Evidence of Change - Findings of *New Atlas*, CS2000 & other studies

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Evidence of Change - Sources

- *New Atlas of the British and Irish Flora* (2002)
- Countryside Survey 2000
- County Floras
- *Junk food for Plants* Plantlife report (2002)

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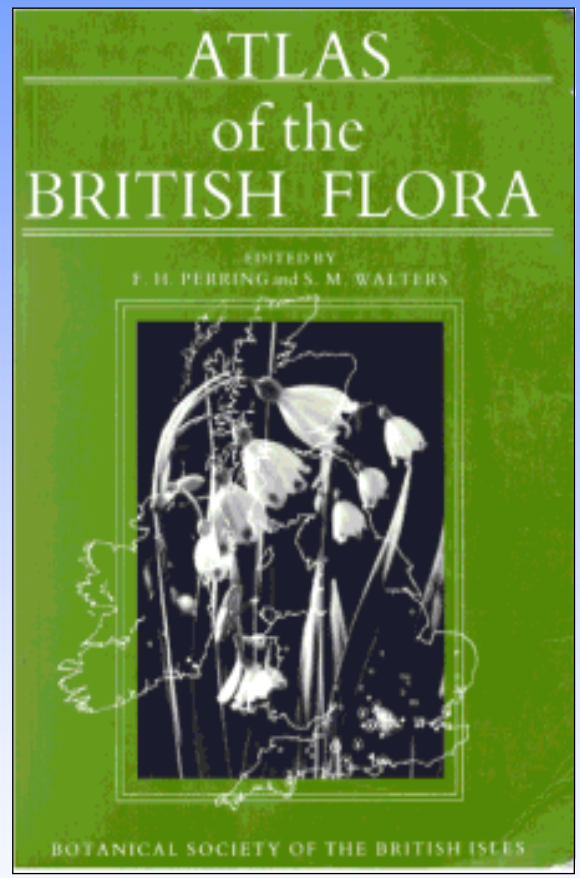
Evidence from Atlases

- 1962 - first national *Atlas* of plant distribution
- Mapped 1600 taxa on 10-km square basis
- Records gathered from 1930-1969



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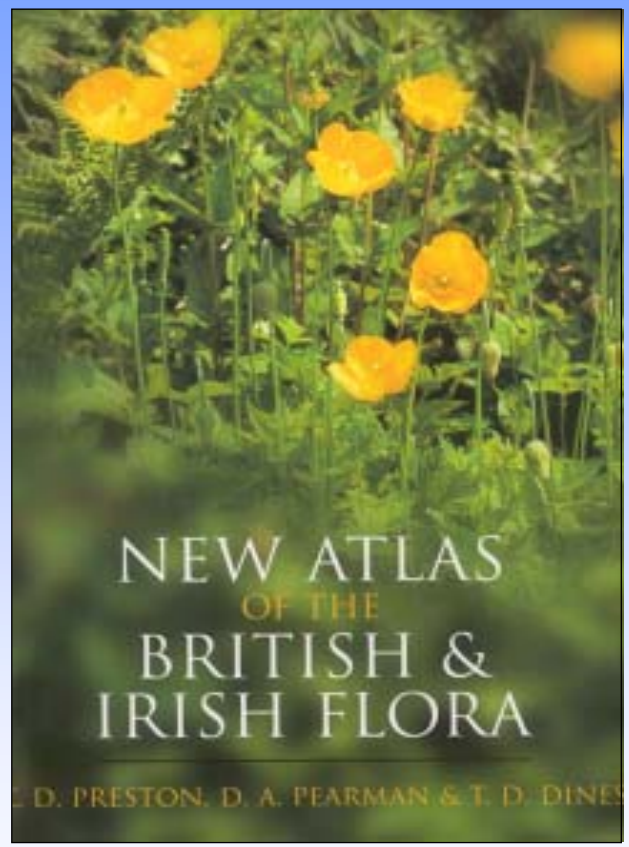
Evidence from Atlases

- 2002 - New Atlas of British and Irish Flora
- Mapped 2400 taxa on 10-km square basis
- Records gathered from 1987-1999



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Evidence from Atlases

Comparison of data provides a powerful tool for the analysis of change in the UK flora

