



**FOOTPRINT
ECOLOGY**

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North Wessex Downs climate change assessment



The Team



- Not traditional consultancy – conservation focused work and novel research.
- 6 staff on this project, plus:
 - Pippa Gillingham, BU.
 - Maria Burns, local wildlife artist.
- External expert opinion and advice:
 - Academic workshop.
 - Farming workshop.



Pippa Gillingham
Species distribution modelling



Maria Burns
Artist

Work areas

First step in NWD climate plan.

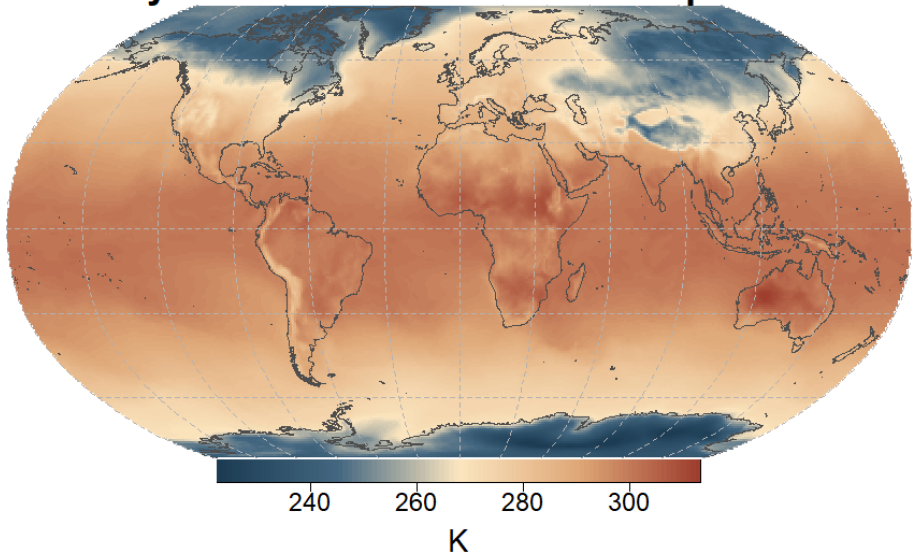


1. **Systematic review & evaluation of literature** - effects of climate change on chalk landscapes.
2. **Landscape character change predictions**
 - Analysis of climate models with visualizations.
3. **Changing range and distribution of priority species**
 - New modelling, data analysis, expert opinion.
4. **Implications for pests, diseases and invasive non-native species (INNS)**
5. **Expert opinion gathering** – landscape and agriculture

