Communication Design.

GRAPHICS & FIGURES

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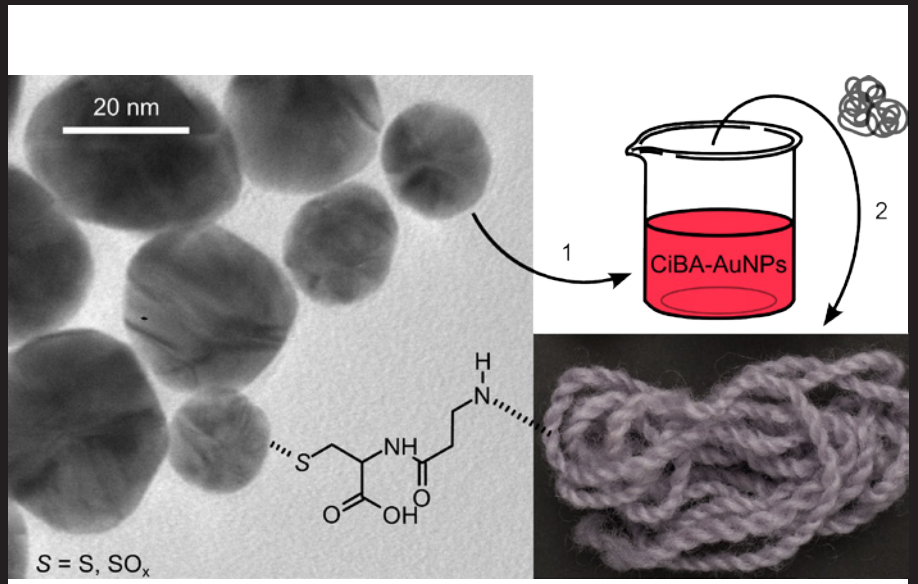
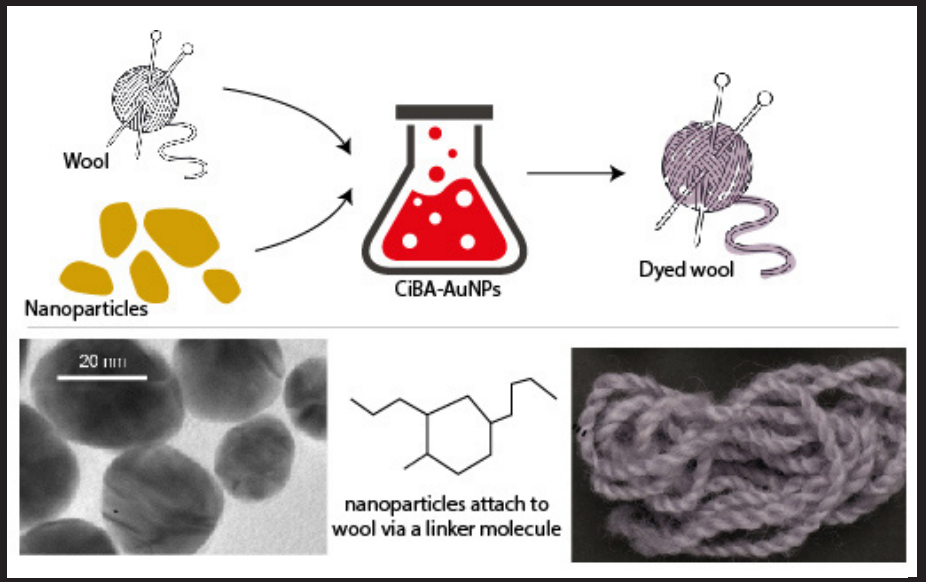
UC SCIENCE

@explorpreter

What.


20 nm
1
CiBA-AuNPs
2
S = S, SOx

Andrea Kolb


Wool
Nanoparticles
CiBA-AuNPs
Dyed wool
20 nm
nanoparticles attach to
wool via a linker molecule

Pollution Sensitive Species

Mayflies, stoneflies and caddisflies are sensitive to degraded stream habitat conditions. Because of their sensitivity, we can tell if a stream is more or less healthy by how many of these macroinvertebrates are found in the stream. They are called "EPT" taxa after their scientific names. The EPT taxa are used as part of a stream health index called the Macroinvertebrate Community Index or "MCI".