1524 taxa were mapped in both Atlases

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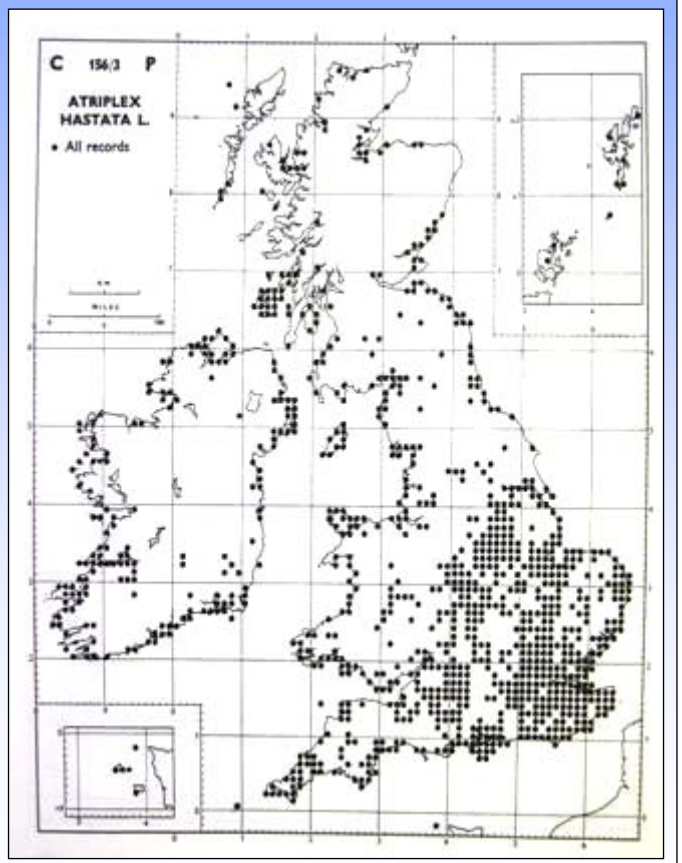
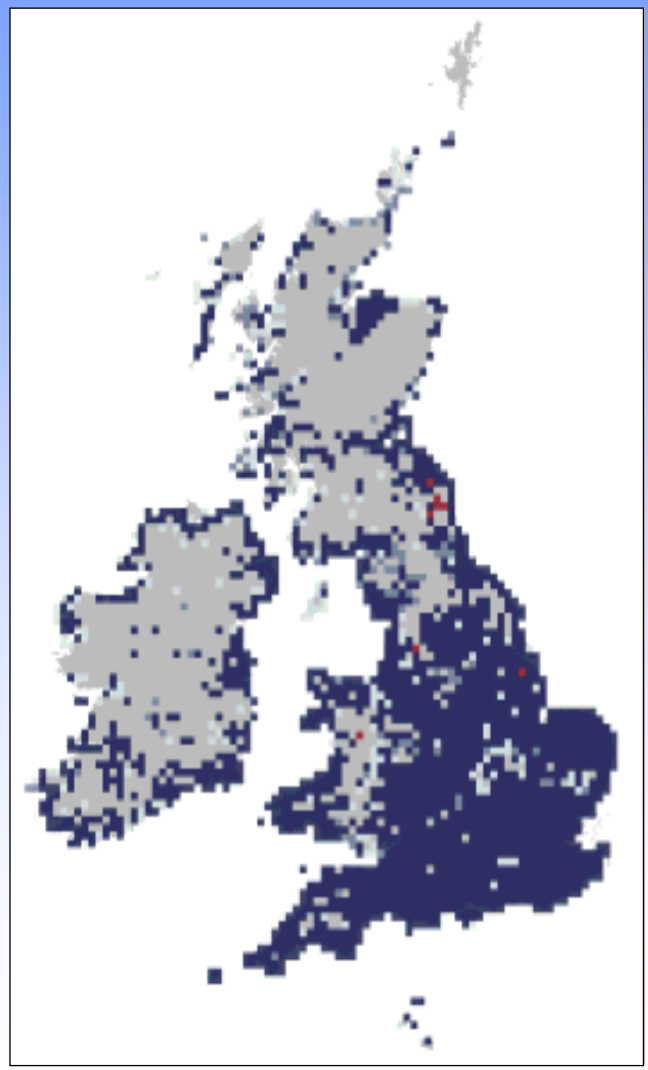
Evidence from Atlases





Direct comparison of maps

e.g. *Atriplex prostrata* (Spear-leaved Orache)