Climate models

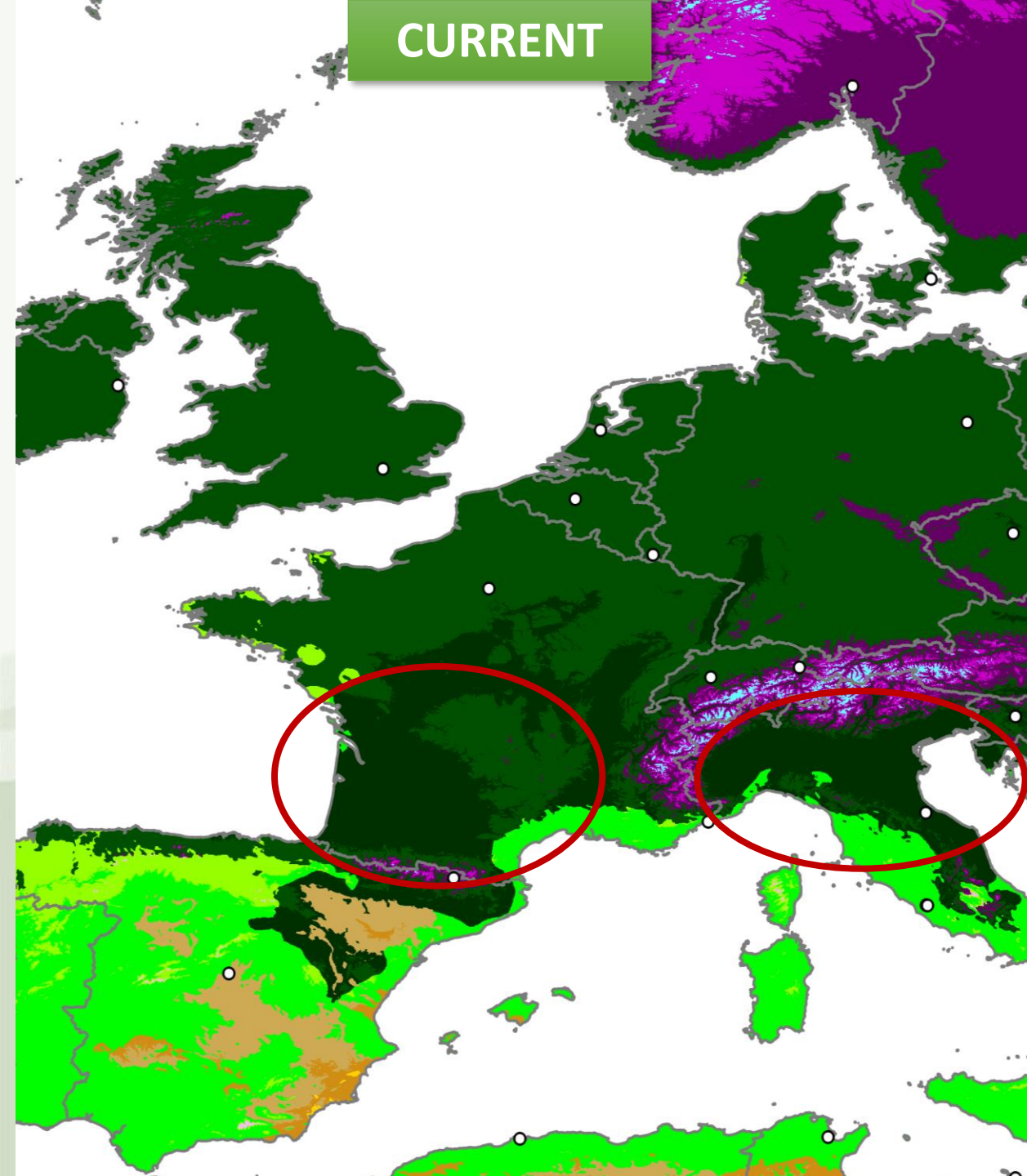


Daily Mean Near-Surface Air Temperature

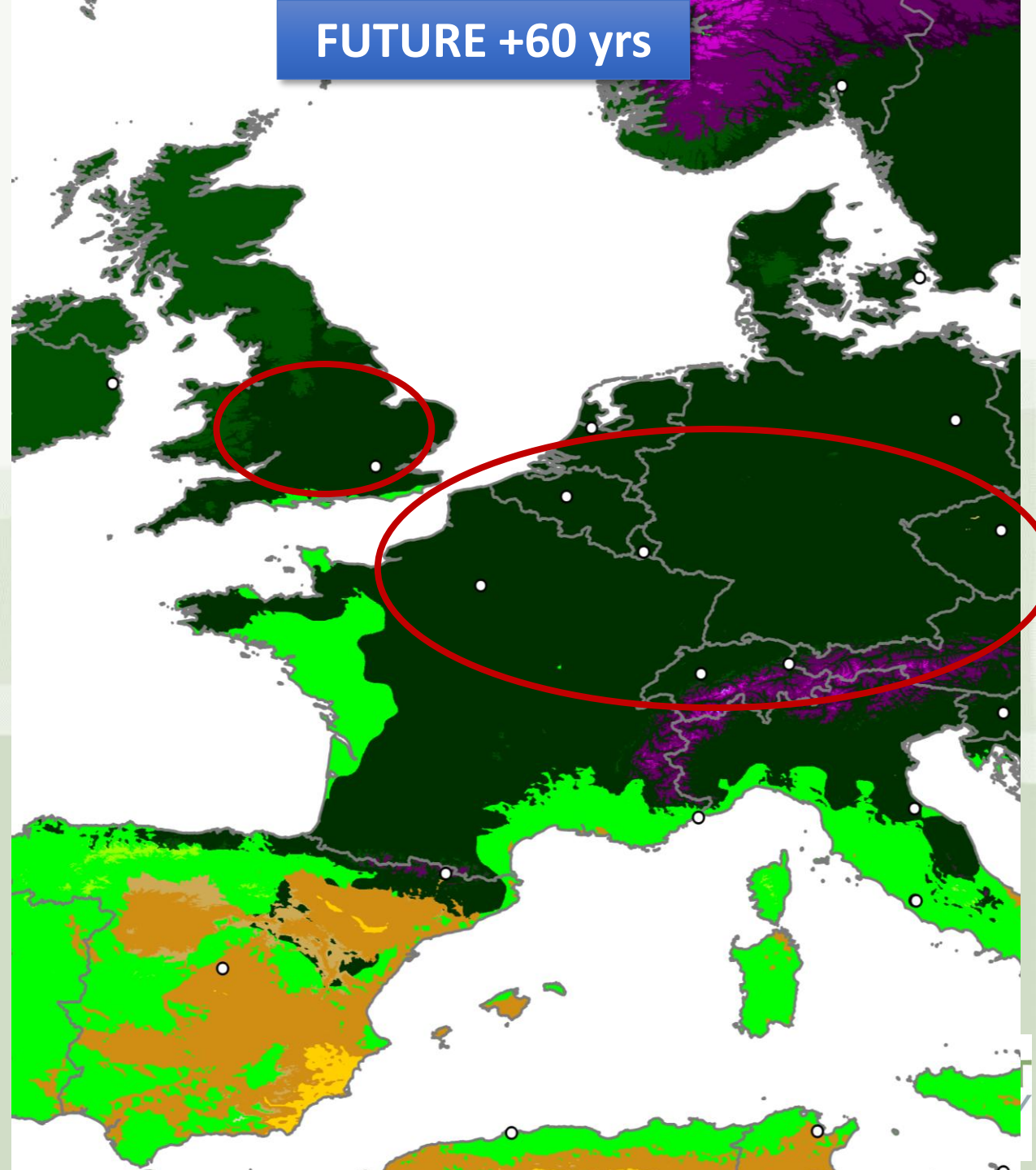


- Various models exist (*follow on work used a different model – same results*).
- CHELSA (Climatologies at High resolution for the Earth's Land Surface Areas).
 - Global.
 - Current → 30 yr prediction → 60 yr prediction.
 - High-resolution climate dataset → 1km resolution.
 - 3 scenarios.

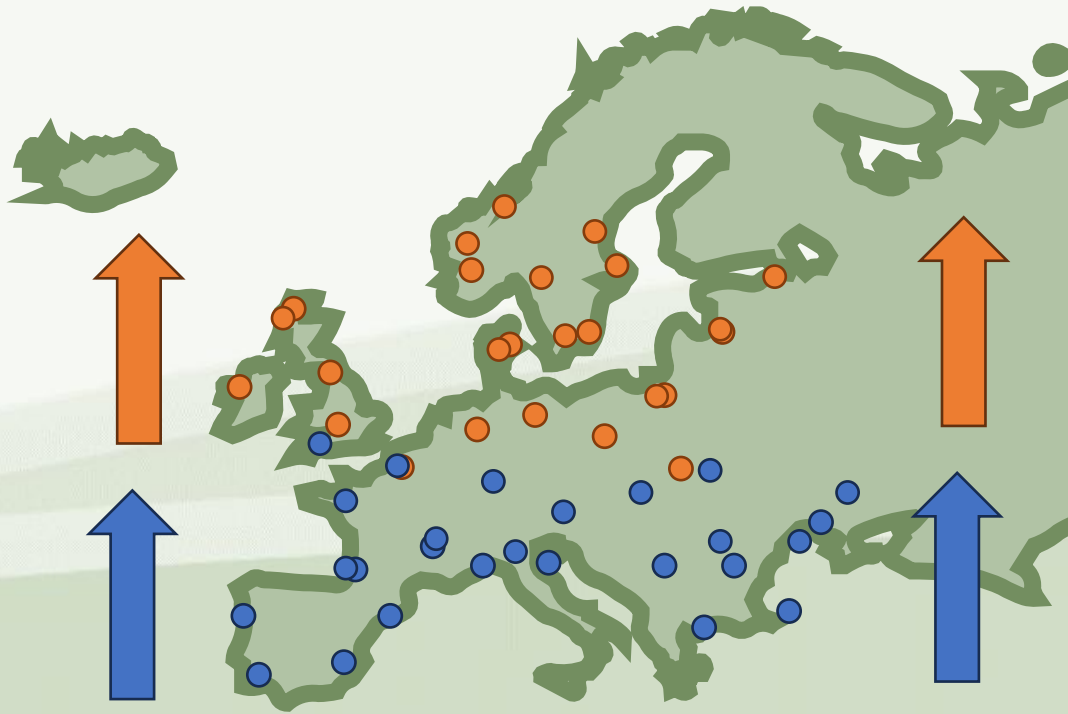
CURRENT



FUTURE +60 yrs



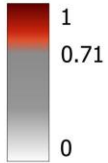
Single species models



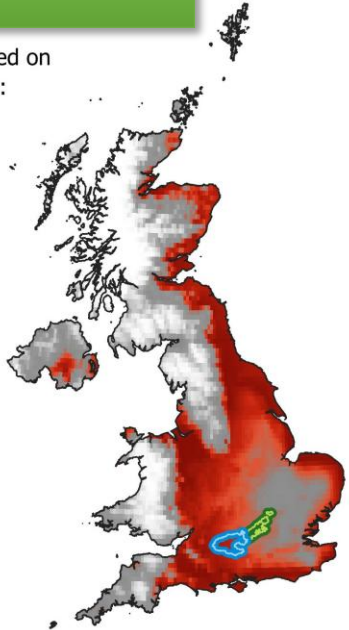
- Map the current distribution of the species, species “envelopes”, understand current climate range.
- Use climate models to predict species range shifts.
- Climate winners and losers;
 - New colonist species.
 - Species “running out of road”.
- Many existing species models.

