

Winners, losers and conservation priorities



Identifying which species require most assistance to survive climate change

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Long-winged conehead

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1800-1960

Thomas *et al.*
(2001) *Nature*



Long-winged conehead

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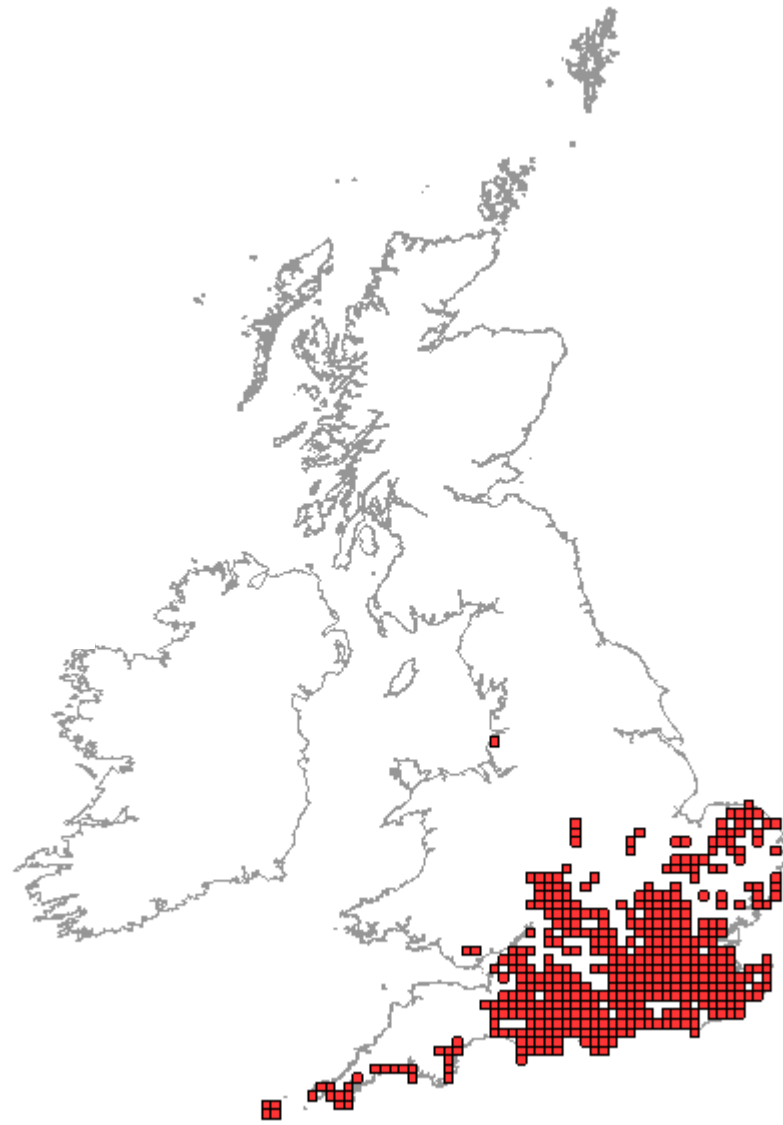
1800-1990