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UC UNIVERSITY OF CANTERBURY

E

Ephemeroptera - Mayflies


Deleatidium


Coloburiscus

P

Plecoptera - Stoneflies


Zelandoperla


Stenoperla

T

Trichoptera - Caddisflies


Olinga


Aoteapsyche

School of Biological Sciences

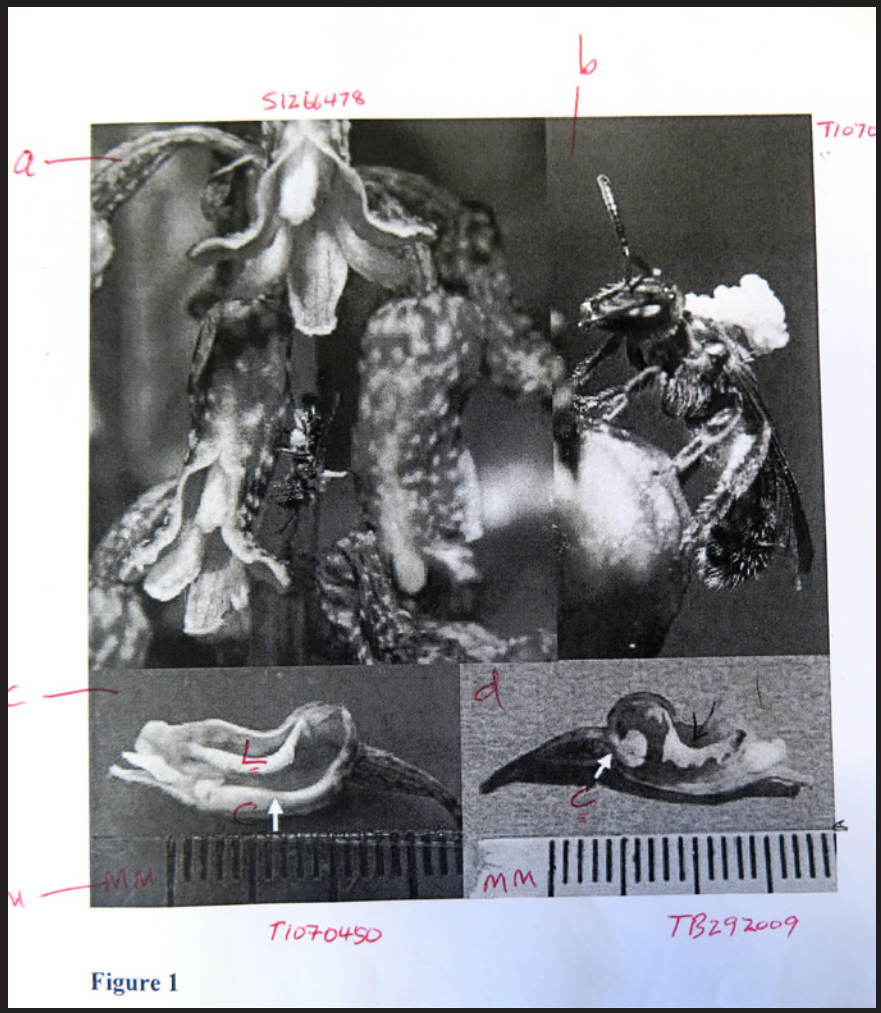
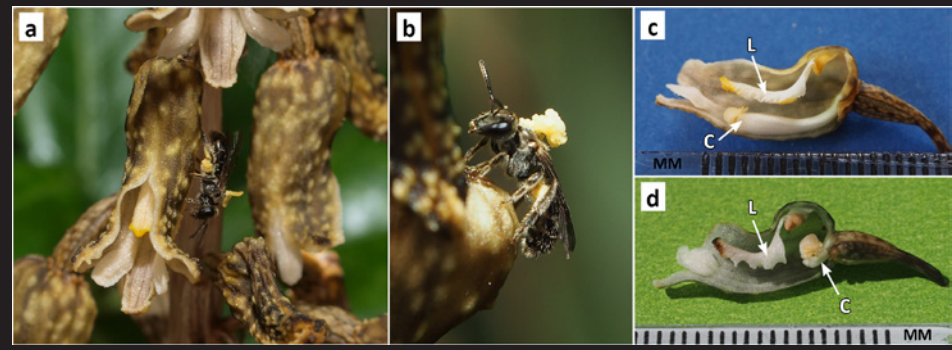