CURRENT

Suitability based on
max threshold:

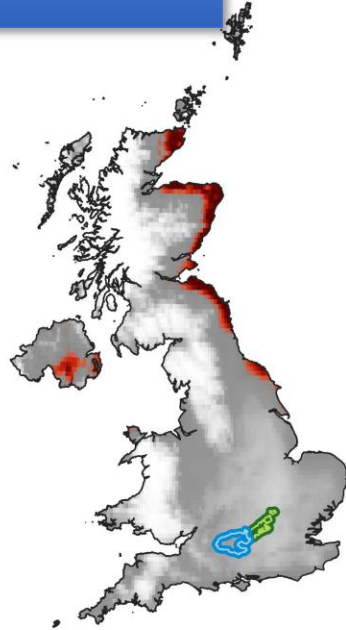


0 50 100 km



FUTURE

0 50 100 km



FUTURE

Rocky Road

0 50 100 km



FUTURE

Fossil Fuelled

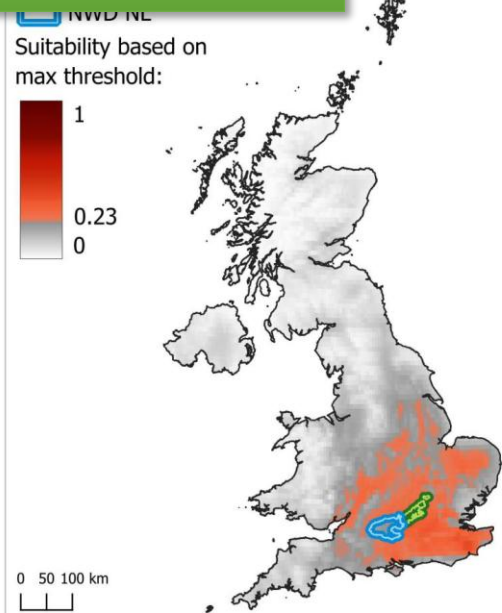
0 50 100 km



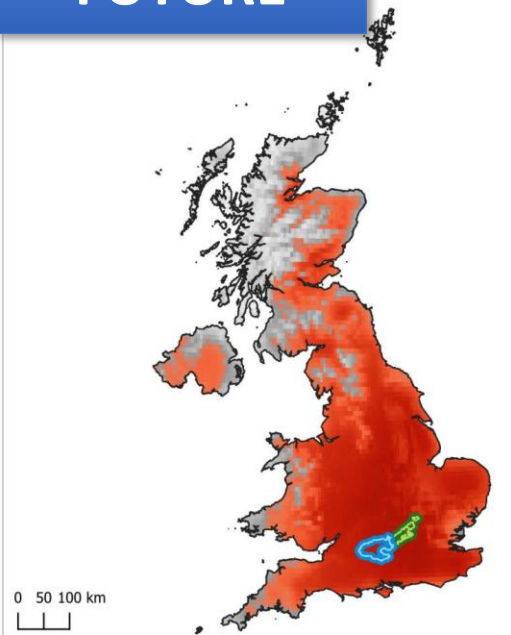
Early gentian

- Plant of shallow chalky soils. Primarily on chalk downland.
- Current climate suitability does not account for environmental suitability – **needs chalk!**
- Future looks very bleak....