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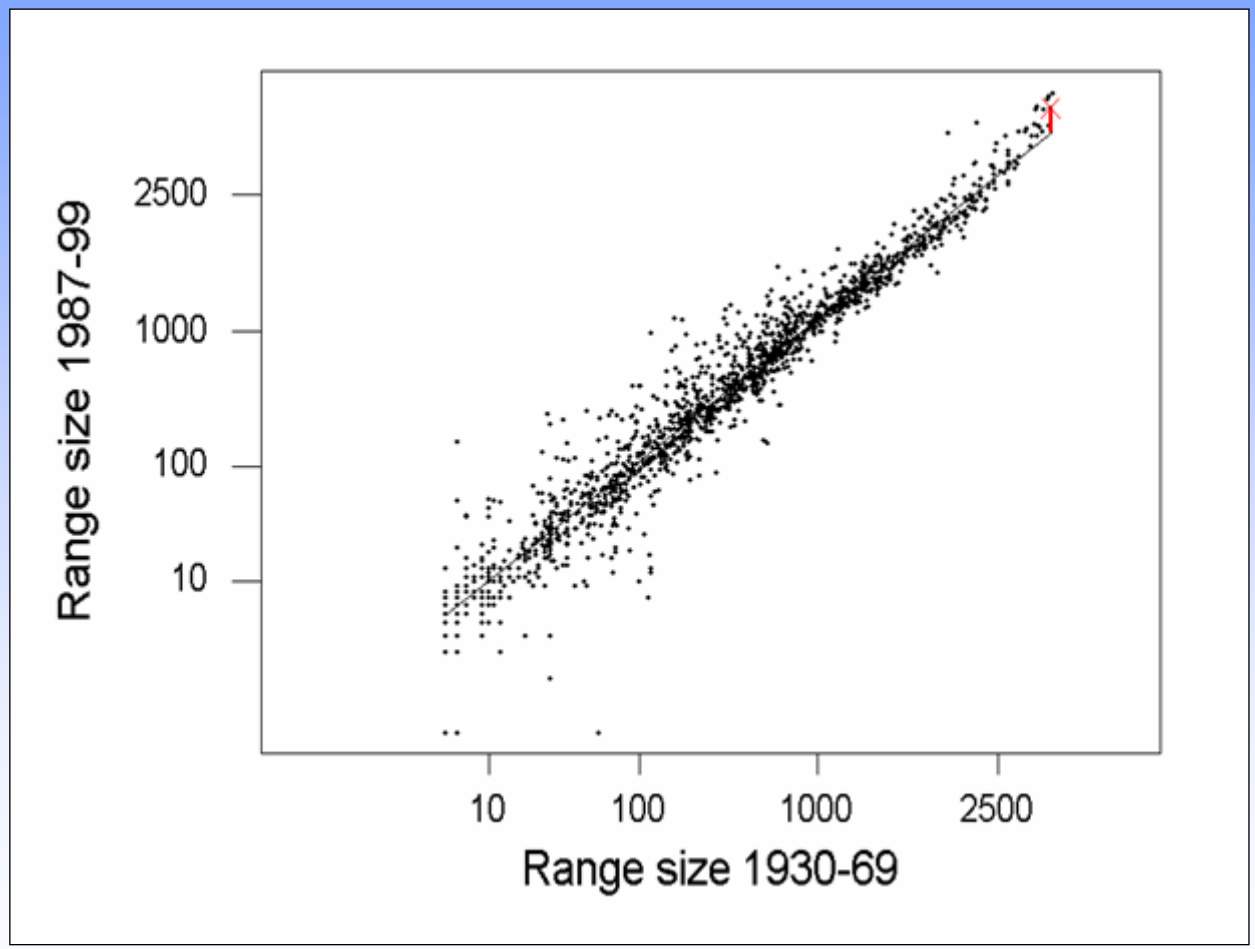
Evidence from Atlases



Change Index

Provides measure of change in relation to all other taxa

(see Telfer *et al., Biol. Conservation* 107: 99-109, 2002).

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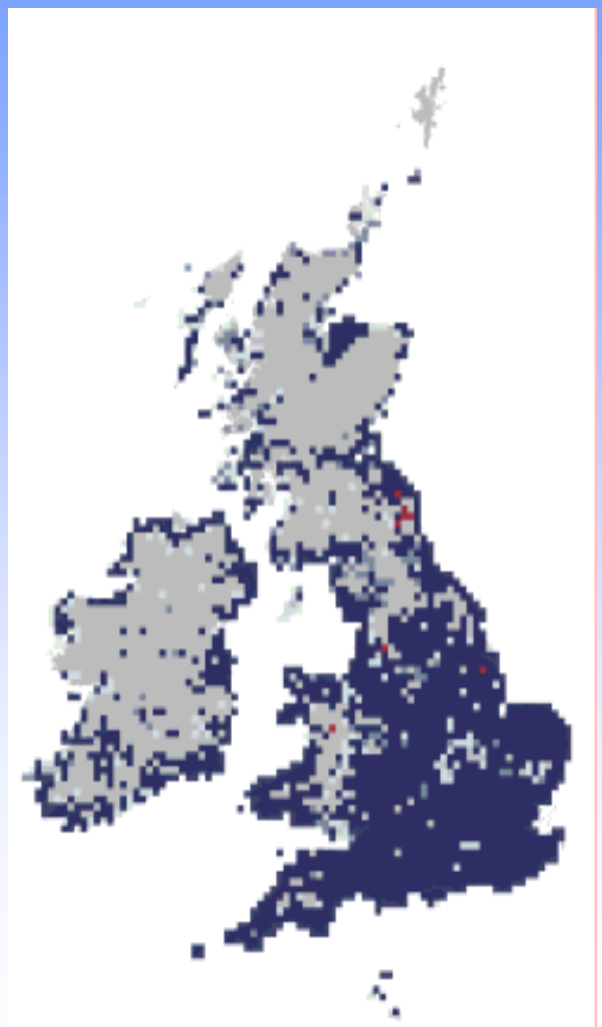
Evidence from Atlases



Atriplex prostrata Change index +1.10

Aira caryophyllea

Change index -0.52

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Evidence from Atlases

Change index becomes very powerful when species from similar habitats or with similar ecological requirements are grouped together.

All native species have been assigned Ellenburg Indicator Values (Hill *et. al*, EcoFact Volume 2. 1999).