Figure 1



L. sordidum is the most widespread and visits the widest range of native and exotic plants. At many sites this species outnumbers other native solitary bees throughout the year, and is a successful competitor of *Apis mellifera* (Donovan 2007). *Lasioglossum* species all nest in the ground and the genus is found in both the North and South Island of New Zealand. These bees are important as pollinators in New Zealand because of both their abundance and their lack of plant specialisation (Donovan 1980).

We studied the pollination systems of three endemic *Gastrodia* species within modified landscapes in the Canterbury Region: *G. cunninghamii*, *G. minor*, and *G.* "long column". The latter undescribed taxon has quite distinctive flower morphology (Rolfe 2010) and is likely to be described as a separate species (C. Lehnebach, Museum of New Zealand Te Papa Tongarewa, pers. comm.). Specifically, our aims were to determine:

(1) How many species of *Gastrodia* grow around urban Christchurch?
(2) Are those *Gastrodia* species capable of autonomous selfing?
(3) What flower visitors go to *Gastrodia* species?
(4) How do sites vary in flower visitation rates and natural fruit-set rates?

Methods

Species studied

Gastrodia have perennial underground tubers, which produce non-photosynthetic brown flowering shoots 10–50 cm tall. The species we found were identified using the guide to New Zealand *Gastrodia* (Rolfe 2010), and voucher specimens sent to the Museum of New Zealand Te Papa Tongarewa herbarium (WELT). Both *G. cunninghamii* and *G.* "long column" have inflorescences >30 cm in height with 20–50 flowers per stalk. The species differ in flower structure, with *G. cunninghamii* having a very short column whereas that of *G.* "long column" is the length of the labellum (Fig. 1). Also, *G.* "long column" has a yellow labellum tip which distinguishes it from *G.* "long column black" (Rolfe 2010). *Gastrodia minor* inflorescences are much smaller, with flower stalks <30 cm in height carrying 2–10 flowers per stalk.

Sites

Six locations around Canterbury were used for this research. Each of the three species was studied at a minimum of two sites (Table 1).

Four sites were in Christchurch City. The Victoria site was a densely settled urban residential area within central Christchurch, within 1.5 km of the Little Hagley and Christchurch Botanic Gardens sites. *Gastrodia* "long column" was found on a residential property under a narrow hedge of *Griselinia littoralis*, *Pittosporum tenuifolium*, and *Coprosma robusta*. The Christchurch Botanic Gardens are a 21-ha area of native and exotic gardens in central Christchurch surrounded by Hagley Park's 165-ha of lawns and trees. *Gastrodia* "long column" and *G. cunninghamii* were located in garden beds planted predominantly with *Magnolia* and *Rhododendron* cultivars, respectively, each with an overstorey of mature exotic

Table 1. *Gastrodia* species studied at various sites in and around Christchurch, with number of stems (and bagged stems) observed each year. CBG, Christchurch Botanic Gardens; –, site not used in that year.

Species	Site	Stems (bagged stems)		
		2012	2013	2014
Gastrodia "long column"	Victoria	11 (3)	22 (15)	10 (5)
	CBG	–	8 (5)	13 (6)
	Addington	–	–	14 (5)
	Ohoka	–	–	2 (1)
Gastrodia cunninghamii Hook.f.	Little Hagley	–	–	17 (8)
	CBG	–	–	3 (0)
	Coleridge	–	–	14 (5)
Gastrodia minor Petrie	Addington	–	–	19 (7)
	Ohoka	–	–	11 (6)