Thomas *et al.*
(2001) *Nature*



Long-winged conehead

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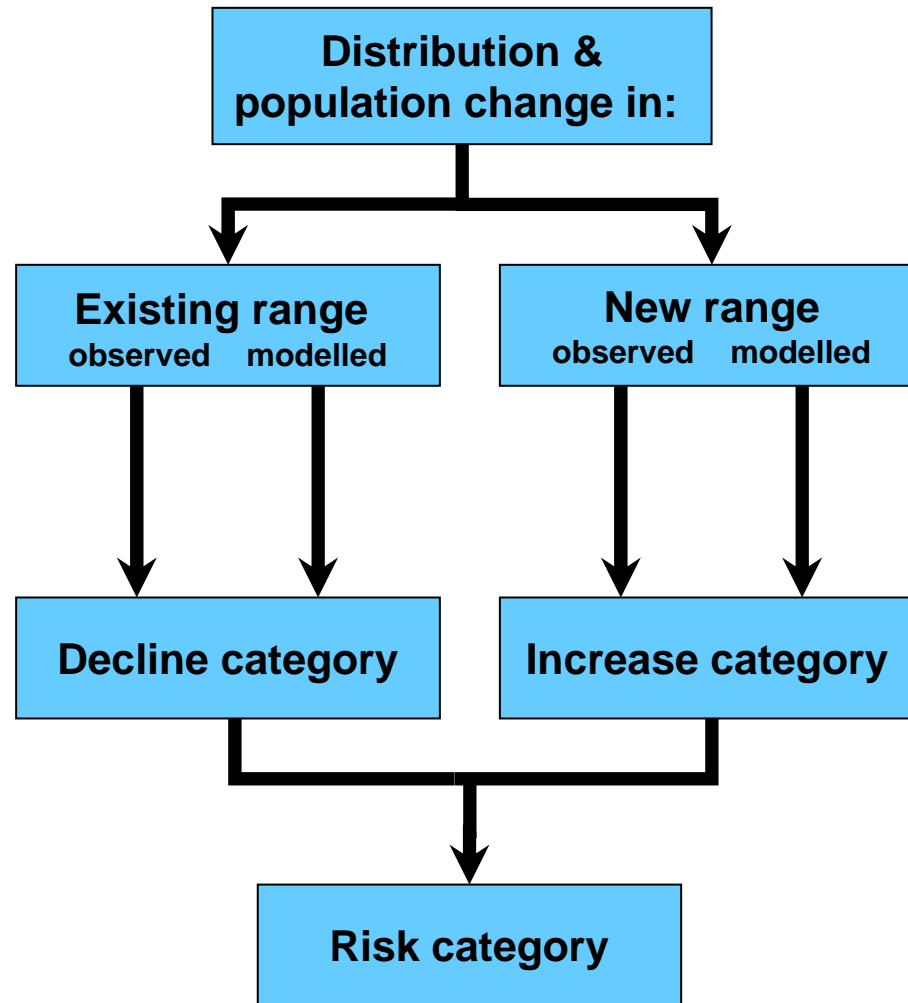
1800-2010

Thomas *et al.*
(2001) *Nature*

Managing change, rather than preserving the past

- Vegetation types?
- Community composition?
- Goods and services?

- Species – building blocks of new communities and community-based goods and services



Thomas, C.D., J.K.Hill, B.J.Anderson, S.Bailey, C.M.Beale, R.B.Bradbury, C.R.Bulman, H.Q.P.Crick, F.Eigenbrod, H.M.Griffiths, W.E.Kunin, T.H.Oliver, C.A.Walmsley, K.Watts, N.T.Worsfold & T.Yardley (2010) A framework for assessing threats and benefits to species responding to climate change. *Methods in Ecology & Evolution* doi: 10.1111/j.2041-210X.2010.00065.x

