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Dynamics of plant communities and the impact of saltwater intrusion on the floodplains of Kakadu National Park

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Supplementary material

Table S1. Salinity units used in the literature, and conversions

Conversions salinity units	
* 100 mM NaCl = 5845 mg L^{-1}	
mg L^{-1} = milligrams per litre	
'm' in 'mM' means 'milli'	
M in 'mM' means molar… molarity is 'moles per litre'	
* 1 g L^{-1} = 1000 mg L^{-1}	
'g' = gram	
L = litre	
* 1 mg L^{-1} = 0.001 ppt = 1 ppm	Source: http://www.4oakton.com/TechTips/OAK_TT17.pdf (accessed 15 October 2016)
ppt = parts per thousand	
* 1 mg L^{-1} = 2 µS cm^{-1}	Source: http://www.biophysica.com/conductivity.html (accessed 15 October 2016)
µS cm^{-1} = microsiemens per centimetre	
* 1 dS m^{-1} = 1000 µS cm^{-1}	Source: DAFF
1 dS m^{-1} = 500 mg L^{-1}	
* mol m^3 to mg L^{-1}	
1 mol L NaCl = 58 460 mg L^{-1} NaCl	
100 mol m^{-3} = 0.1 mol L^{-1}	
100 mol m^{-3} = 5846 mg L^{-1}	
1 mg g^{-1} = 1000 mg kg^{-1} = 1000 ppm	

Table S2. Summary of literature review of salinity tolerances of floodplain plants whose genera or species are found on Kakadu National Park (KNP; from Bayliss *et al*. 2015)

Note this is not a complete list of all floodplain plant species in the region

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
	X	*Aeluropus*	Mediterranean saltgrass	*Aeluropus littoralis*	450 mM and 650 mM NaCl = 26.33 and 38.03 ppt	Increased electrolyte; leakage of leaves; increased enzymatic activities in roots; decreased enzymatic activities in shoot.	Modarresi *et al*. (2014)	26.33	38.03	32.18
X (genus)		*Aeschynomene*	Virginia jointvetch and sensitive jointvetch	*Aeschynomene virginica*	Higher than 1.0% (~0.8 MPa)	1.0% (~0.8 MPa) caused a significant decrease in germination percentage of seeds. Incubating seed in 2.0% NaCl for 5 days or longer caused a significant decline in germination or viability, and all seeds incubated for 20 or 30 days lost viability.	Baskin, *et al*. (1998)	13.7	13.7	13.7
	X	*Alternonthera*	Alligator weed	*Alternonthera philoxeroides*	3.6 g L^{-1} = 3.6 ppt	Declined in abundance with the hurricane, but showed a strong increase the following year	Chabreck and Palmisano (1973)	3.6	3.6	3.6
X (genus)		*Alysicarpus*	Buffalo clover	*Alysicarpus vaginalis*	0.8–1.0 ppm = 0.0008–0.001 ppt	A decrease in the amount of soluble sugars and starch were found in the plants of the saline habitat. However, a higher proline content was recorded in leaves of plants growing in the saline habitat, as well as occurred an increase in contents of nitrogen and ascorbic acid. These change in chemical composition are a physiological adaptation to overcome the salt stress.	Chandrashekar, and Sandhyarani (1994)	0.0008	0.001	0.0009
	X	*Amorpha*	Bastard indigobush	*Amorpha fruticosa*	From 2 to 10 mg g^{-1} = from 2 to 10 ppt	Under 2–10 mg g^{-1} (2–10 ppt) NaCl stress conditions, height increment and dry weight of whole plant of seedling generally lower and generally decrease with enhancing of NaCl concentration.	Xiu-jun *et al*. (2011)	2	10	6

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
X (species)		*Asclepias*	Milkweed	*Asclepias syriaca*	Lower than 70 mM NaCl = 4.1 ppt	Seeds had shorter roots in the salt treatment than in the control treatment.	Beaton and Dudley (2004)	4.1	4.1	4.1
	X	*Bacopa*	Brahmi	*Bacopa monnieri*	3.6 g L^{-1} = 3.6 ppt	Showed little effect of the hurricane.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
	X	*Baumea*	Fine Twig-sedge	*Baumea arthrophylla*	Lower than 8000 mg L^{-1} = 8 ppt	100% survival and can tolerate exposure for up to 6 weeks in saline conditions.	Goodman *et al*. (2010)	8	8	8
X (species)		*Brachiaria*	Koronivia grass	*Brachiaria humidicola*	From 2 dS m^{-1} to 16 dS m^{-1} = from 0.5 to 8 ppt	*Brachiaria humidicola* showed tolerance to salinity when subjected to 4 g L^{-1} (4 ppt). The soil salinity reduced plant height, as well as the percentage of root and shoot dry matter. Now *Urochloa humidicola*	Mergulhao *et al*. (2001)	0.5	8	4.25
	X	*Carthamus*	Safflower	*Carthamus tinctorius varieties: Jawhara 104*	From 0 to 15 g L^{-1} NaCl = from 0 to 15 ppt	0–10 g L^{-1} NaCl (0–10 ppt). Phenols, flavonoids, condensed tannis and carotenoid contents increased with salinity. 10 g L^{-1} NaCl (10 ppt). Reduced plant height by 16.3% (104) and 17.4% (Jawhara) and reduced significantly seeds number by 28.7% (104) and by 29% (for Jawhara). Under 10 ppt. The flower head numbers reduced by 55.6% (for 104) and by 45.5% (for Jawhara). At 15 g L^{-1} NaCl (15 ppt). Reduced plant height by 27.5% (104) and 29.3% (Jawhara) and reduced seeds number by 48.1% (104) and 60.8% (Jawhara).	Salem *et al*. (2014)	15	15	15
X (genus)		*Cassia*	Senna	*Cassia floribunda*	From 2 to 10 mg g^{-1} = from 2 to 10 ppt	Under 2–10 mg g^{-1} (2–10 ppt) NaCl stress conditions, height increment and dry weight of whole plant of seedling are generally lower and generally decrease with an increasing NaCl concentration.	Xiu-jun *et al*. (2011)	2	10	6