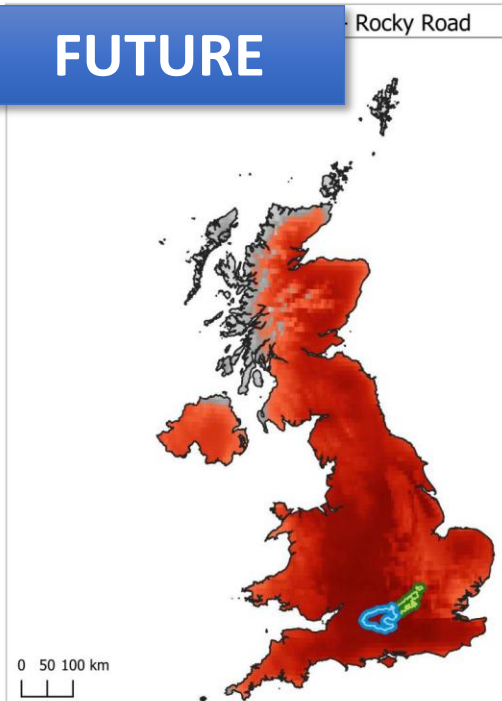
CURRENT



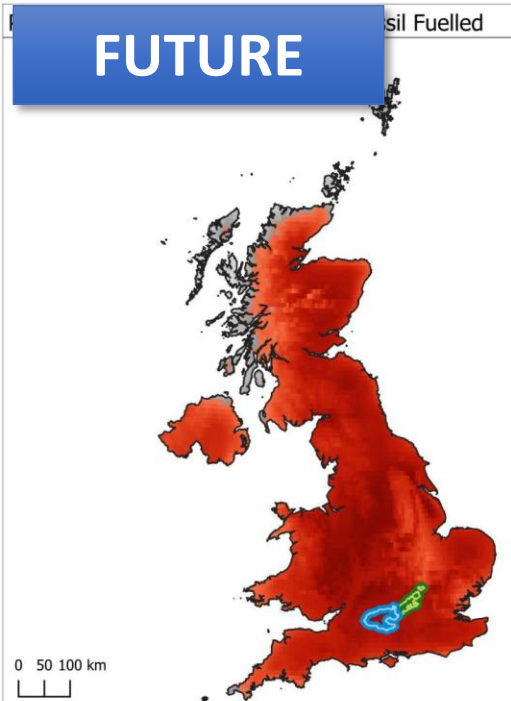
FUTURE



FUTURE



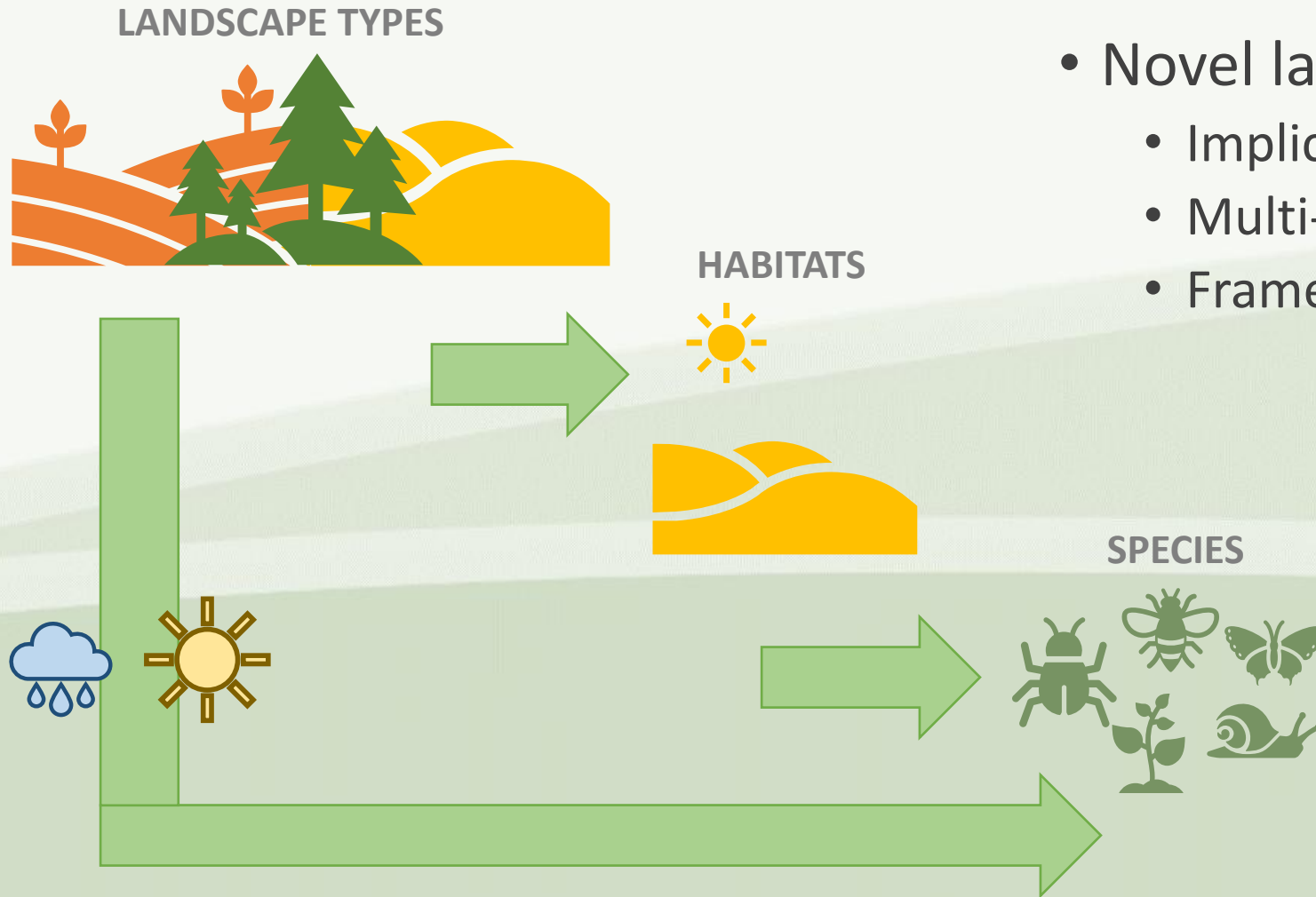
FUTURE



Broad-leaved cudweed

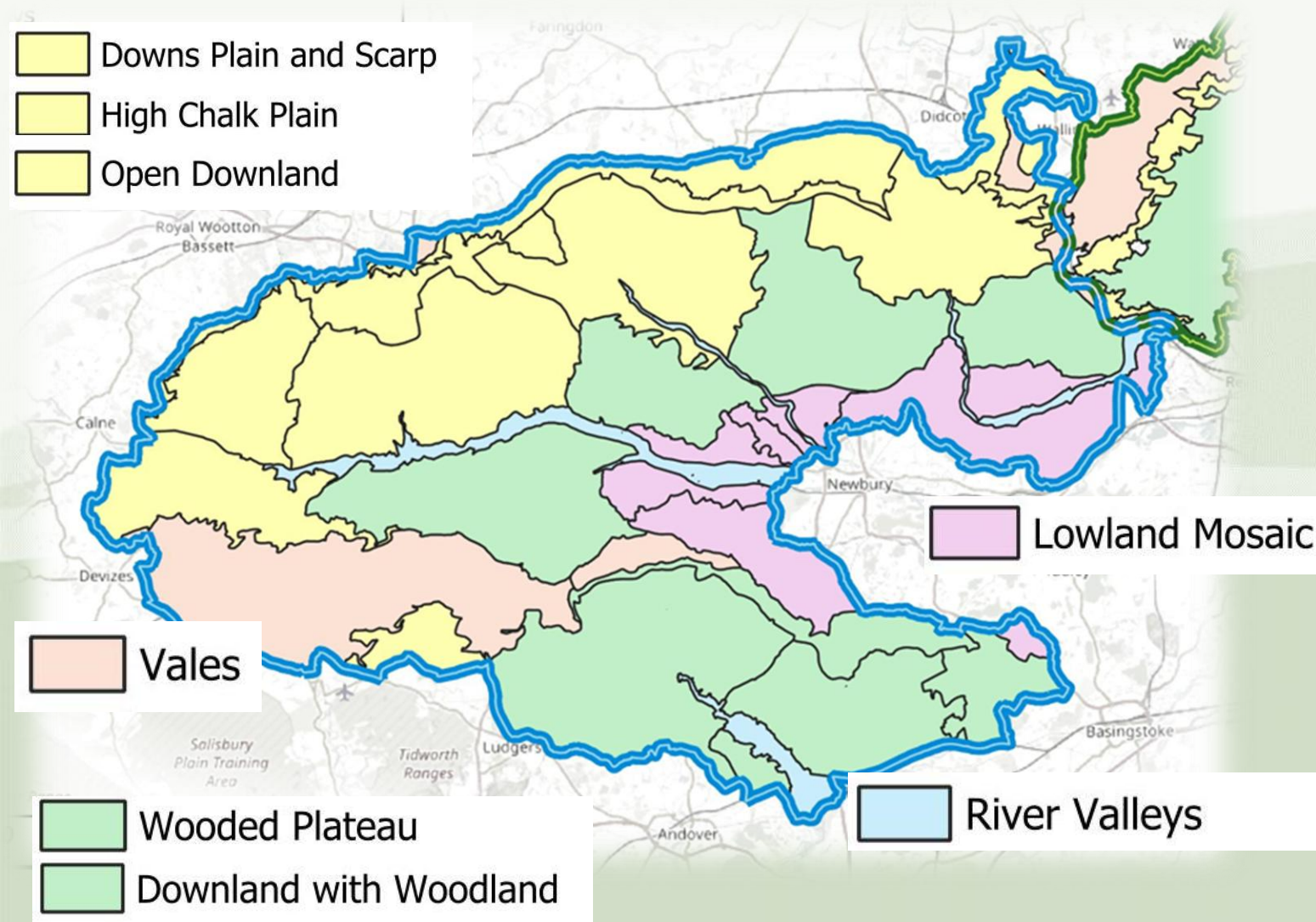
- Very rare “arable weed”
- Dry, droughted and disturbed soil.
- Again – winners and losers....