OBSERVED WITHIN RECENT DISTRIBUTION

STAGE I. OBSERVED CHANGES IN RECENT/HISTORICAL RANGE	CLIMATE-RELATED IMPACT			CONFIDENCE IN ASSESSMENT					
	if	score		if					
I.A Decline in distribution and/or abundance per decade. Decadal % change, relative to initial status at the beginning of the most recent period. Rate of decline in recent range	>7.5%	3	<i>Proceed to I.B</i>	Good - Population monitoring at multiple locations; repeat surveys conducted for any variation in recording effort Moderate - Population monitoring at multiple locations; repeat surveys conducted for any variation in recording effort Poor - Repeat surveys with variable effort; qualitative trend data	3	✓			
	4-7.5%	2	<i>Proceed to I.Dii</i>			x			
	<1%	0				x			
I.B Linkage between decline and climate? One or more of: <ul style="list-style-type: none"> - latitudinal, elevational trends - trends across environmental gradients (large scale and/or small scale) - in line with climate-projected changes - population dynamics and trends correlated with climatic variation Link to climate	Yes		<i>Proceed to I.Ci</i>	Good – if Yes, strong statistical linkage for one of the factors in I.B; or moderate linkage for two or more. – if No, good evidence that any observed decline in distribution or abundance <i>is</i> not linked to climate Moderate – if Yes, moderate linkage for one of the factors in I.B; or weak linkage for two or more. Poor – if No, moderate evidence that any observed decline in distribution or abundance <i>is not</i> linked to climate	3	✓			
	No		<i>Proceed to I.Dii</i>			x			
I.C Exacerbating factors: existing status and other exacerbating <i>observed</i> trends already known to be taking place Exacerbating factors	I.Ci Extent <20,000 km ² , Area occupied <2,000 km ² , Population size <10,000, OR Number of colonies ≤10	Yes,+1	<i>Proceed to I.Cii</i>	Good Poor	3	✓			
		No, 0					x		
	I.Cii Expansions of species leading to competitive interactions (e.g. declining host, expanding enemy), Habitat contracting, Other species-specific losses	Yes,+1	<i>Proceed to I.Di</i>	Good Poor	3	✓			
		No, 0					x		
I.D Observed impact summary: Impact summary	IMPACT SUMMARY			OVERALL CONFIDENCE					
		Score (a)	CAT (α)	if	Score (b)	CAT (β)			
	I.Di Sum of I.A, I.Ci and I.Cii scores (provided B = Yes)	≥ 3 = 3	VERY HIGH	For spp with ≥1% decline, I.A=✓ & I.B=✓ (& relevant I.C=✓ when threat affected by I.C) ----- I.A = ✓ only for spp with <1% decline	3	GOOD			
		2	HIGH				For spp with ≥1% decline, I.A=✓ OR I.B=✓ (& relevant I.C=✓ when threat affected by I.C) ----- I.A=✓ & I.B=✓ (& relevant I.C=x when threat category affected by I.C)	2	MEDIUM
		1	MODERATE						
I.Dii A score = 0 OR B = No	0	LOW (from climate change)	I.A=x & I.B=x ----- I.A=✓ OR I.B=✓ (& relevant I.C= x when threat affected by I.C)	1	POOR				
			I.A = x only for spp with <1% decline						
Overall confidence									

PROJECTED WITHIN RECENT DISTRIBUTION

STAGE II. PROJECTED CLIMATE-RELATED CHANGES WITHIN RECENT/HISTORICAL RANGE	CLIMATE-RELATED THREAT			CONFIDENCE IN ASSESSMENT		
	if	score		if		
II.A Decline in distribution and/or abundance, per decade, based on: - bioclimate, dynamic population models, and/or habitat/ecosystem models, as appropriate - use of climate change scenarios, new extremes, and/or other climate change scenarios - assessment of position of species on environmental gradient, and rate of change (e.g. from elevation range, lapse rate, and warming rate) Decadal % change, relative to initial status at the beginning of the monitoring period.	>7.5%	3	<i>Proceed to II.Ci</i>	Predicts already-observed changes ; consistent for alternative models/scenarios	✓	
	4-7.5%	2				
	1-4%	1	<i>Proceed to II.Dii</i>	Fits existing patterns well (in testing data); qualitatively consistent projections for alternative model/scenarios Fits existing patterns poorly, or no separate testing data; qualitatively inconsistent projections for alternative models/scenarios	~ x	
II.B Link to climate assumed: Not applicable, since models incorporate climate change scenarios and/or climate-driven indirect drivers, and assume linkage						
II.C Exacerbating factors: features not already included in models under A. Consider whether the model is based on an initially small population size, or a small number of colonies (as well as other factors)	II.Ci Extent <20,000 km ² , Area occupied <2,000 km ² , Population size <10,000, OR Number of colonies ≤10	Yes, +1	<i>Proceed to II.Cii</i>	Good Poor	✓ x	
		No, 0				
II.Cii Strong negative interactions (e.g. declining host, expanding enemy), Specific habitat-associated threats, Other species-specific factors		Yes, +1	<i>Proceed to II.Di</i>	Poor	✓ x	
		No, 0				
II.D Projected threat summary: Impact summary	THREAT			OVERALL CONFIDENCE		
		Score (c)	CAT (γ)	if	Score (d)	CAT (δ)
	II.Di Sum of II.A, II.Ci and II.Cii scores	≥ 3 = 3	VERY HIGH	II.A=✓ (& relevant II.C=✓ when threat category affected by II.C)	3	GOOD
		2	HIGH	II.A=? (& relevant II.C=? when threat category affected by II.C)	2	MEDIUM
		1	MODERATE			
II.Dii II.A score = 0	0	LOW (from climate change)	II.A=x ----- II.A=~ (& relevant II.C=x when threat category affected by II.C)	1	POOR	