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
	X	*Chloris*	Feather fingergrass and feather windmillgrass	*Chloris virgata*	From 0 to 250 mM NaCl = from 0 to 14.6 ppt	*C. virgata* seeds were significantly reduced at high salinities and high temperature (30°C); germination percentages dropped from 96.6% in 0 mM (0 ppt) to 87.3% in 250 mM (14.6 ppt) at 20°C.	Zhang, *et al*. (2013)	14.6	14.6	14.6
X (species)		*Cleome*	Sticky spider-flower	*Cleome viscosa*	75 Mm NaCl = 4.38 ppt	Salinity caused slightly higher reduction in plant height of *C. gynandra* than of *C. viscosa*. A small reduction in chlorophyll content was observed in *C. viscosa* after 15 days of NaCl treatment. Proline content in roots, stems and leaves of both species was generally unaffected by NaCl treatment. Secondary oxidative stress responses were more affected in *C. viscosa* than *C. gynandra*. Significant reductions in leaf thickness, petiole and root diameters, and root vascular cylinder were observed in *C. viscosa*. The results suggested that *C. gynandra* was more tolerant of salt stress than was *C. viscosa*.	Kulya *et al*. (2011)	4.38	4.38	4.38
X (genus)		*Cleome*	Shona cabbage or African cabbage	*Cleome gynandra*	75 Mm NaCl = 4.38 ppt	Salinity caused slightly higher reduction in plant height of *C. gynandra* than *C. viscosa*. A small reduction in chlorophyll content was observed in *C. viscosa* after 15 days of NaCl treatment. Proline content in roots, stems and leaves of both species was generally unaffected by NaCl treatment. Secondary oxidative stress responses were more affected in *C. viscosa* than *C. gynandra*. Significant reductions in leaf thickness, petiole and root diameters, and root vascular cylinder were observed in *C. viscosa*. The results	Kulya *et al*. (2011)	4.38	4.38	4.38

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						suggested that *C. gynandra* was more tolerant of salt stress than was *C. viscosa*.				
	X	*Crambe*	Sea kale	*Crambe maritima*	From 100 to 400 mM = from 5.85 to 23.4 ppt	*C. maritima*. Showed the highest growth inhibition compared with the other two species and the measurement of biomass became difficult starting from 200 mM (11.7 ppt) because of the death of plants. Shoot and root biomass declined markedly at each salt concentration and root biomass could hardly be measured at 200 mM (11.7 ppt) or 400 mM (23.4 ppt).	Hamed *et al*. (2014)	5.85	23.4	14.63
X (species)		*Cressa*	Rudravanti	*Cressa cretica*	0, 425 and 850 mM NaCl = 0, 24.8 and 49.7 ppt	425 mM NaCl (24.8 ppt) promoted growth in comparison to non-saline control, whereas no significant difference was found between control and 850 mM NaCl (49.7 ppt) treatment. Rhizome length was greater at moderate salinity and there was no significant difference between the non-saline control and the high-salinity (850 mM, 49.7 ppt) treatments. Low salinity either had no effect or increased production of chlorophyll *a*. The highest salinity concentration (850 mM, 49.7 ppt) substantially inhibited chlorophyll *a* production. Seeds can germinate in up to 850 mM NaCl (49.7 ppt).	Khan and Aziz (1998)	24.8	49.7	37.25
X (species)		*Cyperus*	Yellow nutsedge	*Cyperus esculentus*	Lower than 7 dS m^{-1} = 3.5 ppt	Salinity was significant for yellow nutsedge. Plants had significantly lower maximum height or stem diameter than plants irrigated with freshwater. The average maximum height of yellow nutsedge decreased from 31.1 to 17.2 cm when the salinity of the irrigation	Papiernik *et al*. (2003)	3.35	3.35	3.35

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						water was increased from 2 to 7 dS m^{-1} (from 1 to 3.5 ppt). Increasing salinity decreased the average maximum stem diameter from 4.6 to 3.2 mm.				
X (genus)		*Desmodium*	Greenleaf desmodium	*Desmodium intortum*	From 0.01 to 37.2 dS m^{-1} = from 0.005 to 18.6 ppt	Germination rates declined with an increasing salinity. Although greenleaf desmodium was slightly more salt tolerant than was silverleaf desmodium at the germination stage, both had very low tolerance to salinity. The salinity levels that reduced germination by 50% in greenleaf and silverleaf were 4.8 dS m^{-1} (2.4 ppt) and 3 dS m^{-1} (1.5 ppt) respectively.	Esechie (1994)	0.005	18.6	3.35
X (genus)		*Desmodium*	Silverleaf desmodium	*Desmodium unicatum*	From 0.01 to 37.2 dS m^{-1} = from 0.005 to 18.6 ppt	Germination rates declined with increasing salinity. Although greenleaf desmodium was slightly more salt tolerant than silverleaf desmodium at the germination stage, both had very low tolerance to salinity. The salinity levels that reduced germination by 50% in greenleaf and silverleaf were 4.8 dS m^{-1} (2.4 ppt) and 3 dS m^{-1} (1.5 ppt) respectively.	Esechie (1994)	0.005	18.6	3.35
X (genus)		*Digitaria*	Hairy crabgrass or large crabgrass	*Digitaria sanguinalis*	From 11.7 to 14.6	*D. sanguinalis*. At high salinities of 200 and 250 mM (11.7 and 14.6 ppt), germination percentages were greatly reduced, with 45% of germination in the 250 mM (14.6 ppt) at 20°C. *D. sanguinalis* seeds may have lower capacity to regulate their internal osmotic potential, or have, membranes and enzymes less resistant to salt, and are thus less salt tolerant than the halophytic *C. virgata.*	Zhang *et al*. (2013)	11.7	14.6	3.35