Our Approach



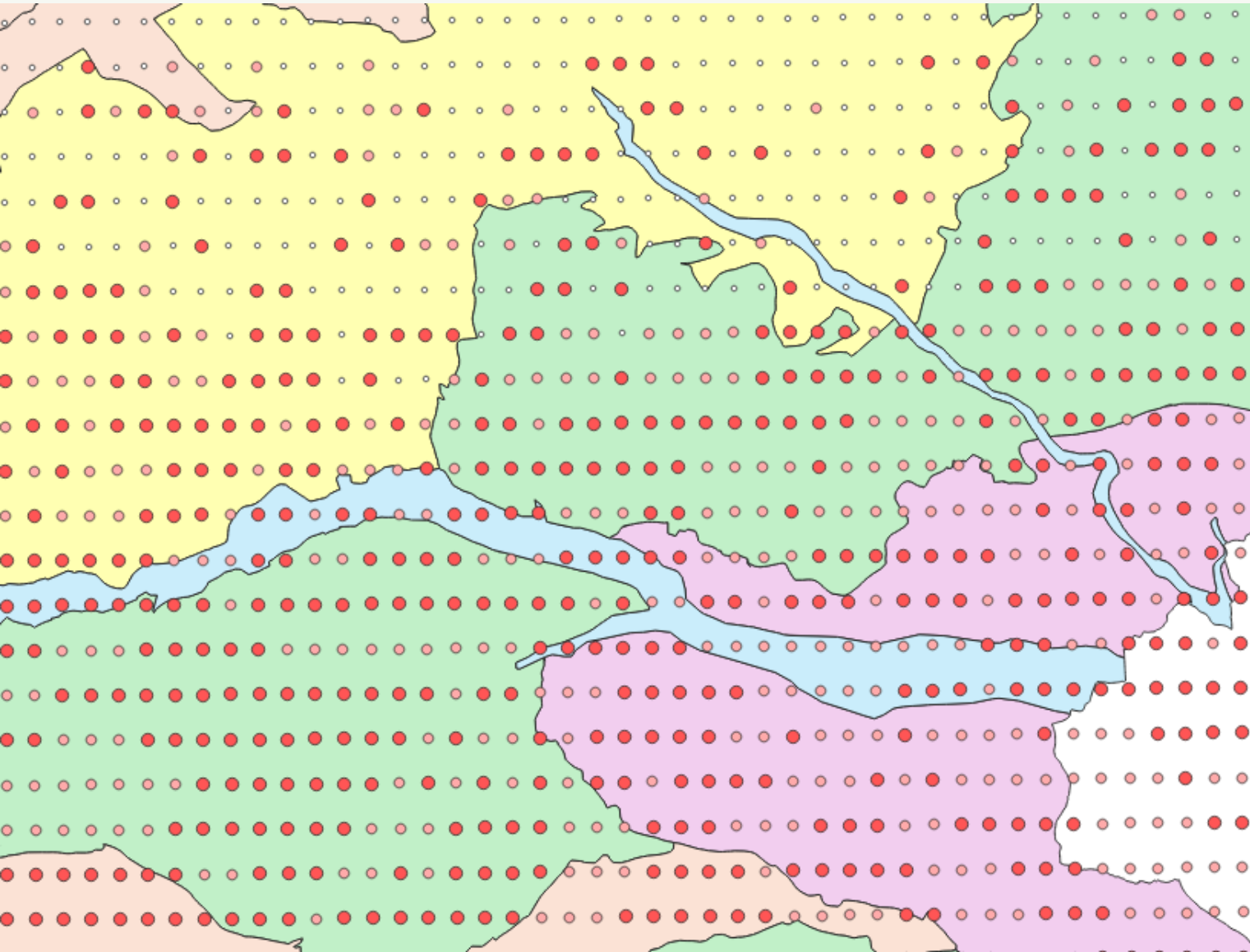
- Novel landscape approach:
 - Implications for “Landscapes Types”.
 - Multi-species implications.
 - Framework for other areas to use.

Landscape Character Types



- LCTs existing classification
- “The Chalk” - chalk downlands, sheep grazing and arable
- “The Cheese” - heavy, fertile clay soils, Vale of Pewsey, rich pastureland, dairy farming
- Land use, cultural, ecological, geological, historic

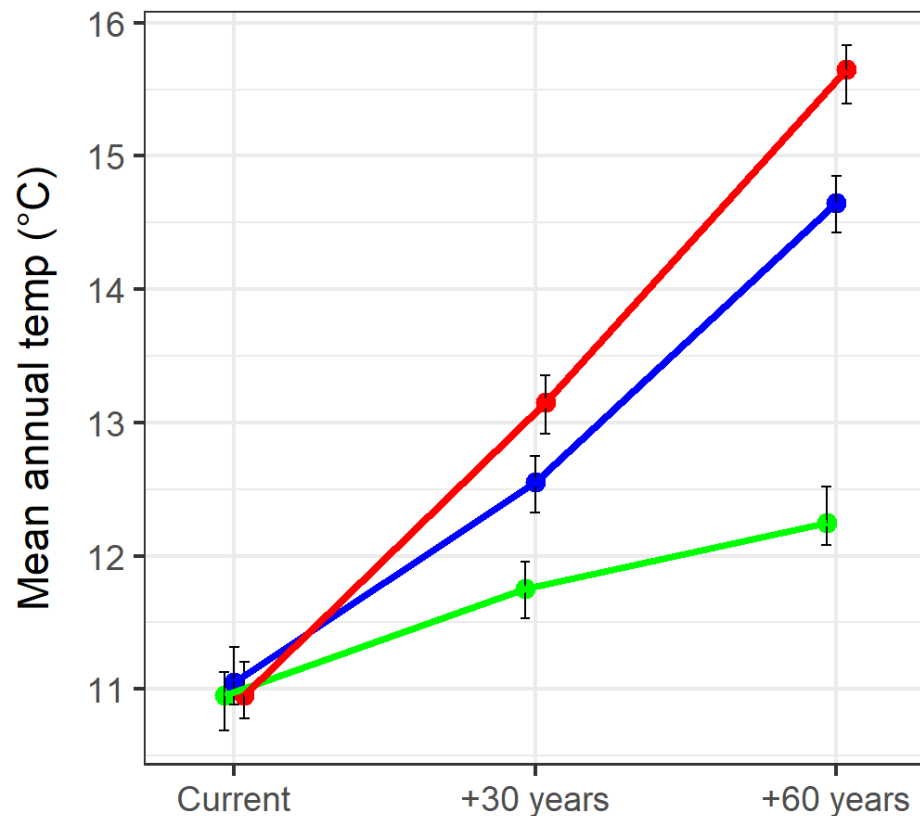
Climate data



- Overlay the 1km climate model data points across the Landscape Types.

