. PROMOTE / ASSIST WITH SPECIES DISPERSAL

2. PROMOTE / ASSIST SPECIES DISPERSAL

- Acknowledges that species distributions will need to change, but that they might not always be able to
- Typically, distributions are expected to shift pole-ward, upward or (more locally) between different microhabitats
- Could involve:

  1) Protecting corridors or stepping stones
  2) Increasing landscape permeability

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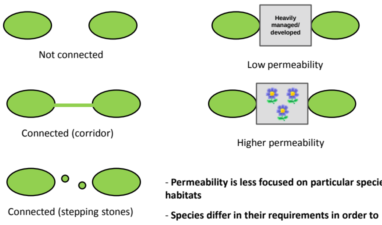
Connectivity vs. permeability



- Permeability is less focused on particular species or habitats

- Species differ in their requirements in order to move

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  2) Increasing landscape permeability
  3) Assisted colonisation

  !!! Assisted colonisation requires careful consideration and planning !!!

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3. INCREASE AVAILABLE HABITAT

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- Marbled White (*Melanargia galathea*)

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3. INCREASE AVAILABLE HABITAT

- i.e. Restoration of degraded habitat, or creation of new habitat.
- Can involve increasing the size of existing habitat patches, or creating new discrete areas.
- Should consider the 'direction' of climate change – i.e. Where will newly created habitat persist under new conditions?
- Clever design can help increase connectivity or permeability.

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3. INCREASE AVAILABLE HABITAT

- Typically, such approaches aim to increase representation (i.e. examples of as many habitat types as possible) or replication (i.e. multiple examples of the same habitat type).
- However, this approach assumes that the structure of communities/ ecosystems will remain the same under new conditions.
- Arguably, the greatest hindrance to this strategy is that it could compete with humans for available space.

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4. PROMOTE CONDITIONS FOR ECOSYSTEM FUNCTION

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4. PROMOTE CONDITIONS FOR ECOSYSTEM FUNCTION

- Ecosystem function = the ways that biological communities interact with the physical environment (including each other).
  - *e.g. Nutrient cycles; water cycles; species interactions.*
- In other words, this approach does not focus on species or assemblages, but on wider processes. However, it usually involves focus upon ecosystem components.
- This strategy can succeed with reduced species diversity, or even with non-native species.
  - *e.g. New pollinator species, new competitors, new nutrient absorbing tree species.*

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4. PROMOTE CONDITIONS FOR ECOSYSTEM FUNCTION

- Disadvantages with this strategy include:
  - Ecosystem function is not always responsive to intervention
  - Non species-focused approach could result in loss of diversity.
  - If practitioners choose to use non-native species to fulfil ecosystem functions, then careful consideration of any side-effects is required. This is usually complex, and can be expensive

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5. REDUCE PRESSURES NOT LINKED TO CLIMATE CHANGE

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- Allows species maximum flexibility and opportunity to evolve responses to climate change

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5. REDUCE PRESSURES NOT LINKED TO CLIMATE CHANGE

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Mountain Pygmy Possum (*Burramys parvus*)

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5. REDUCE PRESSURES NOT LINKED TO CLIMATE CHANGE

- Allows species maximum flexibility and opportunity to evolve responses to climate change
- A true 'no-regrets' strategy.
- However, alone this may not be enough!

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6. ESTABLISH CAPTIVE POPULATIONS OF SPECIES THAT WOULD OTHERWISE GO EXTINCT

- Should be seen as a last resort!
- This strategy can 'buy time' until a solution is determined.
- However – this does not resolve the issue

What to do with captive species if no suitable habitat remains?

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6. ESTABLISH CAPTIVE POPULATIONS OF SPECIES THAT WOULD OTHERWISE GO EXTINCT

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7. EVALUATE AND ENHANCE MONITORING PROGRAMMES

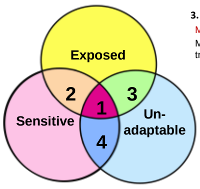
7. EVALUATE AND ENHANCE MONITORING PROGRAMMES

- Another 'no-regrets' strategy – but not remedial!
- Includes better integrating and coordinating existing schemes.
- Important to validate assessments, fill knowledge gaps and **review implemented actions.**
- **Particularly applicable to species highlighted under two of the three dimensions of the assessment framework:**

7. EVALUATE AND ENHANCE MONITORING PROGRAMMES

1. Highly Vulnerable
Of greatest concern
Specific research needed. Interventions probably needed

3. Potential Persisters
May not be threatened
Monitor population trends



2. Potential Adapters
May not be threatened
Monitor and support adaptive responses

4. High Latent Risk
No current threat
Monitor environment

8. REVIEW AND MODIFY LAWS, REGULATIONS AND POLICIES ON WILDLIFE AND NATURAL RESOURCE MANAGEMENT

8. – REVIEW AND MODIFY LAWS, REGULATIONS AND POLICIES ON WILDLIFE AND NATURAL RESOURCE MANAGEMENT

- Most laws, regulations and policies were developed before climate change became a significant threat
  - They aim to conserve 'static biodiversity'
- This strategy typically relates to strategy 5 (reduce non cc-related threats)
- Also reframes our concept of 'alien' species

- **And now, we would like to hear from you....**
  - Are you aware of any (biodiversity-related) climate change adaptation strategies that are, or will be, implemented in this country?
  - Have these been successful?
  - What difficulties have been faced?
  - Can you think of ways that existing conservation strategies could be made more 'climate-smart'?

- **Practical session 3 – Identifying appropriate adaptation strategies for priority species identified in practical session 2**
  - Using the information you have learned so far today, try to complete part 2 of the risk assessment forms you completed yesterday