**RGallagher 27th April 2018**

**Conservation triage limits the adaptive capacity of threatened species to climate change**

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**Abstract** 150 words

**Introduction**

Triage as a necessary part of conservation planning.

* Justification of triage 🡪 economic rationalisation
* Debate about the efficacy of triage and moral imperatives of triage
* Triage has a legacy effect. That is, actions taken to meet objectives under static conditions (current climates, current management objectives) constrain the possibilities for future protection (I am sure this can/is being explicitly discounted in some triage models)
* Because climate conditions are already affecting the distributions and demographics of species it is critical to estimate the effect of current triage decisions on the adaptive capacity of species under active management.

Adaptive capacity (AC)

* an explanation of the major components (genetic variation, traits, climate niche) 🡪 Nicotra paper
* climatic niche of the species is routinely used to assess AC via distribution models
* Niche breadth across the range (max-min climate conditions) is used as an estimate of adaptive capacity 🡪 larger niche breadths confer greater adaptive capacity as they imply ecological generalisation; smaller niche breadths imply specialisation.

Idea/Hypothesis:

Here we illustrate how triage decisions can propagate reductions in the potential of threatened species to adapt to projected changes in temperature and rainfall. We show that limiting the breadth of mean annual temperature (MAT; °C) and annual precipitation (AP; mm) conditions protected under an active triage program (SOS NSW) constrains the potential for species to adapt to future climate conditions. We argue that current triage approaches fail to adequately incorporate measures which will maximise the adaptive capacity of threatened species to climate change. Failing to explicitly encompass the breadth of climate conditions across a species range into triage decisions implicitly assumes that species will have adequate standing genetic variation/trait states to adapt to novel climates or disperse into new regions – a potentially unrealistic assumption.

We also show how expert-driven triage decisions potentially reduce the adaptive capacity of species (? – could do a null model to test this)

**Methods**

1. For each threatened species, match all occurrences/SOS sites to climate data for AP and MAT under current conditions and (maybe) future conditions (NARCLIM extent);
2. Calculate niche breadth across three contrasting scenarios for current and future conditions (?):
   1. All occurrences for the species = entire niche;
   2. Only SOS sites = expert triage niche;
   3. Across a random selection of occurrences (matching the number of sites protected under SOS for each species e.g. 3 occurrences) across the range = random triage niche.
3. Calculate the difference in niche breadth between the pair-wise combinations of the three scenarios for AP and MAT for each species. From this calculate the average difference, across all threatened species, in niche breadth in °C/mm between a scenario protecting the entire niche, the expert triage niche and the random triage niche. This is a quantification of the potential loss of adaptive capacity to climate conditions as a result of the triage process.
4. Compare the niche differences formally using ANOVA (or mixed-effect model with taxonomy as a fixed effect).

**Results**

*Hypothesis* - (1) Protecting a subset of locations reduces the adaptive capacity of threatened species to climate change by X°C/Ymm, on average. Adaptive capacity defined as climatic niche breadth; (2) On average, triage sites chosen via expert opinion do no better than a random selection for capturing the climatic niche breadth and potential adaptive capacity of threatened species.

**Discussion**

* Approach implies a worst-case scenario where all populations which are not protected end up going extinct and, equally, a best-case where all populations under active management are sufficiently protected. The approach is useful for quantifying the potential loss of adaptive capacity, useful for future proofing triage exercises. However, realisation of the scenarios presented will depend on many untested factors including committed stewardship and investment, land-use change, regional rates of climate change (both mean and extreme conditions).