Climate data

— Sustainability — Rocky Road — Fossil Fuelled



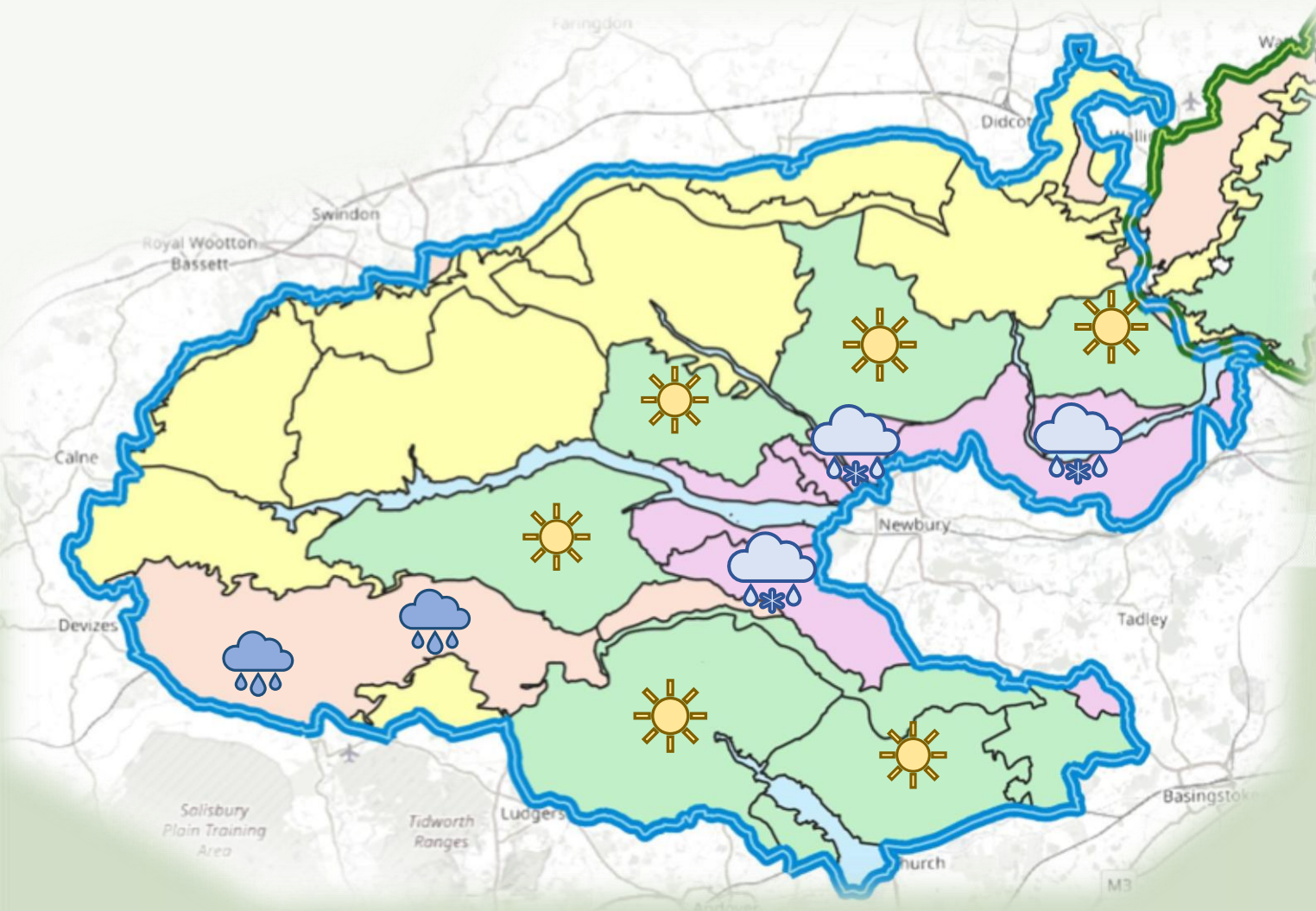
Temperature:

- Up to **4.7 degrees annually** hotter in 60 years
- “Summer Heat” - Up to **5.4 degrees in summer** hotter in 60 years

Rainfall:

- Up to **41 mm more rain per year** in 60 years
- “Winter Wet” -> Up to **16 mm more rain per month** in 60 years
- Small differences big differences to tolerances of species, crops, habitats, people.

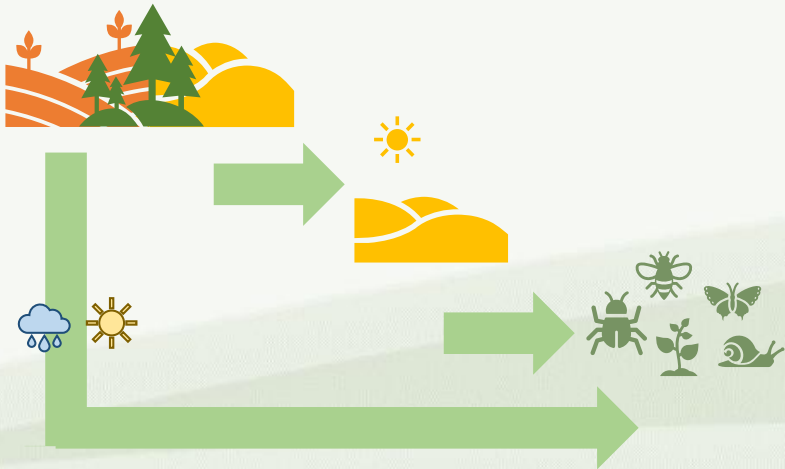
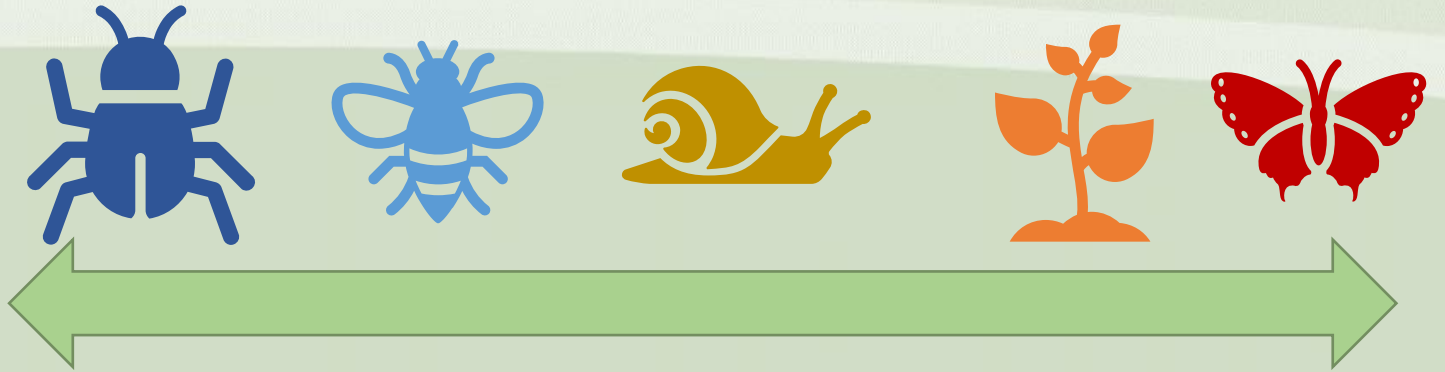
Change by Landscape Type



- All hotter and wetter
- Climate change (+ or -) greatest in **Wooded Plateau and Downland** and lowest in **River valleys**.
- **Wooded Plateau and Downland** - ↑↑ temp & ↑↑ “summer heat”
- **Vales** - ↑↑ rainfall
- **Lowland Mosaic** - ↑↑ winter wet

Species implications

- Priority species assessed
- Created a Species Index for each species:
 - **High score => high risk**
 - High habitat specificity,
 - High habitat-landscape specificity,
 - Strong change in climate in landscapes/habitats.