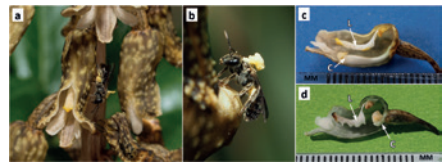
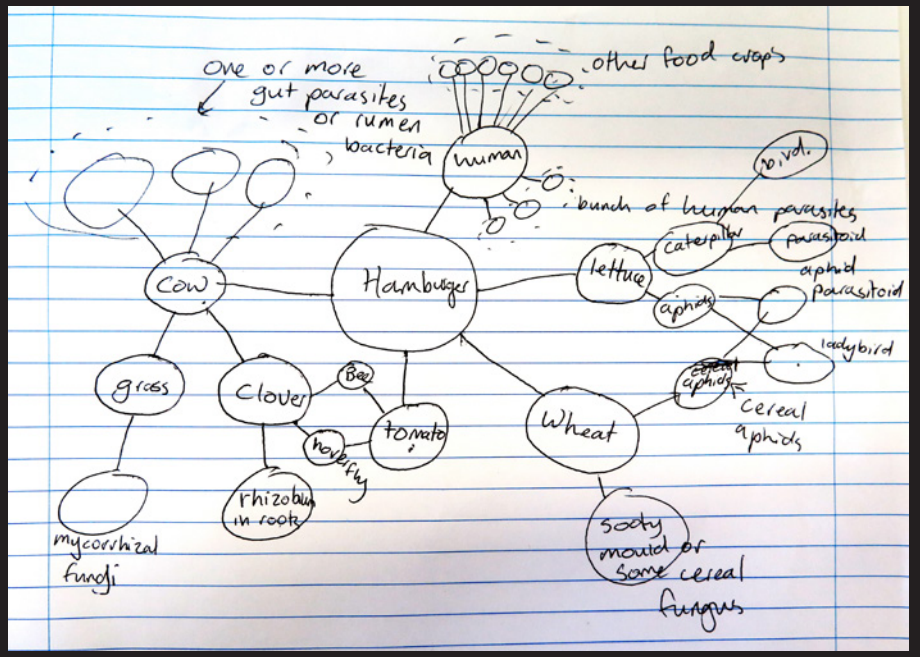
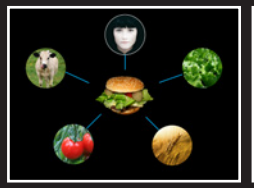