The N value is a general indicator of soil nutrient requirements…

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Evidence from Atlases

Species such as *Aira caryophyllea* (Silver Hair-grass) grow in infertile habitats and have a low Ellenberg nutrient value

N = 2

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Evidence from Atlases

Species such as *Atriplex prostrata* (Spear-leaved Orache) grow in nutrient-rich habitats and have a high Ellenberg nutrient value

N = 7

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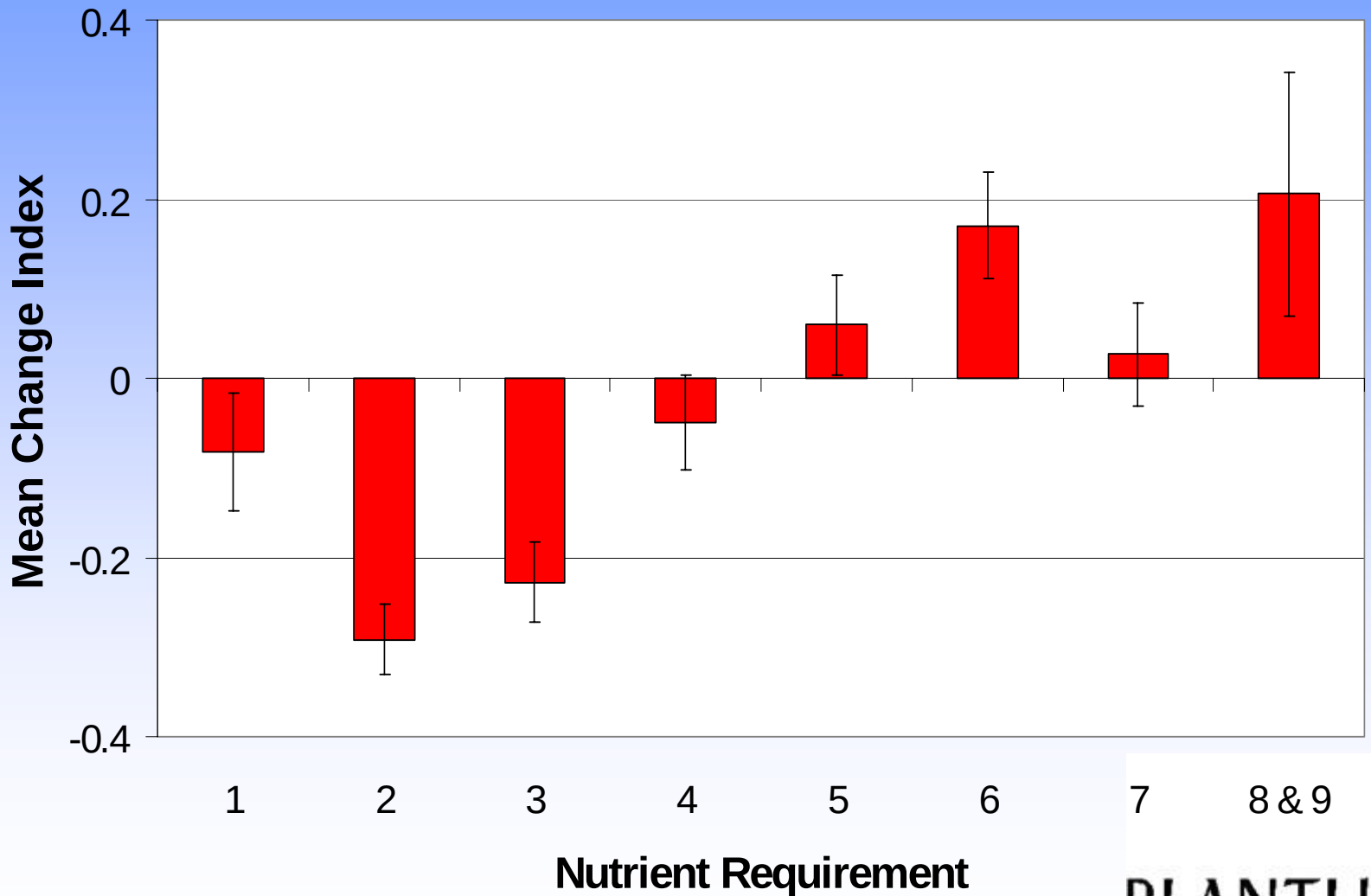
Evidence from Atlases



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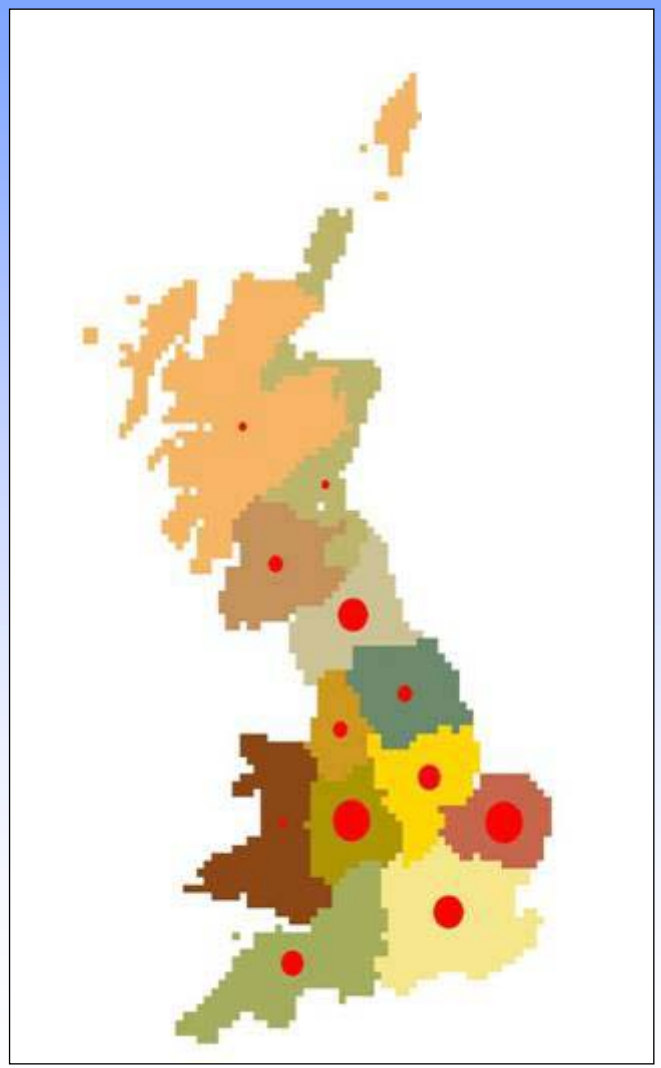
Evidence from Atlases



