

Methods of generating Kirkpatrick Marsh maps

1. Map resource (1972 and 2010)

Kirkpatrick Marsh late summer aspect 1972 (Fig. 1) from NASA contractor report '*Collection and analysis of remotely sensed data from the Rhode River Estuary Watershed*' 1973 (NASA CR-62094) and a snapshot of Kirkpatrick Marsh from Google earth 2010 late summer satellite image (Fig. 2) were used to generate the Kirkpatrick Marsh community maps. The characteristic locations (e.g. road, ditch marked with red arrows in Fig. 1) on NASA 1972 map and four place marks on Google earth 2010 image (Top left, Top right, Bottom right, and Bottom left points with longitude and latitude information) were applied for the Geo-reference to locate Kirkpatrick Marsh in ArcGIS.

2. Training point (Oct 2014)

A color map with a grid was printed and potential training points (which should be 'in the thick' of 7 categories of communities that we are interested in: C3 plant *Scirpus*, C4 plant *Spartina*, and *Scirpus* and *Spartina* mixed (regardless of % mixed), *Phragmites*, *Iva*, *Iva* mixed and boardwalk) were marked. In the field, a person with a GPS went to the potential training area and reported GPS information of the training points. The other person recorded the information and delineated polygons onto the map (mark the edge of different communities), using the grid on printed map to help with delineation of communities/changes. After field training, digitize and use training points in supervised classification (Fig. 3). The coordinates for the training points can be found in Table 1.

3. Delineating polygons in ArcGIS

After comparing the training map and Google earth 2010 late summer satellite image, we confirmed that the vegetation has unlikely changed drastically (all the training points in different communities in 2014 were located in the same communities on Google earth 2010 image). Therefore, we delineated polygons for each community (e.g. *Scirpus*, *Spartina*, *Scirpus* and *Spartina* mixed, *Phragmites*, *Iva*, *Iva* mixed and boardwalk) in ArcGIS by hand based on the community boundary on Google earth 2010 late summer satellite image and training map (Fig. 4). The polygons for each community (based on NASA's classification in 1972) was also delineated in ArcGIS by hand based on the community boundary on Kirkpatrick Marsh late summer aspect 1972 from NASA contractor report (Fig. 5). After delineating polygons, the polygons for the same community (with a unique color) were field added and named with the specific code. The field area for each community was calculated by ArcGIS. The results were exported as 'csv' file and for the further analyzing.

KIRKPATRICK MARSH LATE SUMMER ASPECT

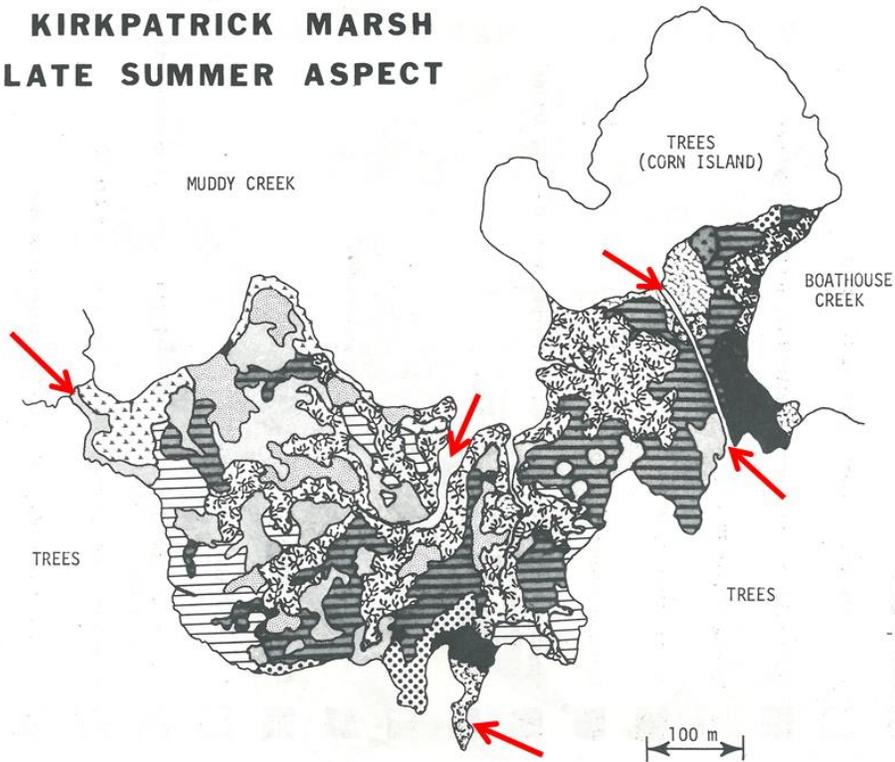


Fig. 1 Kirkpatrick Marsh late summer aspect 1972. (From NASA contractor report 'Collection and analysis of remotely sensed data from the Rhode River Estuary Watershed' 1973)



Fig. 2 A snapshot of Kirkpatrick Marsh from Google earth 2010 satellite image.