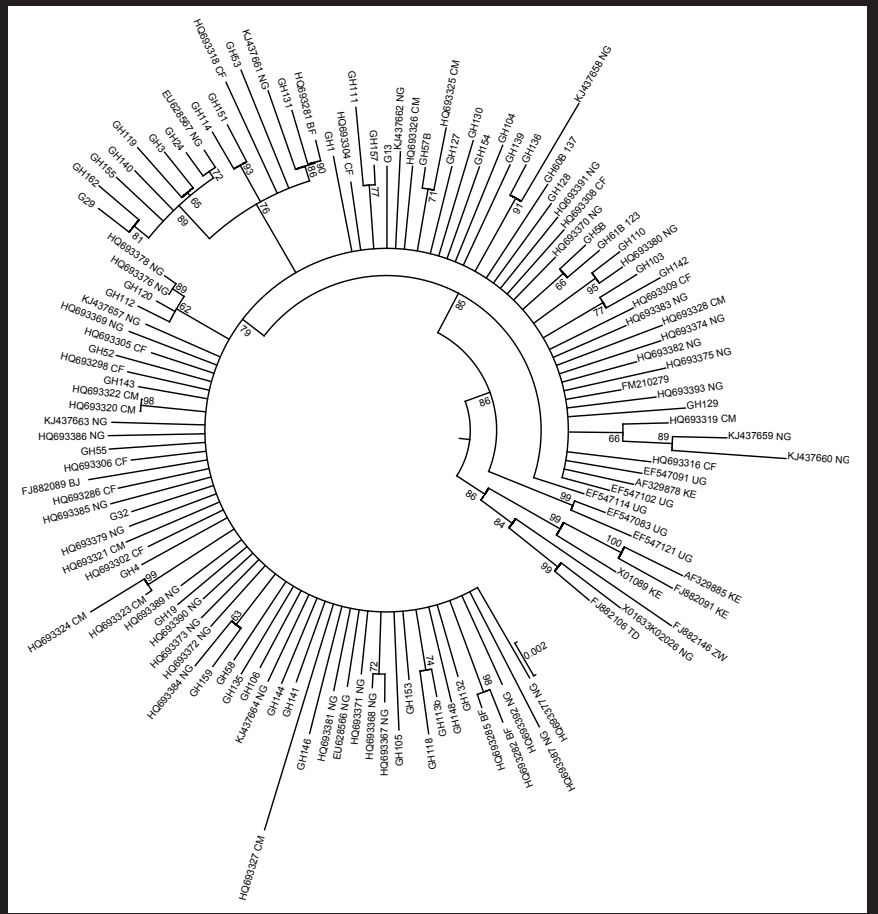
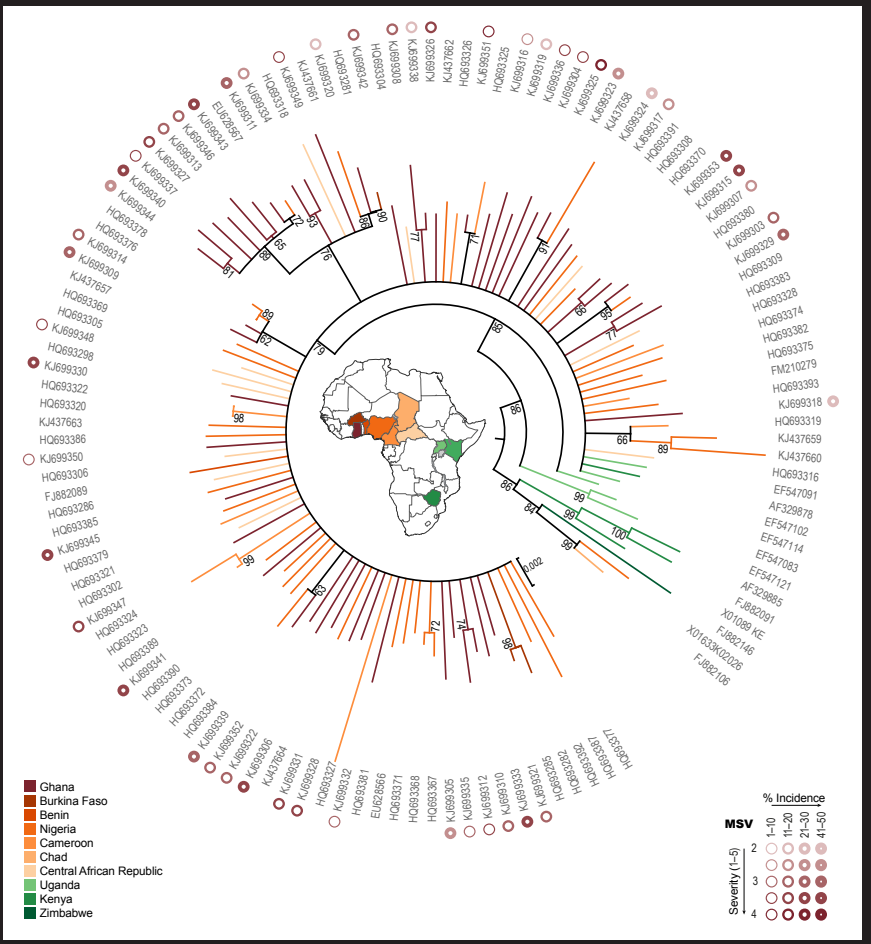