The decline of species of nutrient-poor conditions has been greatest in England

The larger the red circle, the more pronounced the decline

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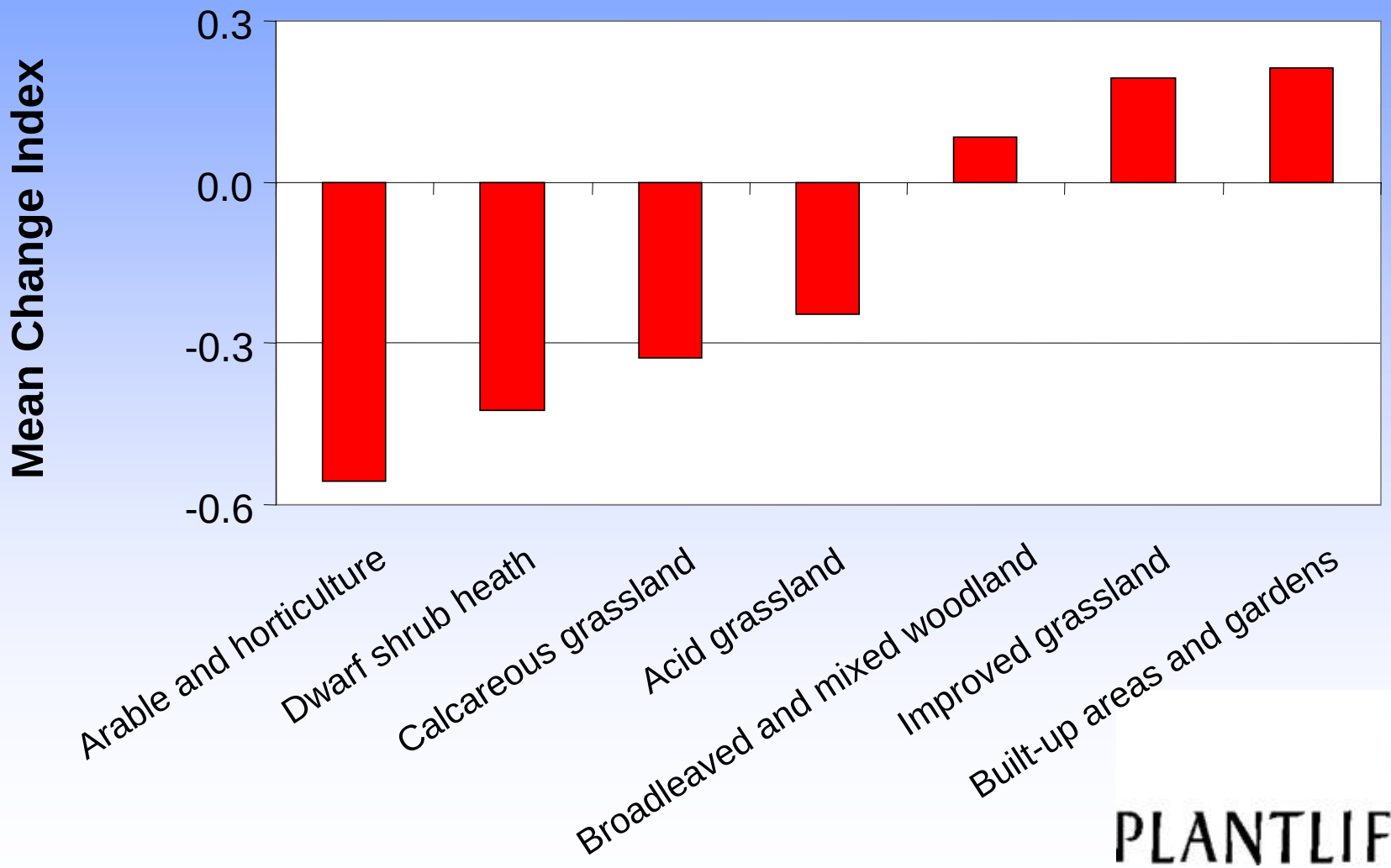
Evidence from Atlases



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Evidence from Stoneworts

Stoneworts (Charophyta) are a group of large, easily identified freshwater algae.

They are very sensitive to changes in water quality, especially eutrophication.

12 are UK BAP species and have been the subject of detailed study by Nick Stewart (BSBI Referee).

All sites for all species have been visited and water samples collected for analysis.