Fig. 3 GPS points of field training points at Kirkpatrick Marsh from Google earth 2010 satellite image.

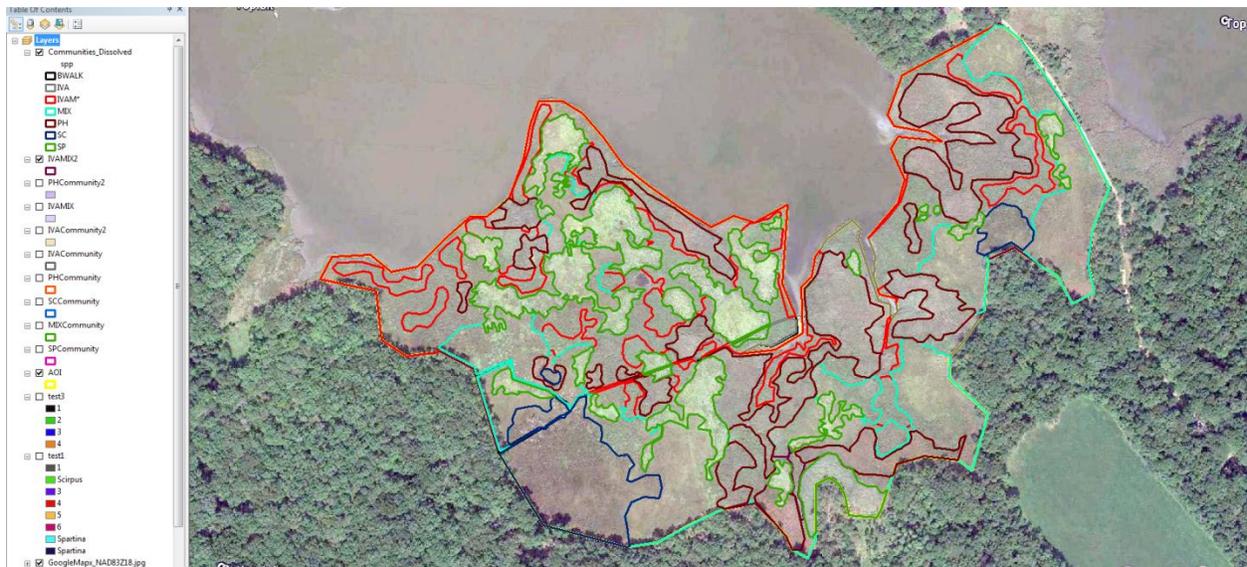


Fig. 4 Delineating polygons in ArcGIS by hand based on the community boundary on Google earth 2010 late summer satellite image and 2014 training map.

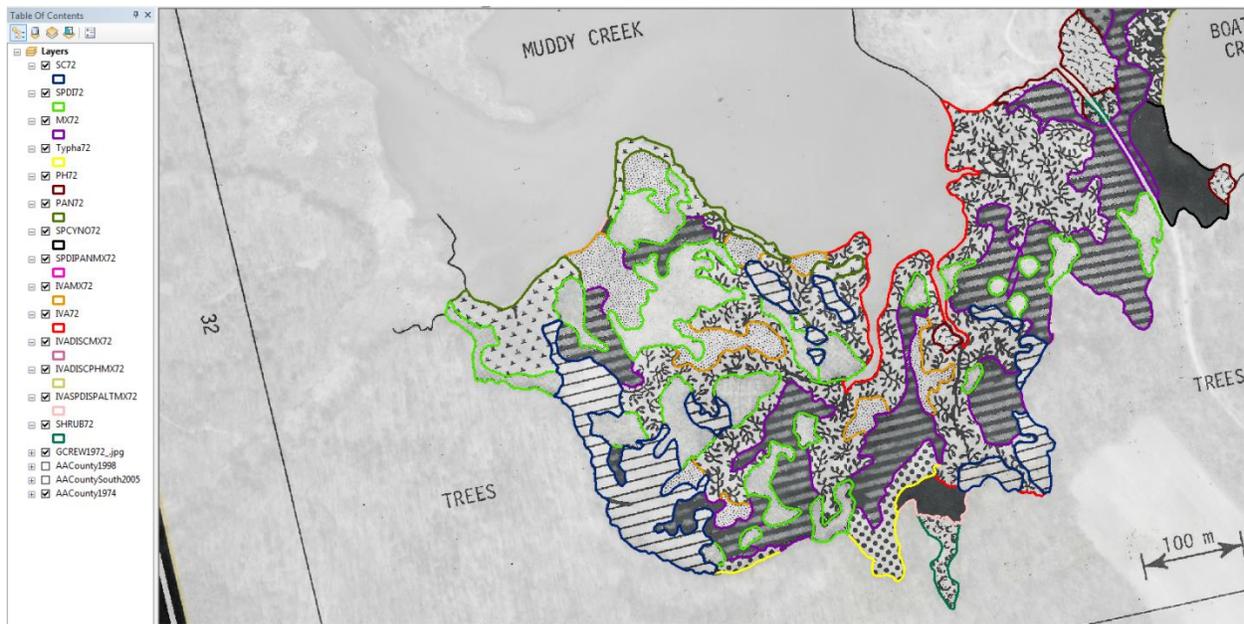


Fig. 5 Delineating polygons in ArcGIS by hand based on the community boundary on Kirkpatrick Marsh late summer aspect 1972 from NASA contractor report.