Projected decline in recent range

Confidence in decline

Link to climate assumed

Exacerbating factors, not included in model

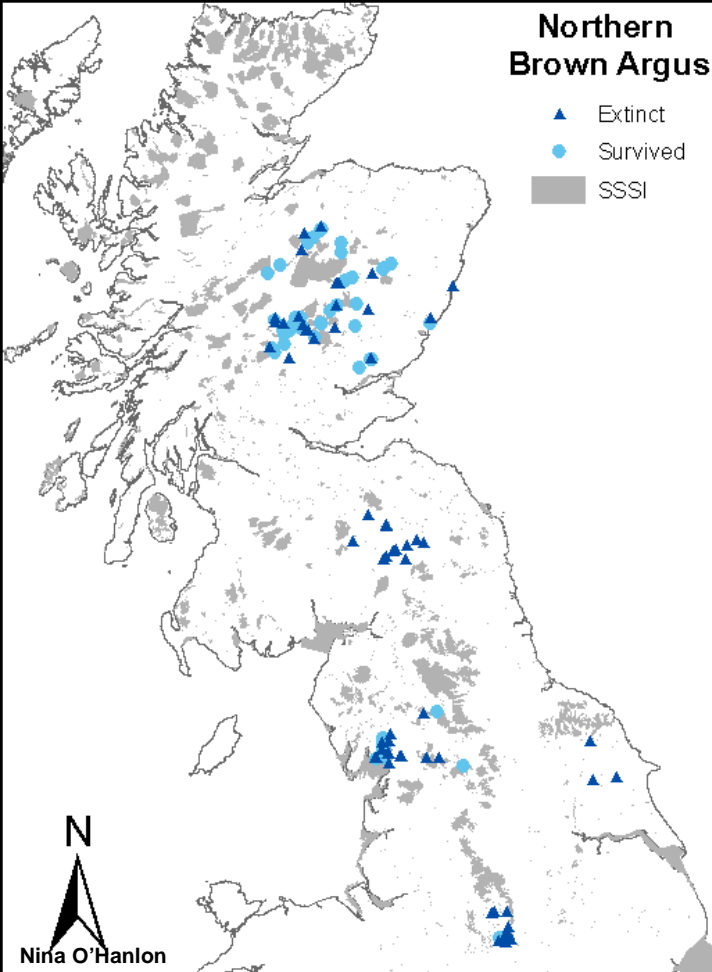
Confidence in these

Impact summary

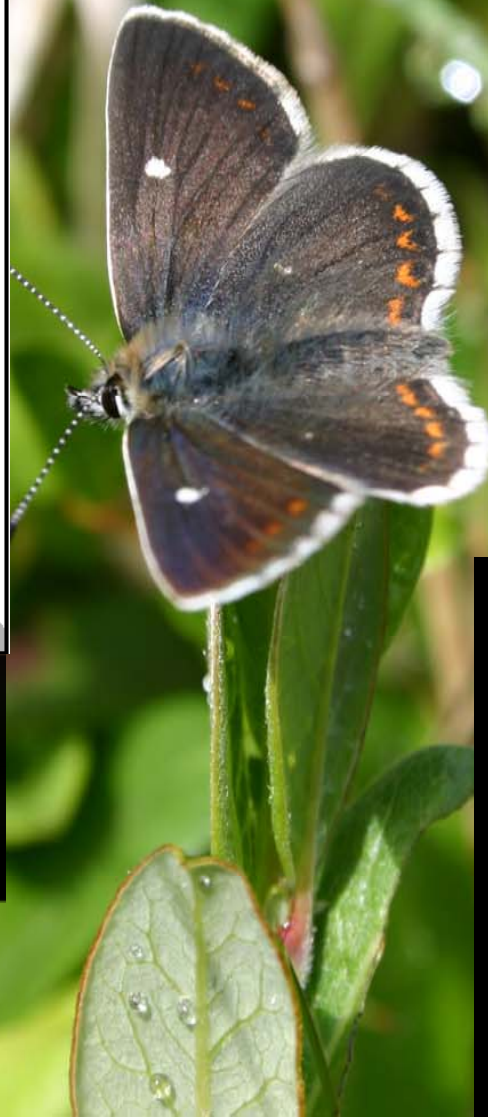
Overall confidence

Northern Brown Argus

- ▲ Extinct
- Survived
- SSSI



Franco et al. (2006)
Global Change Biology



Northern Brown Argus
extinctions are more
likely further south

- 1 km grid squares visited
- past records 1970-1999
- Re-visited 2004/05

Northern Brown Argus

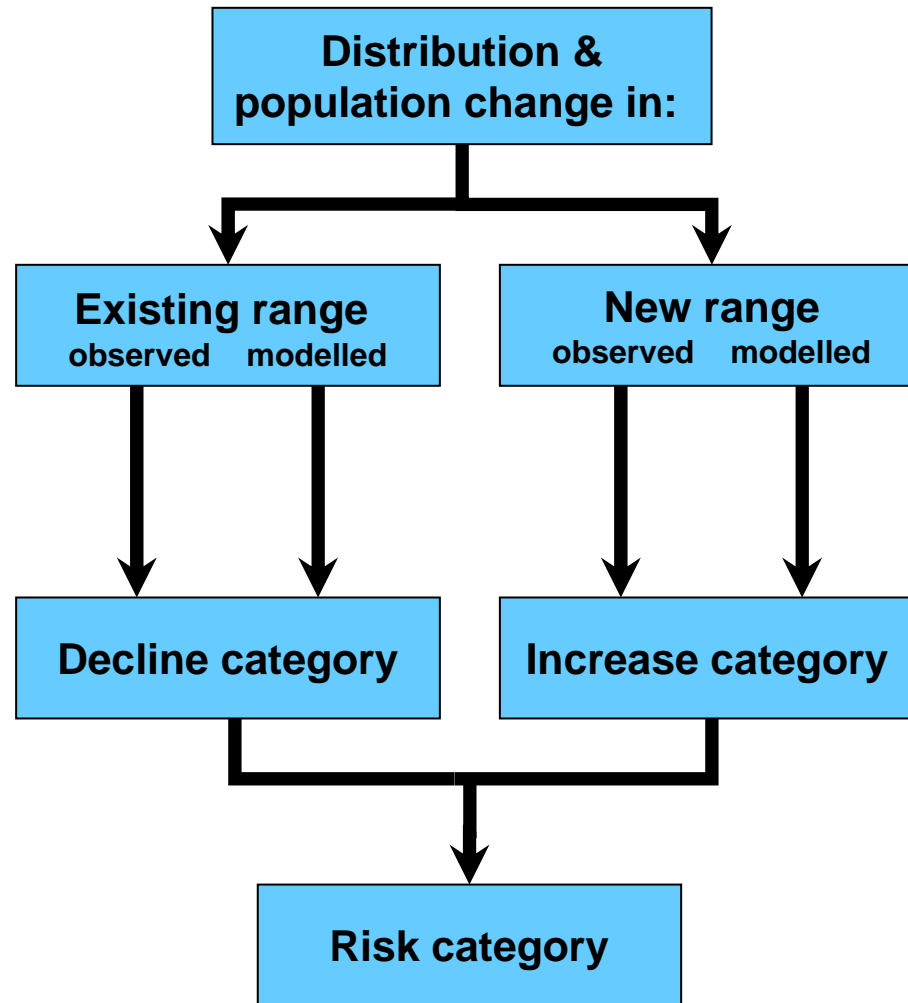
- **Observed decline:** very high threat (3), with good confidence (3)
- **Projected decline:** very high threat (3), with medium confidence (2, no suitable 2080 climate projected in UK for med-high climate scenarios; little for 2080-low; Settele *et al.* 2008)

	Overall decline	Decline	Confidence	Overall threat		Confidence	
		score	score	score	Category	score	category
I	OBSERVED CHANGES IN RECENT HISTORICAL RANGE	a	b	$\frac{a \times b + c \times d}{b + d}$	V. High High Moderate Low	$\frac{b + d - a - c }{2}$	Good Medium Poor
II	PROJECTED CHANGES WITHIN RECENT HISTORICAL RANGE	c	d				

	Overall decline	Decline	Confidence	Overall threat		Confidence	
		score	score	score	Category	score	category
I	OBSERVED CHANGES IN RECENT HISTORICAL RANGE	a	b	$\frac{a \times b + c \times d}{b + d}$	V. High High Moderate Low	$\frac{b + d - a - c }{2}$	Good Medium Poor
II	PROJECTED CHANGES WITHIN RECENT HISTORICAL RANGE	c	d				