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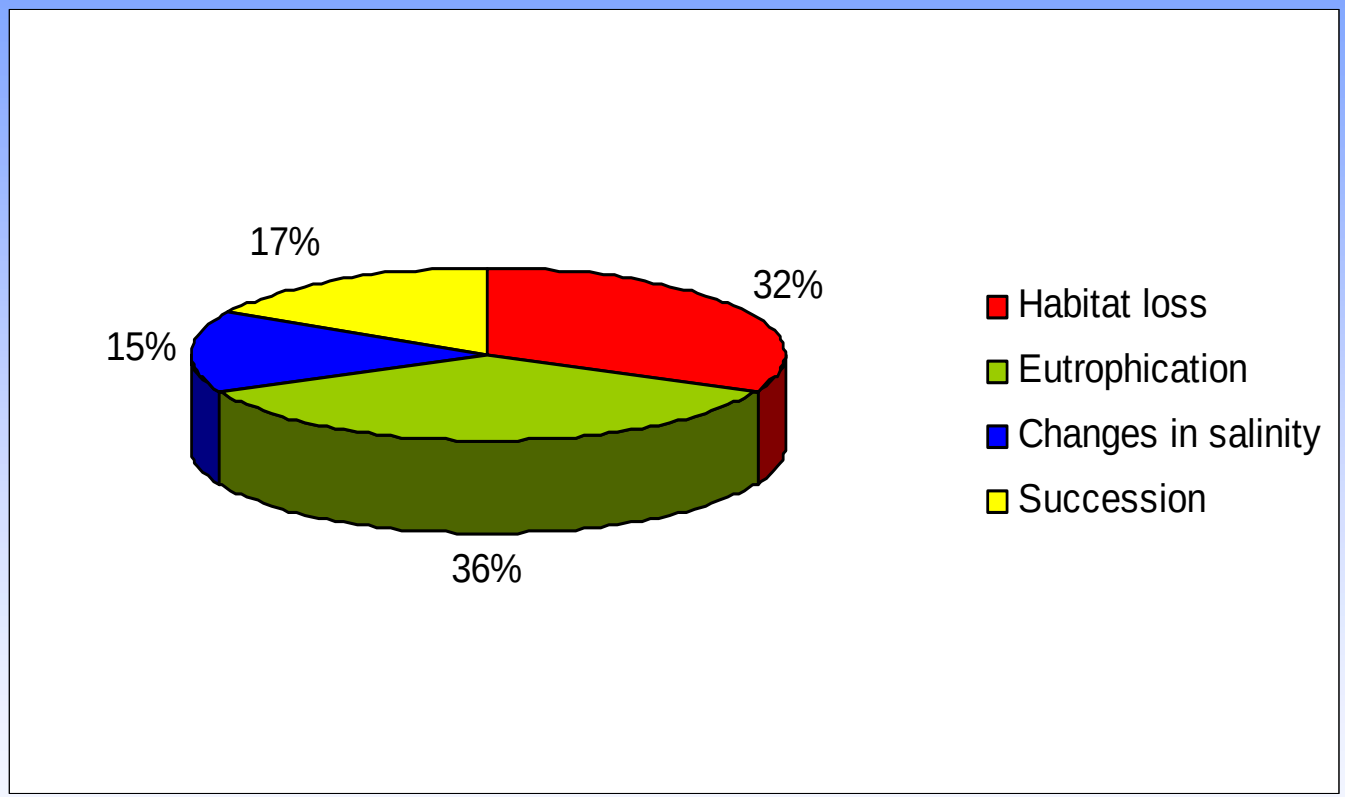
Evidence from Stoneworts



Cause of decline of 12 UK BAP Charophyte species

Data from Stewart, N.F. (2001). *Review of the status of Biodiversity Action Plan stonewort species*. Plantlife Report 170.

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Evidence from Countryside Survey

A systematic survey of 1-km squares recorded in 1978, 1990 and 1998.

Good for showing differences in abundance of common species (*New Atlas* better at rarer species)

Good mechanism for showing changes bought about by changes in land-use (*New Atlas* better at larger-scale phenomena such as eutrophication)

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Evidence from Countryside Survey

56 species showed a significant change (increase or decrease) between the 1978 and 1998 surveys.

When these 56 species are grouped according to Countryside Vegetation System aggregate classes, by far the greatest change has been the loss of species in the infertile grassland category (mean N = 4.6)

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Evidence from Countryside Survey

When the same 56 species are compared to results from the Atlas, it appears that there is a link between low Ellenburg N scores and decline.

	Atlas			
CS	increase	stable	decrease	**mean**
increase	5	4.75	5.5	**5.1**
decrease	4.4	4.5	3.8	**4.2**

The results are not absolutely conclusive however, because the sample size is too small (different species change because of different reasons).