Table 1. Coordinates for GCREW Training Points

ID	Latitude	Longitude	Note
MX Edge	38.874739°	-76.550260°	The edge of Mixed Community
MX-1-1	38.874450°	-76.550130°	SC-SP Mixed Community
MX-1-2	38.874466°	-76.550020°	SC-SP Mixed Community
MX-1-3	38.874610°	-76.549870°	SC-SP Mixed Community
IVA start	38.874740°	-76.549570°	Start point of Iva community
MX-2-1	38.874130°	-76.548831°	SC-SP Mixed Community
MX-2-2	38.874110°	-76.548990°	SC-SP Mixed Community
SC Edge	38.874010°	-76.549550°	The edge of SC Community
SC-18-1	38.873880°	-76.549510°	SC Community
SC-18-2	38.873790°	-76.549350°	SC Community
SC-18-3	38.873880°	-76.549000°	SC Community
MX-SP Edge	38.873770°	-76.548390°	The edge of Mixed and SP Community
SP-13-1	38.874420°	-76.548230°	SP Community
SP-13-2	38.874440°	-76.548110°	SP Community
SP-13-3	38.874360°	-76.548100°	SP Community
SP-16-1	38.874720°	-76.547280°	SP Community
SP-16-2	38.875013°	-76.547300°	SP Community
SP-16-3	38.874880°	-76.547240°	SP Community
SP-16-4	38.874760°	-76.547110°	SP Community
Edge16-14-1	38.875020°	-76.547100°	The edge of SP Community
Edge16-14-2	38.874920°	-76.547010°	The edge of SP Community
Phrag-1-1	38.874920°	-76.546310°	Phrag Community
Phrag-1-2	38.874940°	-76.546189°	Phrag Community
Phrag-1-3	38.874950°	-76.546050°	Phrag Community
Phrag-22-1	38.874380°	-76.547290°	Phrag Community
Phrag-22-2	38.874220°	-76.547270°	Phrag Community



Table 2. GCREW Community codes used for 2010 and 1972 maps in ArcGIS.

2010		
Number	Code	Community
0	BWALK	board walk
1	IVA	IVA community
2	IVAMIX	IVA Mixed community
3	MIX	Scirpus&Spartina patens mixed community
4	PH	Phragmites community
5	SC	Scirpus community
6	SP	Spartina/Distichlis community
7	FORE	Forest Shrub

1972		
Number	Code	Community
0	IVA72	Iva frutescens community
1	IVADISCPHMX72	IVA/Distichlis/Scirpus/Phragmites mixed community
2	IVAMX72	IVA/Distichlis/Scirpus mixed community
3	IVASPDISPALTMX72	IVA/Spartina patens/Distichlis/Spartina alterniflora mixed community
4	MX72	Scirpus&Spartina patens mixed community
5	PAN72	Panicum virgatum community
6	PH72	Phragmites community
7	SC72	Scirpus community
8	SHRUB72	Forest Shrub
9	SPCYNO72	Spartina cynosuroides community
10	SPDI72	Spartina/Distichlis community
11	SPDIPANMX72	Spartina/Distichlis/Panicum mixed community
12	Typha72	Typha community

Table 3. Calculated GREW area for 2010 and 1972 maps (m2)

2010	spp	AREAm2	Total Area (m2)
0	BWALK	902.3146274	222166.5277
1	IVA	29547.74857	
2	IVAMIX*	40454.77372	
3	MIX	55541.95967	
4	PH	48483.51108	
5	SC	15665.21422	
6	SP	30105.87239	
7	FORE*	2367.448031	
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1972	SPP	AREAm2	
0	IVA72	59361.51101	221078.2588
1	IVADISCPHMX72	4591.63642	
2	IVAMIX72	15170.54466	
3	IVASPDISPALTMX72	2378.620577	
4	MIX72	50241.0836	
5	PAN72	11129.58981	
6	PH72	5660.825976	
7	SC72	22124.73725	
8	SHRUB72	2829.745562	
9	SPCYNO72	6039.946691	
10	SPDI72	34894.99697	
11	SPDIPANMX72	985.834358	
12	Typha72	5669.185883	