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KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
X (genus)		*Echinochloa*	Coast Cockspur Grass	*Echinochloa walteri*	3.6 g L^{-1} = 3.6 ppt	Showed little effect of the hurricane	Chabreck and Palmisano (1973)	3.6	3.6	3.6
X (genus)		*Echinochloa*	Barnyard grass	*Echinochloa crus-galli*	From 1 to 24 dS m^{-1} = from 0.5 to 12 ppt	Barnyard grass plant height decreased by 42 at 18 dS m^{-1} (9 ppt). Shoot of barnyard grass, declined by only 24% at 12 dS m^{-1} (6 ppt). Leaf production in barnyard grass decreased by 50% from 18 dS m^{-1} (9 ppt) to 24 dS m^{-1} (12 ppt).	Chauhan *et al.* (2013)	0.5	12	6.25
X (species)		*Echinochloa*	Junglerice	*Echinochloa colona*	From 1 to 24 dS m^{-1} = from 0.5 to 12 ppt	Junglerice plant height decreased by 52% at 18 dS m^{-1} (9 ppt) Junglerice shoot biomass was not influenced by salinity up to 6 dS m^{-1} (3 ppt), but after that, it decreased with incresing salinity. Junglerice shoot biomass declined by 73% at 18 dS m^{-1} (9 ppt).	Chauhan *et al.* (2013)	0.5	12	6.25
X (species)		*Eclipta*	False daisy	*Eclipta prostrata*	From 0 to 250 mM = from 0 to 14.6 ppt	Germination was greater than 83% up to the concentration of 8.8 ppt; 37% germination occurred at 200 mM (11.7 ppt), and completely inhibited at 250 mM (14.6 ppt).	Chauhan and Johnson (2008*a*)	14.6	14.6	14.6
	X	*Eichhornia*	Water hyacinth	*Eichhornia crassipes*	3.6 g L^{-1} = 3.6 ppt	Were fairly common before the storm but were not found on the transects immediately after and had not reappeared as late as 1 year after the hurricane	Chabreck and Palmisano (1973)	3.6	3.6	3.6
X (species)		*Eleocharis*	Chinese Water Chestnut	*Eleocharis dulcis*	Lower than 5 dS m^{-1} = 2.5 ppt	This salinity value 5 dS m^{-1} or higher (2.5 ppt or higher) will reduce germination and also reduce plant growth and corm production. It is suggested that cultivated Chinese waterchestnut has only slight to moderate tolerance to salinity.	Snyder and Sanchez (1990)	2.5	2.5	2.5
X (genus)		*Eleocharis*	Spike-rush	*Eleocharis acuta*	2000 mg L^{-1} = 2 ppt	Reduced in height because the stems died. After 63 and 72 days, one plant at	James and Hart (1993)	2	2	2

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						each salinity above 2000 mg L^{-1} (2 ppt) died.				
X (genus)		*Eleocharis*	Sedge	*Eleocharis sp.*	3.6 g L^{-1} = 3.6 ppt	Showed little effect of the hurricane.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
X (genus)		*Eleocharis*	Spike-rush	*Eleocharis palustris*	6 or 12 g L^{-1} = 6 or 12 ppt	Aboveground biomass was significantly reduced in 12 g L^{-1} (12 ppt) salinity. Total stem height in *Eleocharis* was reduced by all salinity treatments at about the same time.	Howard and Mendelssohn (1999)	6	12	9
X (genus)		*Eragrostis*	Gophertail lovegrass	*Eragrostis ciliaris*	0–15 dS m^{-1} = 0–7.5 ppt	Rate of germination decreased with an increasing salinity, whereas rate of recovery increased with an increasing salinity.	Shaikh *et al*. (2013)	0	7.5	3.75
X (genus)		*Euphorbia*	Sea spurge	*Euphorbia paralias*	0, 200 and 400 mM = 0, 11.7 and 23.4 ppt	The decrease in chlorophyll-*a* and -*b* and carotenoids in response to soil salinity stress was found to be more than that caused by seawater spray. Plant dry weight increased from the first to the third week of plant growth, but this increase was greatly affected by both soil salinity and seawater spray treatments by the fourth week. The decrease in leaf and stem dry weights were more affected by soil salinity than by seawater spray treatments. Seawater spraying was found to decrease leaf and stem dry weights under control but increased their dry weight slightly under 200 mM (11.7 ppt) and 400 mM (23.4 ppt) soil-salinity treatments.	Elhaak *et al*. (1997)	11.7	23.4	17.55
X (genus)		*Fimbristylis*	Forked fimbry	*Fimbristylis dichotoma*	0, 100, 200 mM	Shoot parameters like length and fresh and dry weights increased at 100 mM (5.8 ppt) level, but significantly decreased at 200 mM (11.7 ppt). Shoot	Zahoor *et al*. (2012)	5.8	11.7	8.75