Figure 1. *Gastrodia* spp. flowers. *Lasioglossum sordidum* on *G.* "long column" at Victoria (a) in January 2012 and (b) January 2013. Sectioned flowers of (c) *G.* "long column" from Victoria (January 2013) and (d) *G. cunninghamii* from Little Hagley Park (November 2013), with arrows pointing to the column (C) and labellum (L). Photos by Dave Kelly.

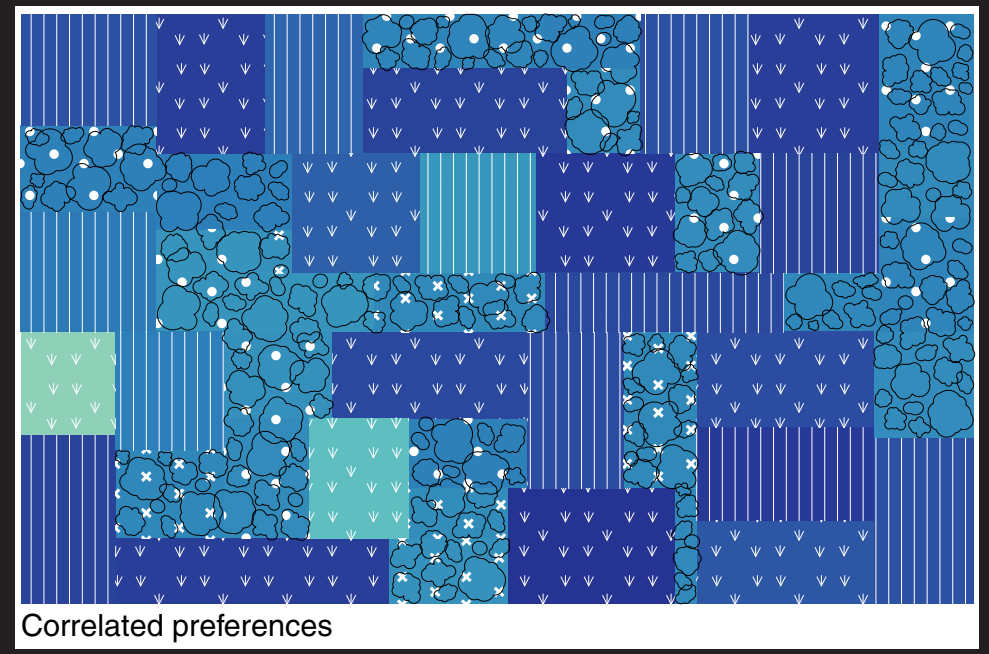

one or more gut parasites or rumen bacteria
other food crops
human
a bunch of human parasites
cow
Hamburger
lettuce
caterpillar
parasitoid
aphids
aphid parasitoid
ladybird
grass
Clover
Bee
tomato
hoverfly
Wheat
cereal aphids
rhizobium in root
mycorrhizal fungi
sooty mould or some cereal fungus

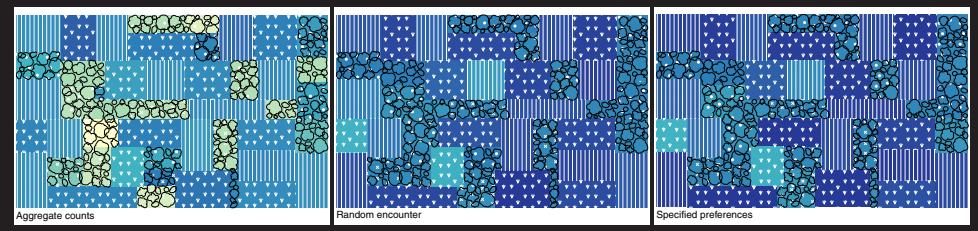


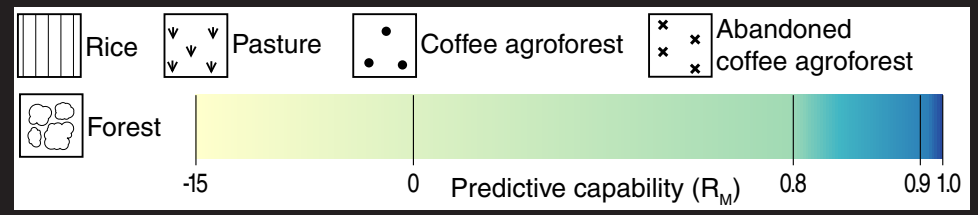



Ghana
Burkina Faso
Benin
Nigeria
Cameroon
Chad
Central African Republic
Uganda
Kenya
Zimbabwe
% Incidence
MSV
Severity (1–5)
1–10
11–20
21–30
41–50
0.002

