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Appendices

Application of the Sea-Level Affecting Marshes Model (SLAMM) to the Lower Delaware Bay, with a Focus on Salt Marsh Habitat

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Appendix A

SLAMM model setup and input parameters

The Sea Level Affecting Marshes Model (SLAMM) software is free and has modest data requirements. “Core” data (the minimum spatial data required to run SLAMM) can easily be obtained from nationwide data sources, including:

- Coastal elevation - https://coast.noaa.gov/dataviewer/#/lidar/search/
- Tidal range (great diurnal tide range, salt elevation) - https://tidesandcurrents.noaa.gov/
- NWI wetlands - https://www.fws.gov/wetlands/Data/Data-Download.html
- NLCD land cover - https://www.mrlc.gov/nlcd11_data.php

If higher resolution and more recent data are available from local sources, SLAMM allows for use of those data.

Other required parameters are as follows:

Wetland Data Photo Date - Year that the wetland data layer being used was taken. This date represents the starting date for the simulation.

DEM Date - Year of the flight or survey for the elevation data.

Historic SLR Trend - The historic rate of sea level rise in mm/year. These data are usually collected from gauge stations present in the area that keep track of this trend.

MTL-NAVD88 – Elevation correction to be applied when using mean tide level as the reference zero elevation.

GT Great Diurnal Tide Range - Equivalent to the difference between MHHW and MLLW. Normally these data are obtained from gauge stations and/or tide tables.

Salt Elevation - The elevation at which dry land and water wetlands begin. Salt elevation is often defined as the elevation that is inundated by salt water less than every 30 days.

Marsh/Swamp/Tidal Flat Erosion - Horizontal erosion rates for each land type. Any information available is welcomed, otherwise literature or default values based on measurements obtained in similar locations can be used to estimate appropriate values.

Marsh/Swamp/Mangrove Accretion – Values of vertical accretion rates for each land type. Accretion rates also may be entered as function of marsh elevation providing a more realistic response to sea level changes. Similar to above, these values can be obtained from literature or any other information available.

Beach Sedimentation Rate - Vertical accretion for tidal flats and beaches.

In this project, to reduce computer processing time, we divided the SLAMM input files into four blocks as depicted in Figure A1. The four blocks are: Dividing and Maurice (NJ); Dennis and Reeds Beach (NJ); Broadkill and Mispillion (DE); and St. Jones (DE).