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						length was relatively more affected than was the overall plant biomass.				
					NaCl = 0, 5.8 and 11.7 ppt	Root length significantly increased at 100 mM (5.8 ppt), but 200 mM (11.7 ppt) imposed a negative effect on root length in *F. dichotoma.* Root fresh and dry weights, however, increased significantly with a gradual increase in salt concentration of the cultural medium. All pigments decreased consistently with increasing in external salt level.				
X (species)		*Heliotropium*	Indian heliotrope	*Heliotropium indicum*	0–250 mM NaCl = 0–14.6 ppt	Seed germination of Indian heliotrope was very tolerant of high concentrations of NaCl. Seed germination at the highest concentration – 250 mM (14.6 ppt) was 84 ± 1.6%. Although a significant amount of seeds germinated at 200 (11.7 ppt) and 250 mM NaCl (14.6 ppt), the radicles of the germinating seeds were often discolored and shorter than those of seeds incubated at lower concentrations of NaCl.	Chauhan and Johnson (2008*b*)	14.6	14.6	14.6
X (genus)		*Hibiscus*		*Hibiscus hamabo*	From 2 to 10 mg g^{-1} = from 2 to 10 ppt	Under 2–10 mg g^{-1} (2–10 ppt) NaCl stress conditions, height increment and dry weight of whole plant of seedling are generally lower and generally decrease with enhancing of NaCl concentration	Xiu-jun *et al*. (2011)	2	10	6
X (species)				*Leersia hexandra*		Field observation around Darwin Harbour, 250 km west Kakadu Region.	Cowie (2003)			0.15
X (genus)			Rice cut grass	*Leersia oryzoides*		Field observation, grows in brackish water (Vaughan 1989). *L. oryzoides* (var. *oryzoides f. glabra*) reported to grow in saltwater. Brackish water 0.05–35 ppt.	Vaughan (1989) Pyrah (1969)	0.05	35	17.52

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
X (species)		*Ipomoea*	Water spinach	*Ipomoea aquatica*		That of leaves, stems, and roots of water spinach was markedly decreased ($P < 0.05$) with an increased salinity. The leaf water potential (LWP) and osmotic potential (OP) decreased with an increasing salinity. In conclusion, the growth of water spinach was markedly decreased under saline conditions	Yousif *et al*. (2010)	1	1	1
	X	*Matricaria*	Seashore or wild chamomile	*Matricaria maritima*	From 100 to 400 mM = from 5.85 to 23.4 ppt	*M. maritima*. Fresh weight and dry weight decreased by 10 and 31% at 100 mM (5.85 ppt) and 200 mM (11.7 ppt) and by 87% at 400 mM (23.4 ppt). Shoot and root did not change so much at an increasing salt level.	Hamed *et al*. (2014)	5.85	23.4	14.63
X (genus)		*Melaleuca*	Swamp paperbark	*Melaleuca ericifolia*	2, 49 and 60 dS m^{-1} = 1, 24.5 and 30 ppt	All plants had survived by week 10 in the 2 dS m^{-1} (1 ppt) salt treatment	Salter *et al*. (2007)		1	1
					Survisorship declined >1 ppt	Survivorship declined as salinity increased and the effects of water depth become apparent. At 49 dS m^{-1} (24.5 ppt) all waterlogged plants and half of the submerged plants had died by Week 10, but no plants died in the exposed treatment. At 60 dS m^{-1} (30 ppt), all plants in the waterlogged and submergerd treatements died soon after week 5, and only 10% of plants in the exposed treatment had died by Week 10. Both salinity and water depth significantly reduced plant height. Total plant biomass generally declined as salinity and water depth increased.				
X		*Mimosa*	Mimosa	*Mimosa pigra*		Woody shrub, introduced weed.	Miller (1983)			17.5

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
(species)						Tolerates moderate level salinity (50%), assumed that it's half of sea water at 35 ppt (i.e. 17.5 ppt).				
X		*Melaleuca*	Swamp paperbark	*Melaleuca* spp. Various species	72 mS cm^{-1} or ~0.46 ppt	Maximum salt level set for seedling survival and height.	Niknam and McComb (2000)			0.46
X (genus)		*Melochia*	Redweed	*Melochia concatenata*	0–250 mM Nacl = 0–14.6 ppt	Redweed germination was greater than 91% up to a concentration at 150 mM (8.8 ppt), although germination was completely inhibited at 250 mM NaCl (14.6 ppt).	Chauhan and Johnson (2008*c*)	0	14.6	7.3
X (genus)		*Myriophyllum*	Myrio Filigree	*Myriophyllum simulans*	Lower than 8000 mg L^{-1} = 8 ppt	100% survival and can tolerate expusure for up to 6 weeks in saline conditions.	Goodman *et al*. (2010)	8	8	8
X (genus)		*Myriophyllum*	Upright Water-milfoil	*Myriophyllum crispatum*	2000 mg L^{-1} = 2 ppt	Plant at 1000 mg L^{-1} (1 ppt) salinity increased in length; Plants grown at 2000 (2 ppt) and 3500 mg L^{-1} (3.5 ppt) increased in length to 42 days and decreasing thereafter; for salinities 5000 (5 ppt), 6000 (6 ppt) and 7000 mg L^{-1} (7 ppt) the length decreased after 22 days. An initial increase in shoot numbers followed by a decrease occurred at salinities of 2000 (2 ppt) and 3500 mg L^{-1} (3.5 ppt) and at salinities of 5000 (5ppt), 6000 (6 ppt) and 7000 mg L^{-1} (7 ppt) occurred no increase in shoot number and had a mean of less than the initial two shoots. After 72 days, 8, 28 and 48% of the plants grown in salinities of 5000 (5 ppt), 6000 (6 ppt) and 7000 (7 ppt) respectively died.	James and Hart (1993)	2	2	2
X (genus)		*Myriophyllum*	Watermilfoil	*Myriophyllum* sp.	4000 mg L^{-1} = 4 ppt	This genus disappears in salinities above 4000 mg L^{-1} (4 ppt) and are replaced by halophytic species such as *Ruppia* spp. and *Lepileana* spp.	Nielsen *et al*. (2003)	4	4	4