Species implications

- Species index:

- **Most affected species:** - Eagle's claw lichen, Corn bunting, Stone Curlew, Pasqueflower, Small Blue, Brook Lamprey, White clawed crayfish-> **specialists, arable and aquatic species.**

- **Least affected species:** - Bluebell, Hedgehog, Lapwing, Adder, Hare, bat species -> **more "generalist" or habitats across multiple LCTs.**

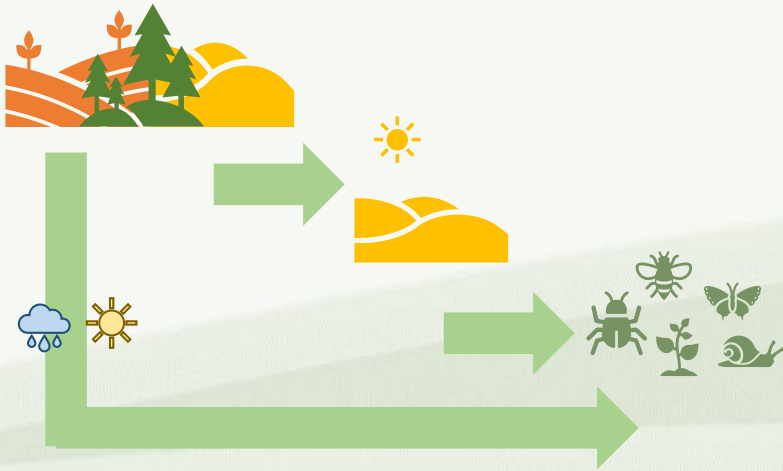
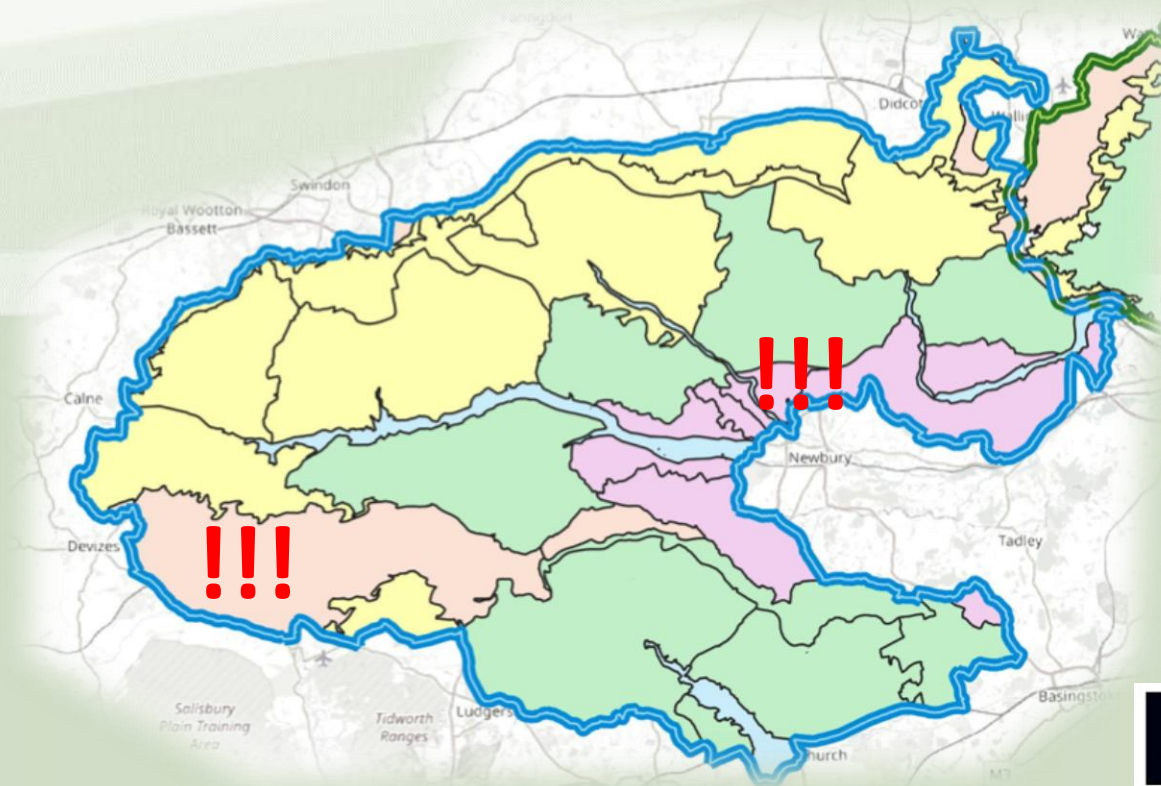
- Top 5 groups strongly affected:

1. Lichen
2. Arable plants
3. Arable birds
4. Butterflies
5. Woodland birds



Landscape implications

- **Vales** – most associated species, therefore high risk
- **Lowland Mosaic** – fewer species, high average score for species high risk