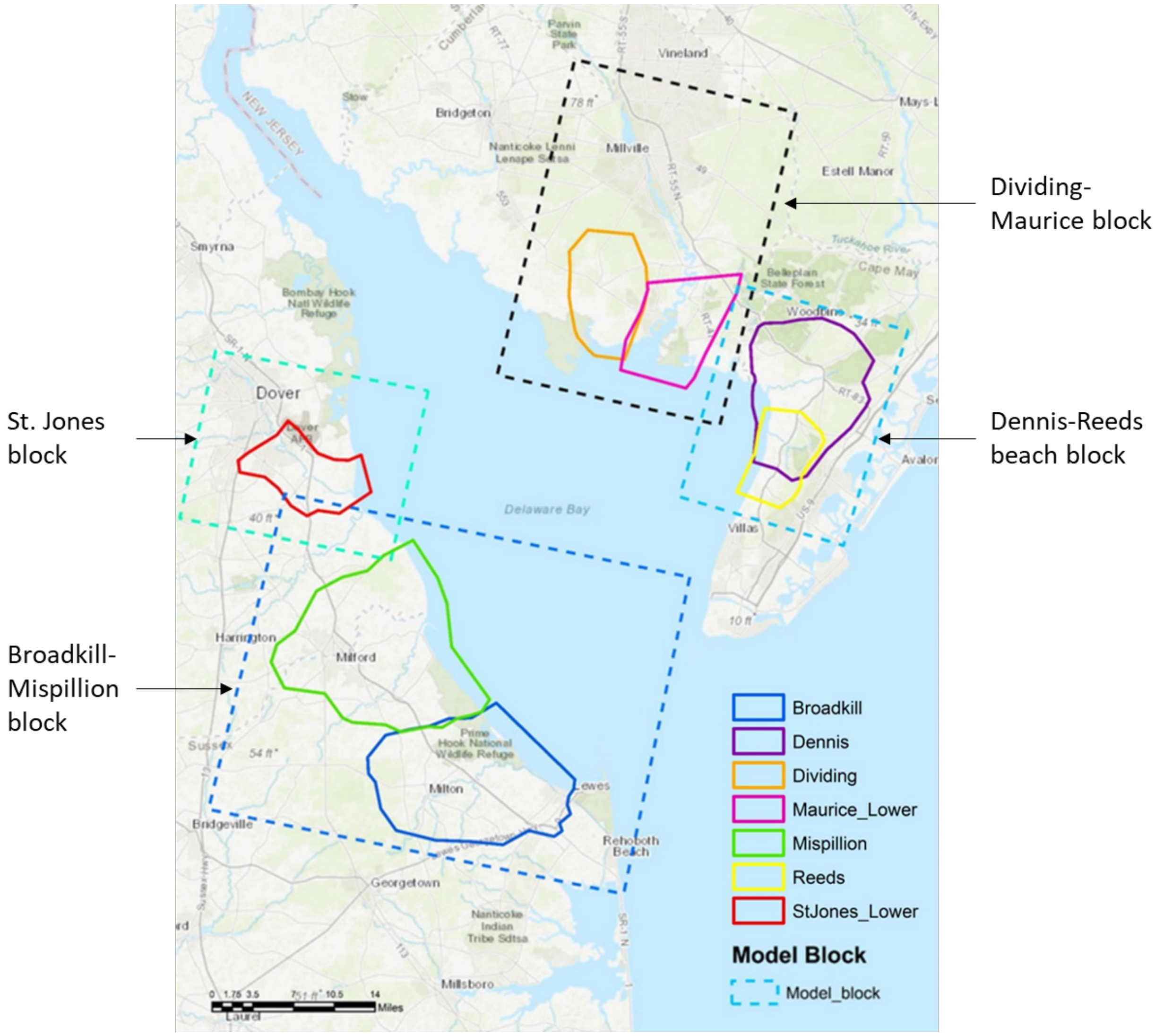


Figure A1. To reduce computer processing time, we divided the SLAMM input files into four blocks as depicted in this map. The four blocks are: Dividing and Maurice; Dennis and Reeds Beach; Broadkill and Mispillion; and St. Jones. The seven sites were delineated based on PDE's monitoring and management units. Note that in some cases (such as Dennis and Reeds), the output sites partially overlap.

Table A1 contains the minimum wetland elevations that were applied to the study area. Minimum wetland elevations define the elevation, relative to Mean Tide Level (MTL), below which a wetland is assumed to convert to another wetland class or open water. We used the default settings for everything except transitional salt marsh, which we changed from 1 to 0.75.

Table A1. Minimum wetland elevations used in the SLAMM conceptual model.

SLAMM Category	Min Elev.	Min Unit
Developed Dry Land	1	Salt Elev.
Undeveloped Dry Land	1	Salt Elev.
Swamp	1	Salt Elev.
Cypress Swamp	1	Salt Elev.
Inland-Fresh Marsh	1	Salt Elev.
Tidal-Fresh Marsh	0	Meters
Trans. Salt Marsh	0.75	HTU
Regularly-Flooded Marsh	0	Meters
Mangrove	0	Meters
Estuarine Beach	-1	HTU
Tidal Flat	-1	HTU
Ocean Beach	-1	HTU
Ocean Flat	-1	HTU
Rocky Intertidal	-1	HTU
Inland Open Water	1	Salt Elev.
Riverine Tidal	0	Meters
Irreg.-Flooded Marsh	0.5	HTU
Inland Shore	-1	HTU
Tidal Swamp	0	Meters

In each block, we used the same SLAMM Execution Options (Figure A2) and applied the same accretion rate formula (inputs are shown in Table A2; the derivation of this formula is shown in greater detail in Attachment 1). In three of the blocks (all but the St. Jones) we had to create input subsites to account for differences in input parameters (NWI photo dates, DEM dates, tide range, salt elevation or marsh erosion).