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
X (species)		*Oryza*	Asian Rice	*Oryza sativa*	Lower than 40 mM NaCl = 2.34 ppt	Reduction in the number of tillers.	Munns and Tester (2008)	2.34	2.34	2.34
X (genus)		*Panicum*	Torpedo Grass	*Panicum repens*	3.6 g L^{-1} = 3.6 ppt	Declined in the relative abundance 3 weeks after the storm	Chabreck and Palmisano (1973)	3.6	3.6	3.6
X (genus)		*Panicum*	Maidencane	*Panicum hemitomon*		Were fairly common before the storm but were not found on the transects immediately after and had not reappeared as late as 1 year after the hurricane	Chabreck and Palmisano (1973)			12
X (genus)		*Panicum*	Maidencane	*Panicum hemitomon*	6 or 12 g L^{-1} = 6 or 12 ppt	Total stem height effects were a reduction in the 12 g L^{-1} (12 ppt) treatments for all species. *Panicum* exhibited above-ground mortality in the 12 g L^{-1} (12 ppt) treatments. *Panicum* displayed depression of total stem height earlier in the 12 g L^{-1} (12 ppt) treatments than in the 6 g L^{-1} (6 ppt).	Howard and Mendelssohn (1999)	6	12	9
X (genus)		*Paspalum*	Seashore paspalum	*Paspalum vaginatum:* Salam Excalibur Adalayd	From 2.2 to 54 dS m^{-1} = from 1.1 to 27 ppt	Salam was found to have superior salt tolerance compared to the others. Excalibur also exhibited high salinity tolerance and both were better than Adalayd. Under the highest salinity (54 dS m^{-1}, 27 ppt), Salam showed the lowest leaf firing percentage (80%) followed by Excalibur (90.5%) and Adalayd showed 100% leaf firing. Only Salam showed acceptable turf quality at salinity level 32 dS m^{-1} (16 ppt). Salam and Excalibur quality declined less severely with increasing salinity, whereas Adalayd had the poorest quality	Shahba (2010)	1.1	27	14.05

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						among all cultivars. Adalayd exhibited a decrease in root mass as salinity increased from 16 to 32 dS m^{-1} (from 8 to 16 ppt). At higher salinity (54 dS m^{-1}, 27 ppt), Salam exhibited the highest root activity among all cultivars and maintained an increasing linear trend.				
X (genus)		*Physalis*		*Physalis ixocarpa* *Physalis peruviana*	0–180 mM NaCl = 0–10.5 ppt	Germination percentages of both species significantly decreased with increasing salt stress. The greatest final germination percentage (FGP) at 180 mM NaCl (10.5 ppt) was obtained from *P. peruviana* with 72%. Elevated NaCl concentrations from 0 mM to 180 mM (from 0 to 10.5 ppt) increased the mean germination time (MGT) in both species. *P. Peruviana* gave the fastest germination rate values compared with those of *P. ixocarpa* in all NaCl concentrations. Final emergence percentage (FEP) values of *P. peruviana* and *P. ixocarpa* were reduced by 59 and 47% at 30 mM (1.8 ppt) and 100 and 62% at 60 mM (3.5 ppt), respectively and both species did not show emergence at 90 (5.3 ppt), 120 (7 ppt), 150 (8.8 ppt) and 180 mM NaCl (10.5 ppt). Salt stress significantly affected fresh weight and dry wieght of both species seedling. Plant fresh weight of *P. Peruviana* and *P. ixocarpa* were reduced by 75 and 60% at 30 mM (1.8	Yildirim *et al*. (2011)	10.5	10.5	10.5

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						ppt) and 100 and 72% at 60 mM (3.5 ppt) respectively.				
	X	*Pistia*	Water Lettuce	*Pistia stratiotes*	830 mg L^{-1} = 0.83 ppt 2500 mg L^{-1} = 2.5 ppt	Reduction in biomass at 830 mg L^{-1} (0.83 ppt). Increase in mortality at 2500 mg L^{-1} (2.5 ppt).	Haller *et al*. (1974)	2.5	2.5	2.5
	X	*Patamogeton*	Potamogeton tricarinatus	*Potamogeton tricarinatus*	2000 mg L^{-1} = 2 ppt	Shoot numbers increased after the first 12 days for all plants grown at salinities lower than 5000 (5 ppt). The number of shoots in plants grown at 2000 (2 ppt) and 3500 mg L^{-1} (3.5 ppt) began to decline after 42 days; for plants grown at 5000 (5 ppt), the number of shoots started to decline after 33 days. Plants grown at salinities higher than 1000 (1 ppt) were reduced to green stems with or without submerged leaves. Mortality was high for plants grown at 5000 mg L^{-1} (5 ppt), 4% died after 42 days and 44% after 72 days.	James and Hart (1993)	2	2	2
	X	*Sagittaria*		*Sagittaria falcata*	3.6 g L^{-1} = 3.6 ppt	Showed little effect of the hurricane.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
	X	*Sagittaria*	Arrowhead	Freshwater Plants. e.g. *Sagittaria latifolia*	1000 mg L^{-1} = 1 ppt	Above 1000 mg L^{-1} (1 ppt), effects on aquatic plants appear, with reduced growth rates and reduced development of roots and leaves. High salinity is usually inhibitory and toxic to seed germination having significant impact when it exceeds 1000 mg L^{-1} (1 ppt). So germination of seeds decreases as salinity increases.	Nielsen *et al*. (2003)	1	1	1
	X	*Sagittaria*	Bulltongue arrowhead	*Sagittaria lancifolia*	6 or 12 g L^{-1} = 6 or 12 ppt	*Sagittaria* exhibited aboveground mortality in the 12 g L^{-1} (12 ppt) treatments. *Sagittaria* showed visible signs of stress with nrowning and curling of leaf edges.	Howard and Mendelssohn (1999)	12	12	12