	Northern Brown Argus	Decline	Confidence	Overall threat		Confidence	
		score	score	score	Category	score	category
I	OBSERVED CHANGES IN RECENT HISTORICAL RANGE	3	3	3	V. High	2	Medium
II	PROJECTED CHANGES WITHIN RECENT HISTORICAL RANGE	3	2				

threat rounded up, confidence rounded down



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photo: Aldina Franco, Tiago Silva

fit SPECIES	Climate-related decline in existing range				
	Very High	High	Moderate	Low	
Low	Northern Brown Argus	High risk	Medium risk	Limited impact	Maximise benefits
Moderate	High risk	Medium risk	Risks & benefits	Medium benefit	
High	Medium risk	Risks & benefits	Medium benefit	High benefit	
Very High	Risks & benefits	Medium benefit	High benefit	High benefit	
Thomas <i>et al.</i> , MEE 2010	Ameliorate declines				

Expansion

Ameliorate declines

Maximise benefits



photo: Aldina Franco, Tiago Silva

fit SPECIES	Climate-related decline in existing range				
	Very High	High	Moderate	Low	
Low	Northern Brown Argus	High risk	Medium risk	Limited impact	Maximise benefits
Moderate	High risk	Medium risk			
High	Medium risk	Risks & benefits			
Very High	Risks & benefits	Medium benefits			
Thomas <i>et al.</i> , MEE 2010	Ameliorate				

Expansion

Ameliorate other pressures

Are adaptation measures available (e.g., increase *Helianthemum* at higher altitude)?

Threat & Benefit Framework for SPECIES		Climate-related decline in existing range				
Butterflies		Very High	High	Moderate	Low	
Expansion	Low	2 species Mt. ringlet N.B.A.	1 species Scotch Argus	3 species PBF/SPBF L.Heath	27 species	Maximise benefits
	Moderate				10 species	
	High				12 species	
	Very High				2 species Marb.Wh Br.Argus	
Thomas <i>et al.</i> , <i>MEE</i> 2010		Ameliorate declines				

Threat & Benefit Framework for SPECIES		Climate-related decline in existing range			
Butterflies		Very High	High	Moderate	Low
Expansion	Low	Mainly northern/mountain species; ameliorate other pressures			Widespread+ southerly spp with some opportunities to speed up
	Moderate				
	High	Few in Britain; many at a European scale			Southerly expanding; no need to help
	Very High				
Thomas <i>et al.</i> , MEE 2010		Ameliorate declines			

PBF
 SPBF
 L. Heath
 N. D. A.
 Argus

10 species
 12 species
 11 species
 Br Argus

Maximise benefits



Climate-related decline in existing range

Very High High Moderate Low

Mountain ringlet Ring ouzel Norwegian mugwort **Chalk-hill blue**

Low

Moderate

High

Very High

Barbastelle bat

Stag beetle

Brown argus

Maximise benefits

Monitor / manage existing habitats: lack of much host plant further north

Expansion

Ameliorate declines

Thomas *et al.*,
MEE 2010



Climate-related decline in existing range

Very High

High

Moderate

Low

Low

Mountain ringlet

Ring ouzel

Norwegian mugwort

Chalk-hill blue

Moderate

Barbastelle bat

High

Stag beetle

Very High

Brown argus

Maximise benefits

Expansion

Can benefit be increased?

Consider roost availability?

Thomas *et al.*,
MEE 2010



Simon A. Eugster

		Climate-related decline in existing range				
		Very High	High	Moderate	Low	
Expans		Mountain	Ring	Norwegian mugwort	Chalk-hill blue	Maximise benefits
					Barbastelle bat	
					Stag beetle	
	Very High				Brown argus	
Thomas <i>et al.</i> , MEE 2010		Ameliorate declines				

Consider habitat needs within overall strategy for species associated with decaying wood

- Classification → conservation strategies
- Species-specific needs
- Works in Britain
- European perspective is needed

Need to start going through the European species

- Shopping list of **globally-threatened** European species
- Then develop conservation adaptation strategies
- Avoid “species-lite” approaches that may principally benefit species that are not threatened



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