Text Box #1. Output vs. input sites

Output and input sites can be a source of confusion in SLAMM. Output sites are used to create Word maps, raster, and tabular results for a specific location within the study area. In our SLAMM simulations, the output sites are the seven marsh areas depicted in Figure A1, which are based on units used by PDE for monitoring and management. In some cases, there is overlap across output sites (e.g., Dennis and Reeds Beach). This overlap does not affect or alter results for the seven sites since SLAMM reports results for each output site independently.

Input subsites (such as those shown in Figure A4) are used to adjust for spatially-variable model input parameters (such as tide, accretion and erosion) within the study blocks. Boundaries of input subsites are driven by differences in input parameters (and do not necessarily correspond with output sites).

Table A2. We applied the same accretion rate input formula (shown below) to each block.

Parameter	Inputs
Reg Flood Use Model [True,False]	TRUE
Reg Flood Max. Accr. (mm/year)	8
Reg Flood Min. Accr. (mm/year)	3.5
Reg Flood Elev a (mm/(year HTU^3))	1.3
Reg Flood Elev b (mm/(year HTU^2))	-4
Reg Flood Elev c (mm/(year*HTU))	1.3613
Reg Flood Elev d (mm/year)	7.6316
Irreg Flood Use Model [True,False]	TRUE
Irreg Flood Max. Accr. (mm/year)	4.6
Irreg Flood Min. Accr. (mm/year)	3.8
Irreg Flood Elev a (mm/(year HTU^3))	0
Irreg Flood Elev b (mm/(year HTU^2))	0
Irreg Flood Elev c (mm/(year*HTU))	-1.6386
Irreg Flood Elev d (mm/year)	0
T.Flat Use Model [True,False]	FALSE
Tidal Fresh Use Model [True,False]	FALSE

