**Material and methods**

*Study system & design*

The study was undertaken in two reserves in the Australian Capital Territory, around the city of Canberra (Fig.#). The region has a cool temperate climate, with mean temperatures ranging from 13–28 ºC in summer to 0–11 ºC in winter (Australian Government Bureau of Meteorology). Mean annual precipitation is 629 mm but is highly variable and rainfall is generally distributed throughout the year. The ecological community is classified as Natural Temperate Grassland and is listed as threatened at the regional level (Australian Capital Territory Government *Nature Conservation Act* 2014) and as critically endangered at the national level (Australian Government *Environment Protection and Biodiversity Conservation Act 1999*). Approximately 95% of Natural Temperate Grassland in Australia has been cleared or degraded since European colonisation (Keith 2004). Only small fragments (25–140 ha) remain in an urban and agricultural matrix (ACT Government 2005). Native grasses include *Themeda*, *Austrostipa*, *Rytidosperma*, *Poa* and *Bothriochloa* species and common exotic grasses include *Avena*, *Phalaris*, *Bromus*, *Aira* and *Vulpia* species.

In each reserve, we established eight sites in areas of forb rich natural temperate grassland with no St john’s Wort (Fig #). Sites were separated by at least 106 m (range 106-387 m) within reserves. Each site contained two treatment plots (1. spot spray (Plot A); and 2. boom spray – fine droplet (Plot B)) and one control plot (not sprayed (Plot C)) (Fig. #). The location of the plots were position to include the following group of native species: *Eryngium ovatum* (Apiacea), *Chrysocephalum apiculatum* (Asteraceae), *Tricoryne elatior* (Hemerocallidaceae), and Desmodium and/or Glycine species (Fabaceae). Treatments were randomly assigned within each site and plots were spaced at least 8 m apart (range 8-14 m). Each plot was 1 m2 with a 0.5 m buffer.

The herbicide fluroxypyr (Starane Advanced) was applied to all treatment plots (including buffers) using one of the following two application methods and rates:

1. Spot spraying with quick spray unit at a rate of 300ml fluroxypyr per 100L water plus 500ml Uptake Oil per 100L water (spot spray).
2. Boom spraying with twin bodied nossel at 60o at a rate of 1.8L fluroxypyr per ha, 75L water per ha and 500ml Uptake Oil per 100L water (boom spray – fine droplet).

No herbicide was applied to control plots and a screen was placed between control and treatment plots to reduce the risk of spray drift.

NEED TO INCLUDE METHODS FOR COMPONENT 1, 2, 3A AND 4.

*Data collection*

Two experienced botanists (TH and MM) surveyed vegetation in November 2017 (spring). All plant taxa observed within each plot were counted and assigned a cover score to the nearest 10%. All taxa (85%) were identified to species following NSW Flora Online (http://plantnet.rbgsyd.nsw.gov.au). Nineteen taxa were difficult to identify and were assigned to a genus (e.g. *Avena,* *Aira*, *Conyza*, *Vulpia*, see Table #) or to three different morphospecies (*Rytidosperma*).

We classified each taxon into categories based on origin (native/exotic), lifespan (annual/perennial), growth form (forb, grass, shrub, sedge, rush), photosynthetic pathway for grasses (C3/C4) and ability to fix nitrogen (legume/non-legume) (Table #) (Díaz *et al.* 2007). We also used three binomial categories that are used by the local government to monitor grassland quality (Rehwinkel 2015; Australian Government 2017): (1) indicator species (sensitive native taxa that are indicative of high value native grassland), (2) important species (taxa used to classify vegetation as Box-Gum Grassy Woodland under the Australian *Environment Protection and Biodiversity Conservation Act 1999*) and (3) increaser species (common native and exotic taxa that tolerate or respond positively to disturbance). Taxa were assigned to 24 functional groups based on these categories in a hierarchical way. For example, we analysed the diversity of all taxa, native taxa and exotic taxa separately, while native and exotic grasses were further divided into C3 and C4 categories (Table S1). This allowed us to examine broad functional responses while also examining which functional traits drove broader patterns. For each functional group in each subplot, we calculated species richness (number of species) and, to account for variation in abundance and evenness among species, the Shannon diversity index (*H*'). These data were analysed at the plot level (48 observations).