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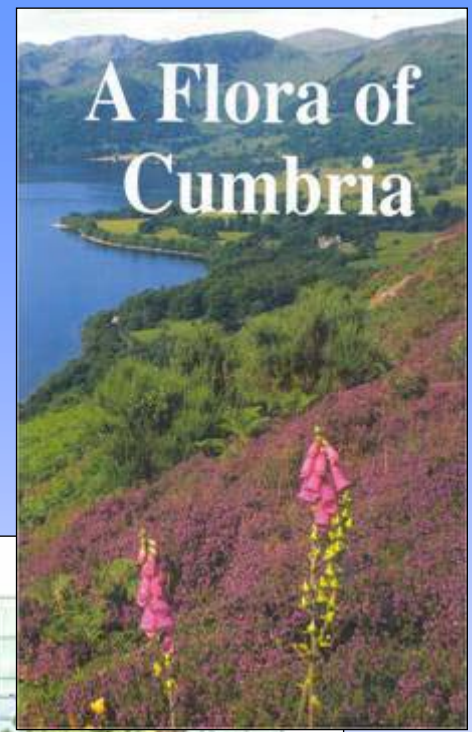
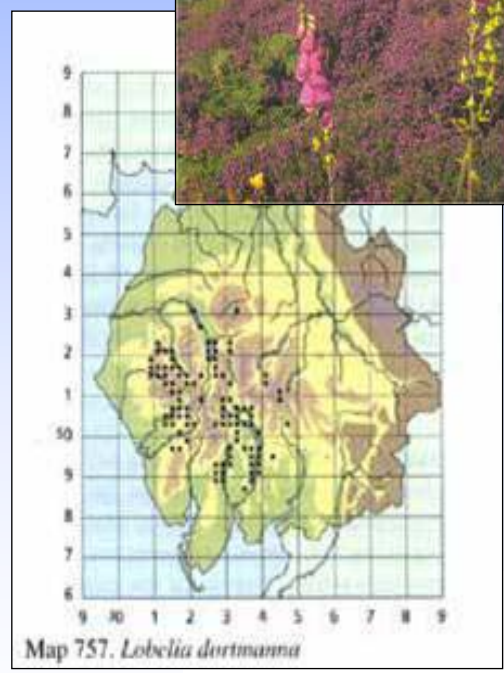
Evidence from Floras

Local county floras contain some of the most detailed accounts of small-scale distribution of species.

Mapping often takes place at the tetrad (2km square) scale, and also often includes an account of extinctions within the county.

Floras are now being produced that allow comparison of recent datasets with those from the original county flora.





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Evidence from Floras

Four studies have looked at the characteristics of the extinct species within various counties.

All four found a significant correlation between extinction and Ellenburg N values.

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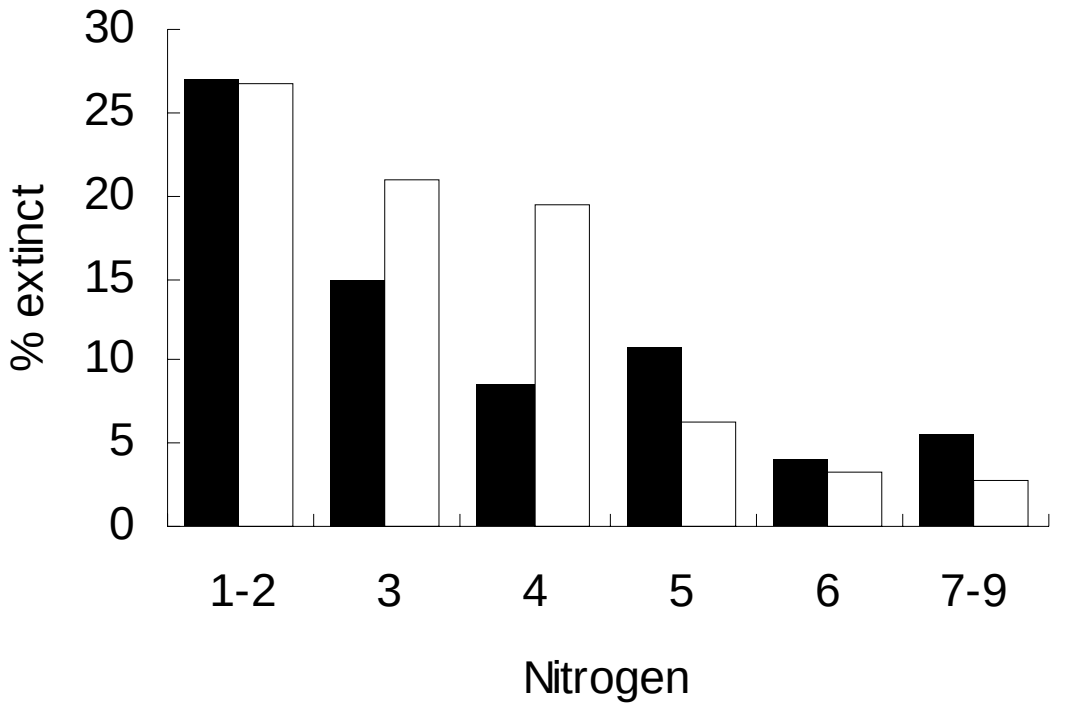
Evidence from Floras



Black - Bedfordshire

White - Northampton

% expressed as total of all species in each county

(from Walker, K. in press)