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						Sagittaria displayed depression of total stem height earlier in the 12 g L^{-1} (12 ppt) treatments than in the 6 g L^{-1} (6 ppt).				
	X	*Salix*	White willow	*Salix alba*	Salinity 0–2	The difference in leaf number was not significant.	Markus-Michalczyk *et al*. (2014)			2.5
	X	*Salix*	Osier	*Salix viminalis*	From salinity 2	Root number and root dry mass were slightly higher at salinity 2 than 0. Number of leaves decreased after 7 weeks and number of roots decreased with further increasing salinity.	Markus-Michalczyk *et al*. (2014)			2.5
X (genus)		*Salvinia*	Floating watermoss	*Salvinia natans*	Lower than 50 mM NaCl = 2.93 ppt	Primary effects: ionic toxicity and osmotic stress. Secondary effects: inhibition of K+ uptake, membrane dysfunction and generation of reactive oxygen species in the cells.	Jampeetong and Brix (2009)	2.93	2.93	2.93
X						Salt flats and bare ground exposed to frequent tidal inundation are assumed to at least have water salinity values of seawater (35 ppt), although soil salinity can exceed this because of evaporation.	Field observations Kakadu Region.			35
			Salt marsh habitats		15–25 ppt	Salinity values for salt-marsh habitats used in experimental study ranged between 15 and 25 ppt.	Shen *et al*. (2015)	15	25	20
X(genus)		*Schenoplectus*	Sedge	*Schenoplectus juncoides*	0, 100, 200 mM	Shoot parameters like length and fresh and dry weights increased at 100 mM (5.8 ppt) level, but significantly decreased at 200 mM (11.7 ppt). Shoot length was relatively more affected than was overall plant biomass. Root length significantly increased at 100 mM (5.8 ppt), but 200 mM (11.7 ppt) imposed a negative effect on root length in *S. juncoides*	Zahoor *et al*. (2012)	5.8	11.7	8.75

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
					NaCl = 0, 5.8 and 11.7 ppt	Root fresh and dry weights, however, increased significantly with a gradual increase in salt concentration of the cultural medium. In *S. juncoides*, 100 mM (5.8 ppt) level significantly reduced chlorophyll and carotenoid contents, but further increase in salt concentration in the growth medium had non-significant effects.				
	X	*Scirpus*	Olney's three-square bulrush	*Scirpus americanus*	3.6 g L^{-1} = 3.6 ppt	Declined in abundance with the hurricane, but showed a strong increase the following year.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
	X	*Scirpus*	Salt Marsh Bulrush	*Scirpus robustus*	17.5 g L^{-1} = 17.5 ppt	Were fairly common before the storm but were not found on the transects immediately after and had not reappeared as late as 1 year after the hurricane.	Chabreck and Palmisano (1973)			17.5
	X	*Scirpus*	chairmaker's bulrush	*Scirpus americanus*	6 or 12 g L^{-1} = 6 or 12 ppt	Total height of *Scirpus* continued to increase in salinity treatments.	Howard and Mendelssohn (1999)	6	12	9
X (genus)		*Senna*	Chinese senna	*Cassia tora (Senna tora)*	From 2 to 10 mg g^{-1} = from 2 to 10 ppt	Under 2–10 mg g^{-1} (2–10 ppt) NaCl stress conditions, height increment and dry weight of whole plant of seedling are generally lower and generally decrease with enhancing of NaCl concentration.	Xiu-jun *et al*. (2011)	2	10	6
X (species)		*Sesbania*	Yellow Pea Bush	*Sesbania cannabina*	From 2 to 10 mg g^{-1} = from 2 to 10 ppt	Under 2–10 mg g^{-1} (2–10 ppt) NaCl stress conditions, height increment and dry weight of whole plant of seedling are generally lower and generally decrease with enhancing of NaCl concentration	Xiu-jun *et al*. (2011)	2	10	6
X (species)		*Sonneratia*	Mangroves		Field values from 17 to 50 ppt	Field measurements from species distribution patterns on the Adelaide River. Salinity values are for plots with	Ball (1998)	36.2	103.2	69.7

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						mangrove species (n = 8–15 per plot). Mean salinity values ranged between 36.2 ppt to 103.2 ppt.				
X (species)		*Sonneratia*	Mangrove	*Sonneratia Lanceolata*		Growth response to salinity in relation to distribution in northern Australia including the Kakadu Region. Found interspecific differences in salt tolerance. *S. alba* grew in salinities ranging from freshwater to seawater, with growth being maximal in 5–50% seawater.	Ball and Pidsley (1995)	16	35	25.5
X (species)			Mangrove	*Sonneratia Lanceolata*		In contrast to *S. alba* (see above), *S. lanceolata* grew in salinities ranging from 0 to 50% seawater, with maximal growth occurring in 0–5% seawater.	Ball and Pidsley (1995)	0	32	16
	X	*Sorghum*	Spear grass	*Sorghum* sp.	100 mol m^{-3} = 5.85 ppt	Shortened the growth zone and reduced the maximal growth rate of cells.	Volkmar *et al.* (1998)	5.85	5.85	5.85
	X	*Spartina*	Salt marsh cord grass	*Spartina alterniflora*	3.6 g L^{-1} = 3.6 ppt	Declined in the relative abundance 3 weeks after the storm.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
	X	*Sphaerophysa*	Alkali swainsonpea	*Sphaerophysa kotschyana*	150 mM and 300 mM NaCl = 8.78 and 17.55 ppt	*S. kotschyana* was able to withstand short-term low salinity 150 mM (8.78 ppt). However roots appear to be the most vulnerable part of this plant. Plants had more pronounced reductions in growth, relative water content (RWC), relative growth rate (RGR), photosynthetic efficiency and osmotic potential at 300 mM (17.55 ppt).	Yildiztugay *et al.* (2014)	8.78	17.55	13.17
	X	*Suaeda*	Seablites	*Suaeda aegyptiaca*	From 20 dS m^{-1} to 80 dS m^{-1} = from 10 to 40 ppt	Electrolyte leakage (EL) increase from 19% at 20 dS m^{-1} (10 ppt) to 23% at 40 and 60 dS m^{-1} (20 and 30 ppt). Up to 60 dS m^{-1} (30 ppt): decrease dry weight of plants. Between 60 and 80 dS m^{-1} (30 and 40 ppt), EL decreased and plant biomass	Zakery-Asl *et al.* (2014)	10	40	25

