

Discussion # 11

30 November / 1 December

[from the 2010 final exam, though it was disguised on the exam since some of Selita's labmates were in the class]

Different plant species use resources differently, so a mix of species more fully utilizes available resources than does a single species. One result is that a mixture of species often is more productive than a single species, for instance as in intercropped *vs.* monoculture agriculture. A related effect of this more varied and complete utilization of resources might be that a mix of native species will have a greater competitive effect on an invasive plant species—and so may suppress it better—than will a single native species.

To test this, Selita Ammond (recent MS graduate from NREM) conducted a greenhouse experiment on the effect of the diversity of native species on the growth of *Urochloa maxima* ["U"] (= *Panicum maximum*, Guinea grass), an invasive grass species in Hawai'i. Three native species were used: *Myoporum sandwicense* ["M"] (naio), *Dodonea viscosa* ["D"] ('a'ali'i), and *Plumbago zeylanica* ["P"] ('ilie'e).

Plants were grown in pots, with four plants per pot; pots with native plants had one *U. maxima* and 3 native plants, in various species combinations. The treatments thus were:

- no natives: UUUU
- 1 native species: UMMM, UDDD, UPPP
- 2 crop species: UMMD, UMMP, UMDD, UMPP, UDDP, UDPP
- 3 crop species: UMDP

There were four replicate pots for each of the 11 treatments. The plants were grown in the greenhouse for 11 weeks; locations of the 44 pots in the greenhouse were randomly assigned.

The response variable is the total mass of *U. maxima* at the end of the experiment; for the UUUU treatment one of the four plants was randomly selected to be weighed.

Hypotheses:

The principal hypothesis motivating this study was:

- H1: growth (final mass) of *U. maxima* will be inversely related to the number of crop species with which it is growing (at constant total density).

Two opposing hypotheses were considered concerning the growth of *U. maxima* alone compared to when in competition with native species. Extending the preceding hypothesis about the effect of plant species diversity leads to the hypothesis that:

- H2: growth (final mass) of *U. maxima* will be greater when grown alone than with one or more native species (at constant total density).

Alternatively, intraspecific competition generally is stronger than interspecific competition, leading to the hypothesis that:

- H3: growth (final mass) of *U. maxima* will be less when grown alone than with one or more native species (at constant total density).

The data:

treatment	crop spp.	weed mass			
UUUU	0	3.36	4.04	3.30	2.87
UMMM	1	2.59	3.82	2.66	1.79
UDDD	1	5.43	5.73	4.48	4.02
UPPP	1	5.96	5.03	5.26	4.58
UMMD	2	0.84	2.63	2.12	2.24
UMMP	2	4.44	3.58	2.79	2.74
UMDD	2	2.45	2.88	2.02	3.46
UDDP	2	4.47	4.85	3.24	3.89
UMPP	2	2.79	3.02	2.39	3.45
UDPP	2	2.21	3.30	2.14	3.16
UMDP	3	2.51	3.97	2.35	3.08

Your assignment:

Analyze the data to address the three hypotheses stated above.