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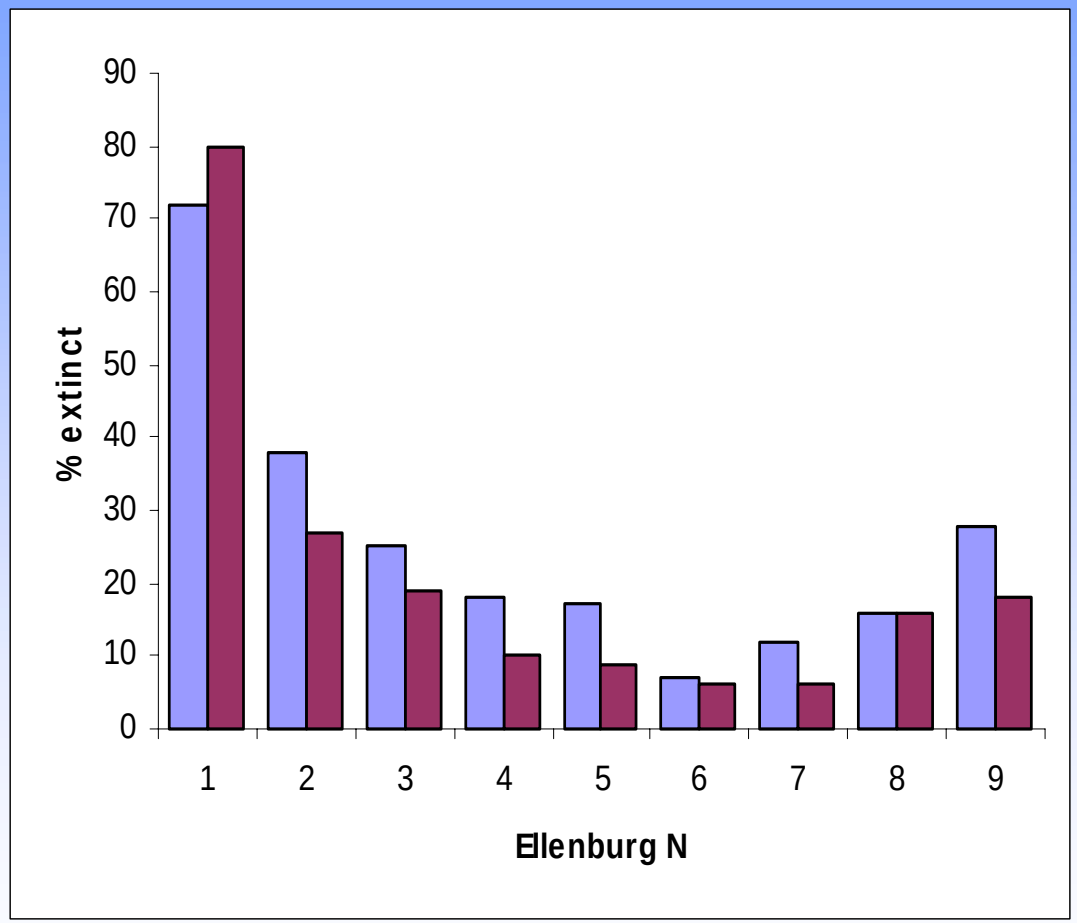
Evidence from Floras



Purple - Middlesex

Red - Cambridgeshire

% expressed as total of all species in each county

(from Walker, K., Trans. Suffolk. Nat. Soc, 38, 2002)

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Evidence from Floras

Study of extinction of aquatic species in Cambridge

Ellenburg	No. of spp	% Extinct
2	1	100
3	2	100
4	6	100
5	9	67
6	23	22
7	19	11
8	2	0

(Preston *et al.*, 2003)

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Sources of eutrophication

Nitrogen and phosphorus are the main plant nutrients involved in eutrophication.

Most nutrient pollution, in the form of various compounds, comes from:

Agriculture

Sewage

Transport

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Sources of eutrophication

Agriculture

- Intensification of agriculture over the last 50 years has led to an enormous increase in the application of fertilisers
- 90,000 tonnes of P and 1.2 million tonnes of N are applied to UK farmland each year
- 67 million tonnes of animal manure are collected each year in England and Wales, containing 340,000 tonnes of N and 90,000 tonnes of P
- 45 million tonnes of excreta are deposited directly onto farmland by grazing animals each year
- 85% of atmospheric ammonia comes from agriculture

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Sources of eutrophication

Sewage

- A combination of human waste and phosphorous-rich detergents
- Enters the water cycle through sewerage system
- Difficult to quantify, but a surplus of 16 kg of phosphorous per hectare per year is flooding into the UK environment
- More detailed modelling of a dairy farm indicated it was accumulating 27 kg of phosphorous per hectare per year

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Sources of eutrophication

Transport

- Car exhausts and industrial emissions release nitrogen-containing compounds into the air
- Oxides of nitrogen are the main culprits...
- 46% of these come from road transport
- 21% come from burning fossil fuels
- However, while emissions of ammonia have remained constant since 1990s, those of oxides of nitrogen declined by 46% from 1990 to 1999

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In Summary...

- The *New Atlas* has shown that, in the last 50 years, species with a high nitrogen requirement have increased, while those with a low nitrogen requirement have decreased.
- The *New Atlas* and CS2000 have shown that species characteristic of nutrient-rich habitats have increased, while those of nutrient-poor habitats have declined.
- Stonewort populations have declined as a direct consequence of eutrophication.
- Four county Floras have shown that species with a low-nitrogen requirement are more likely to become extinct than those with a high-nitrogen requirement.

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