Visualisations

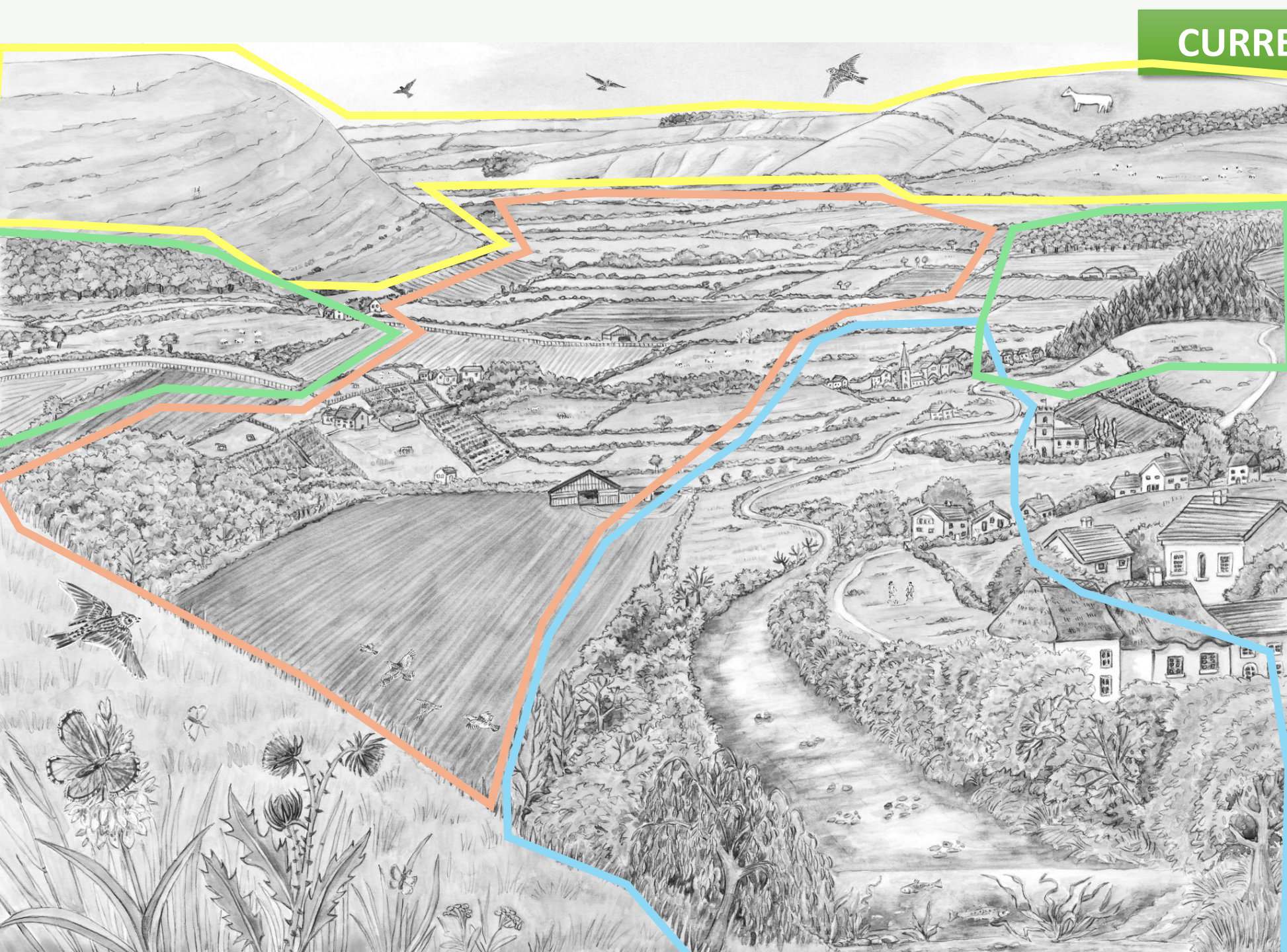


- Convey how climate change will shape the future landscape.
- **Current landscape** - single composite image with the multiple landscapes.
- **Future landscape**
 - Affects of climate change
 - What can be done? How we might shape the future.
- Informed by literature review and expert discussion.

CURRENT



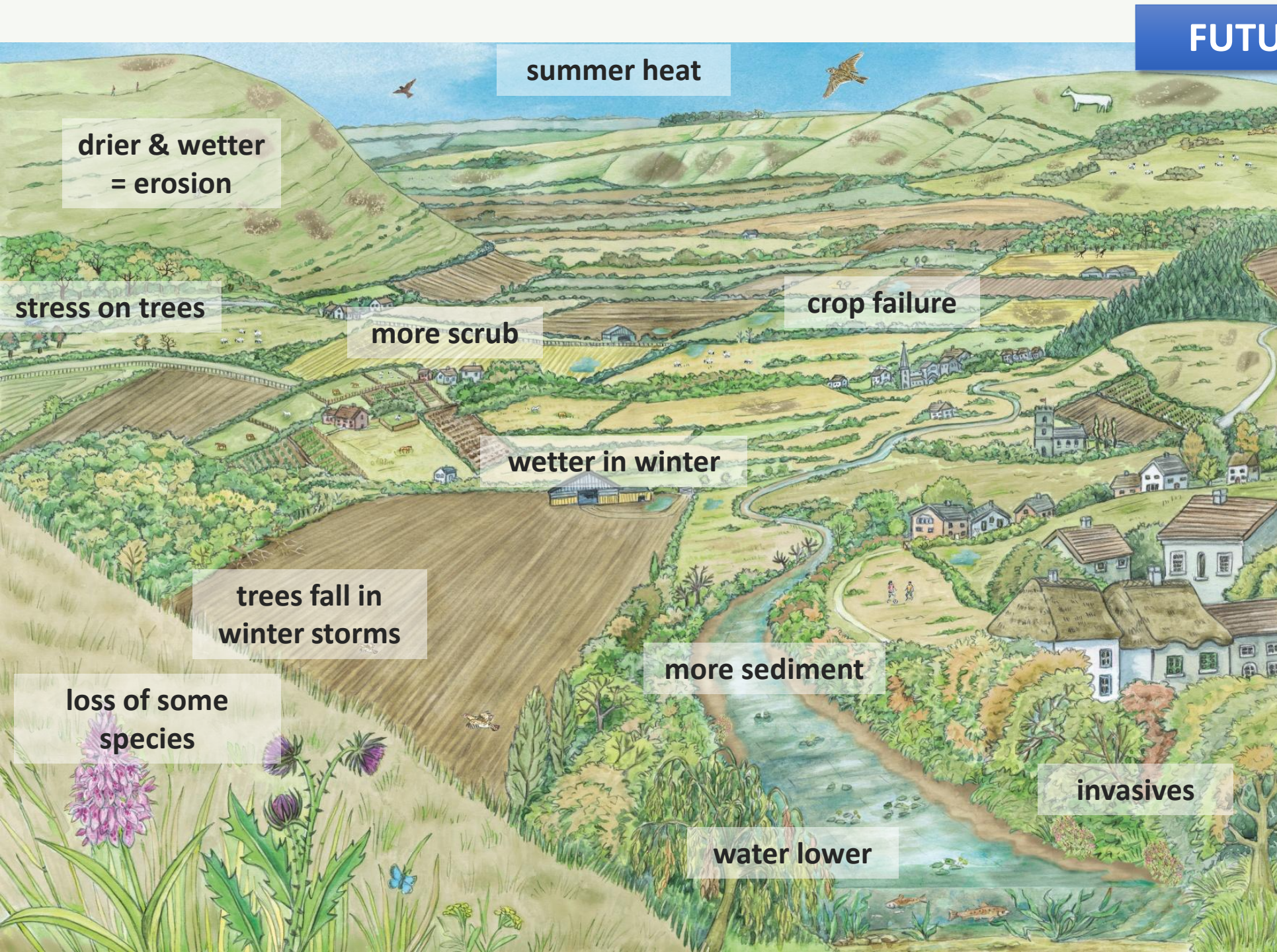
CURRENT



CURRENT



FUTURE



DIRECT

- Summer droughts
- Warmer, winter winters
- Flooding (flash floods)
- Storms
- Fires

INDIRECT

- Biodiversity loss
- Agricultural impacts (yield loss)
- Not-natives benefit
- Disease risks
- Phenological shifts
- Human health
- Landscape character changes (historic features threatened)

FUTURE ADAPTATIONS

livestock
shelters

hedge planting

tree planting

trees for
carbon/shelter

crop changes

land use
changes

ponds

“Slow the flow”

Livestock need more shelter

Contour ploughing

Winter cover crops

Different crops

Flood management

Runoff

Ponds to hold water

Naturalise water
courses/floodplains

Woodland planting

Changing

Renewable energy