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						production showed no significant difference.				
X (genus)		*Tecticornia* (Family Chenopodiaceae)	Various samphire species	*Tectricornia pergranulata* *(was Halosarcia pergranulata)*		Nine species were tested to determine the effect of salt on seed germination. Upper limit 30 ppt chosen based on limits used in previous studies (Barrett 2000).	Purvis *et al*. (2009)			30
	X	*Tetragonia*	New Zealand spinach	*Tetragonia tetragonioides*	0, 50, 100 and 200 mM NaCl = 0, 2.9, 5.8 and 11.7 ppt	The dry weight of roots of New Zealand spinach increased at low salt level (50 mM, 2.9 ppt) and then decreased with increasing salinity; however, the dry weights of leaves and roots of this plant were still higher on 100 mM (5.8 ppt) and 200 mM (11.7 ppt) treatment than those in the control. The dry weight of stems was not affected by the salinity. The growth of New Zealand spinach was promoted under saline conditions, indicating that New Zealand spinach is halophytic.	Yousif *et al*. (2010)	2.9	11.7	7.3
X (species)		*Trianthema*	Horse Purslane	*Trianthema portulacastrum*	From 1 to 24 dS m^{-1} = from 0.5 to 12 ppt	The results suggest that horse purslane was the most tolerant species among the weeds and barnyardgrass and junglerice decreased in biomass and height of weed seedlings when salinity increased. Root biomass of horse purslane was not influenced by salinity up to 24 dS m^{-1} (12 ppt).	Chauhan *et al*. (2013)	0.5	12	6.25
X (genus)		*Triglochin*	Water-Ribbons	*Triglochin procerum*	Lower than 8000 mg L^{-1} = 8 ppt	100% survival and can tolerate exposure for up to 6 weeks in saline conditions.	Goodman *et al*. (2010)	8	8	8
X (genus)		*Triglochin*	Water-ribbons	*Triglochin procera*	2000 mg L^{-1} = 2 ppt	Leaf numbers decreased over the first 54 days and then remained constant. No plants died at any of the salinity	James and Hart (1993)	2	2	2

KNP Yes	No	Genus	Common name	Scientific name	Salinity-tolerance threshold level	Response or effect	Source	Min.	Max.	Mean
						treatments, although the leaves tended to become narrower as the salt concentration increased.				
	X	*Typha*	Narrow Leaf	*Typha angustifolia*	3.6 g L^{-1} = 3.6 ppt	Declined in abundance with the hurricane, but showed a strong increase the following year.	Chabreck and Palmisano (1973)	3.6	3.6	3.6
	X	*Vitis*	Wine Grape	*Vitis vinifera*	Lower than 75 mM NaCl = 4.39 ppt	Leaf burn and depression in shoot growth.	Downton (1977)	4.39	4.39	4.39
X			Riparian Vegetation, species not specified, emphasis on Victorian Species.		2000 mg L^{-1} = 2 ppt	Reduced growth and reproductive success or plant death that can be due to toxic effects or water deficiency.	Hart *et al*. (1991)	2	2	2
X			Macrophyte populations, species not specified		Increase in salinity of 2 ppt	Germination of many upper estuarine specie of submerged macrophyte, plants that can compete with seagrasses at the limits of salinity intrusion, has been shown most frequently to decrease with increasing salinity. Increase in salinity as a result of SLR can result in the reduction or elimination of populations of other macrophytes and a shift to seagrass communities.	Short and Neckles (1999)	2	2	2
X			Most submerged macrophytes		1500–3000 µS cm^{-1} = 0.75–1.5 ppt	Sublethal effects, lethal effects for some species.	James *et al*. (2003)	0.75	1.5	1.13
X			Aquatic plants in general		1 g L^{-1} = 1 to 4 ppt	Number of taxa will decreases in 30%. For salinity of 4 g L^{-1} (4 ppt) number of taxa decreases in 74%.	Nielsen and Brock (2009)	1	4	2.5

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Table S3. Salinity values (conductivity in microsiemens per centimetre) derived from fig. 1 in Cowie (2003), converted to parts per thousand, and water depth (m)

Data are from Wilson *et al*. (1991)