	A	B	C	D	E	F	G	H
1		Habitat.type	Percentage	thousand	field	modeltype	uncertainty	rescaled_uncertainty
2	1	Pasture	2.950913679	295	5	aggregate.counts	0.0430204	0.939739085
3	2	Forest	1.224992759	122	29	aggregate.counts	-3.861099	0.681567295
4	3	Coffee agroforest	1.794463526	179	39	aggregate.counts	-4.013769	0.671471526
5	4	Pasture	2.680595668	268	8	aggregate.counts	0.6791334	0.981803995
6	5	Coffee agroforest	1.918213533	192	46	aggregate.counts	-0.7845946	0.885010522
7	6	Forest	1.838630787	184	25	aggregate.counts	-3.070339	0.733858709
8	7	Coffee agroforest	0.9205482	92	43	aggregate.counts	-10.10873	0.268423661
9	8	Coffee agroforest	1.092002484	109	42	aggregate.counts	0.2182619	0.951327463
10	9	Pasture	3.178122818	318	3	aggregate.counts	0.2702955	0.954768343
11	10	Rice	2.272650222	227	19	aggregate.counts	-0.1827982	0.924806142
12	11	Pasture	3.07794736	308	2	aggregate.counts	0.4990667	0.969896536
13	12	Rice	2.685755746	269	13	aggregate.counts	-0.05004347	0.933584953
14	13	Rice	2.94095269	294	15	aggregate.counts	-0.03143445	0.934815531
15	14	Rice	2.830950924	283	17	aggregate.counts	-0.1070577	0.929814713
16	15	Coffee agroforest	2.080282028	208	41	aggregate.counts	-1.295119	0.85125054
17	16	Abandoned coffee agroforest	0.9205482	92	33	aggregate.counts	0.48552	0.969000719
18	17	Rice	2.680595668	268	22	aggregate.counts	0.6080612	0.977104129
19	18	Pasture	2.614916218	261	7	aggregate.counts	0.04830815	0.940088753
20	19	Forest	1.012419738	101	28	aggregate.counts	-5.604461	0.566282171
21	20	Rice	2.934218322	293	24	aggregate.counts	0.3302136	0.95873061







BIC
BIOMOLECULAR
INTERACTION
CENTRE

Centre for Integrative Ecology

Biomolecular
Interaction Centre

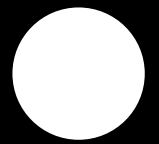
Centre for Integrative Ecology
School of Biological Sciences

CAREX
Canterbury Waterway
Rehabilitation Experiment

How.

Know your message

Start at the end

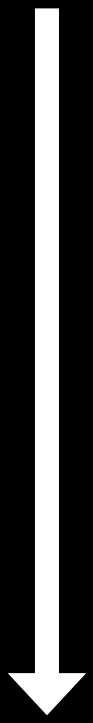


Remove
the junk

Save the rainbows

What the font

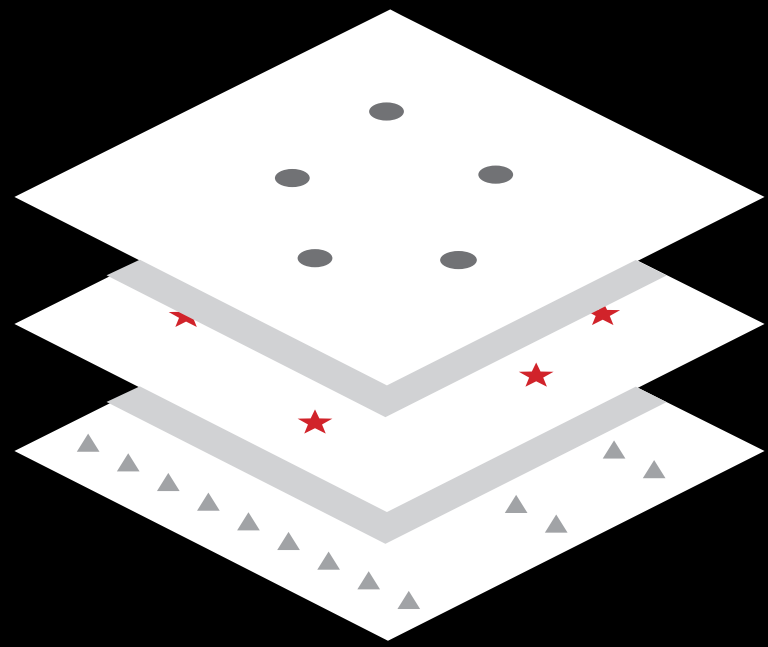
→ Make it flow



Diminish

the low value stuff

Layer the information



Understand
file formats

Be consistent