Code	Wetland plant-community class	Conductivity (μS cm^{-1})	Salinity (ppt)	Water depth (m)
1	*Pistia stratiotes–Nelumbo nucifera*	182.2	0.09	1.2
2	*Leersia hexandra–Actinoscirpus* spp.	303.5	0.15	0.9
3	*Hymenachne acutigluma*	154.3	0.08	0.7
4	*Oryza* spp.–*Pseudoraphis spinescens*	191.1	0.1	0.49
5	*Hymenachne acutigluma–Oryza* spp.	193.2	0.1	0.5
6	*Melaleuca leucadendra–E. sphacelata*	453.5	0.23	0.49
7	*Eleocharis spahacelata*	350	0.17	0.39
8	*Pseudoraphis spinescens–Eleocharis* spp.	97.5	0.05	0.19
9	*Urocloa mutica* (paragrass)	128.5	0.06	0.19
10	*Phragmites vallatoria*	297.9	0.15	0.19
11	*Scleria poaformis*	312.4	0.16	0.19
12	*Echnichloa polystachya–Leersia hexandra*	335.1	0.17	0.19
13	*Oryza* spp.–*Eleocharis* spp.	335.1	0.17	0.19
14	*Cyperus scarpiosus–Imperata* sp.	549.6	0.27	0
15	*Malachra fasciata–Cyprus scarpiosus*	696.5	0.35	0.09
16	*Eleocharis spiralis–Cyprus scarpiosus*	715.1	0.36	0.09
17	*Ischaemum australe*	739.9	0.37	0.09
18	*Paspaulm distichum*	946.5	0.47	0.09
19	*Leptochloa fusca–Eleocharis spiralis*	958.9	0.48	0.09
20	*Sporobolus virginicus*	1128.30	0.56	0.09
21	*Eleocharis dulcis–Monochoria hastata*	1421.90	0.71	0.19
22	*Schoennoplectus litoralis*	1558.20	0.78	0.19
23	*Xerochloa imberbis*	2100.00	1.02	0.09

http://dx.doi.org/10.1071/MF16148_AC

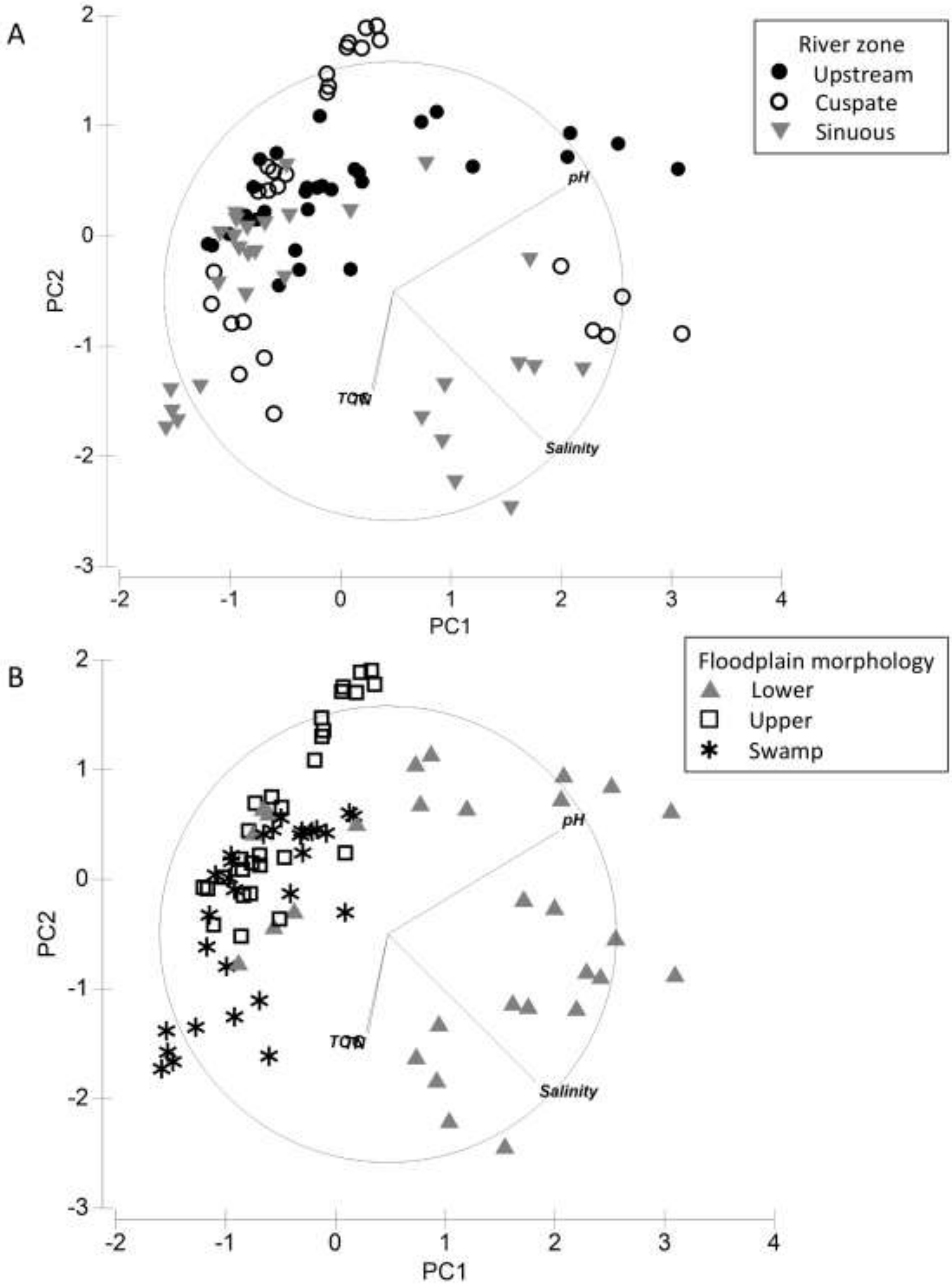

Fig. S1. Distribution maps for the dominant vegetation communities over 4 years.

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