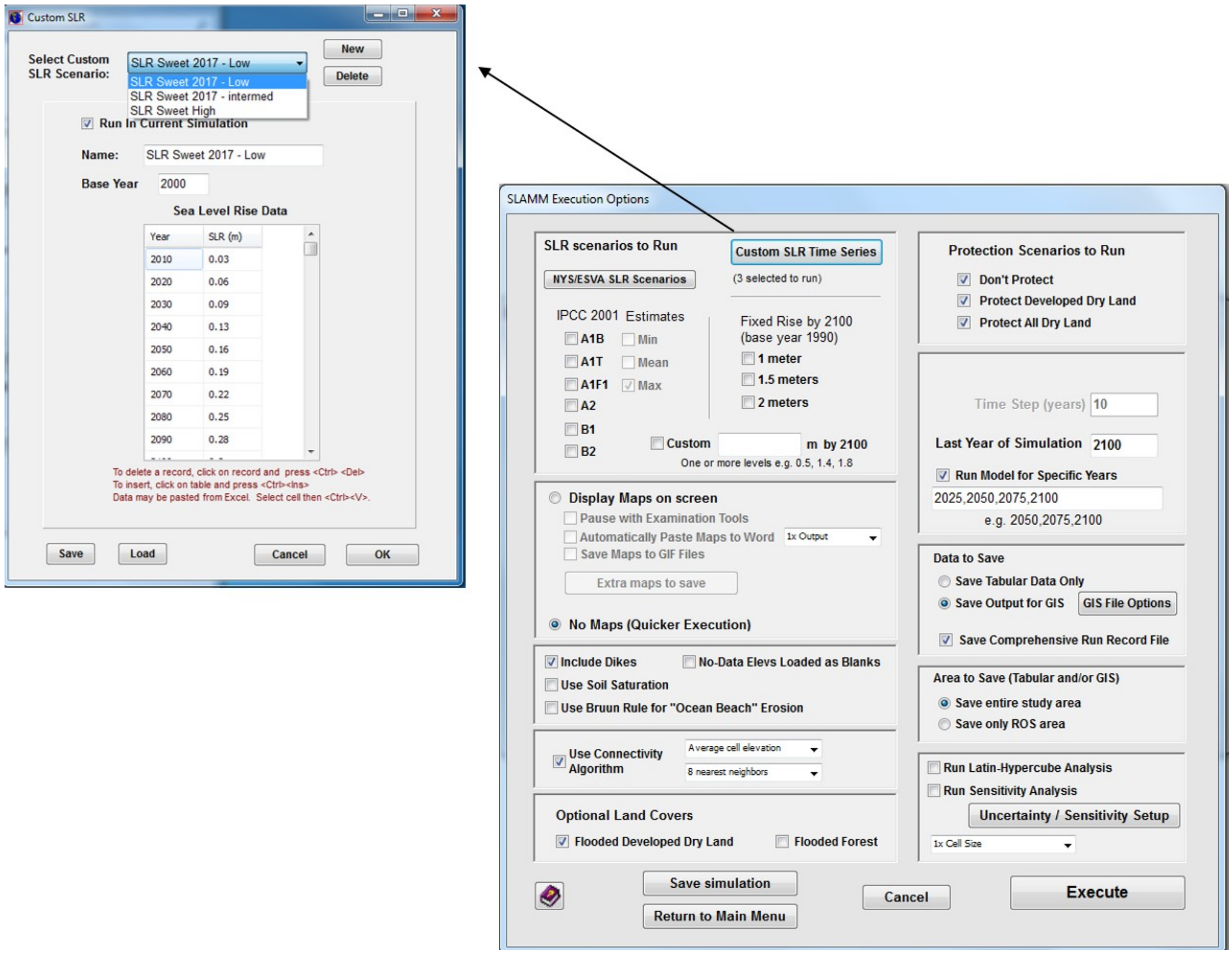


Figure A2. We used the same SLAMM Execution Options (as shown in this screenshot) for each of the four blocks.

Before running the simulations for future years, we did “time zero” SLAMM runs in each block to identify if there were any initial problems with key SLAMM modeling inputs (such as NWI land cover, elevations, modeled tidal ranges and hydraulic connectivity). In these “time zero” runs, the tides are applied to the study area but no sea-level rise, accretion or erosion inputs are considered. Differences will arise between the original NWI land cover layer and the SLAMM “time zero” land cover layer if cells are below the lowest allowable elevation land cover categories (based on the SLAMM settings), which causes them to be converted to a different land cover category. For example, an area classified in the NWI wetland layer as fresh-water swamp that, based on the elevation data, tidal data and SLAMM settings, is subject to regular saline tides, would be converted by SLAMM to a tidal swamp at time zero. More detailed information on “time zero” SLAMM runs can be found in the SLAMM technical manual. (Warren Pinnacle 2016)

If there are significant differences between the land cover output from the “time zero” SLAMM run and the original NWI land cover layer (e.g., too many conversions are occurring) additional investigation is required and adjustments may be necessary. In some cases, the initial land cover re-categorization by SLAMM better describes the current coverage of a given area (e.g., sometimes the high horizontal resolution of the elevation data can allow for a more refined wetland map than the original NWI-generated shapefiles). We found this to be the case with the two New Jersey blocks, where some of the NWI data date back to 1995, and extensive restoration work has been performed in certain areas (such as near the outlets of the Maurice and Dividing Rivers).

We did additional checks to verify the accuracy of the “time zero” SLAMM land cover layers by using GIS software to overlay aerial photographs and GIS inundation files over the land cover layer. We also had LeeAnn Haaf (PDE) and Kari St. Laurent (NOAA/St. Jones estuary) review the land cover maps. In some cases, we found discrepancies and had to make edits to the “time zero” land cover layer. Those land cover edits, as well as other model inputs, are described in detail in this Appendix, which are divided into four separate sections (one for each block: 1 - Dennis-Reeds Beach; 2 - Dividing/Maurice; 3 - Broadkill/Mispillion; 4 - St. Jones).

It should be noted that we had difficulty modeling certain areas in the Broadkill and Mispillion block. More specifically, the SLAMM model appears to flood some areas along the coast too aggressively in the “time zero” run. We tried making adjustments by reducing the salt elevation, but none of these changes made a big difference. This is a difficult area to model due to the barrier/dunes along the coast and because a large restoration project is underway in the Prime Hook NWR, where some of the marsh areas behind the barrier/dunes are very subsided due to many years of impoundments. There may also be dikes or flow alterations not currently accounted for in the GIS layers.

Dennis-Reeds Beach block

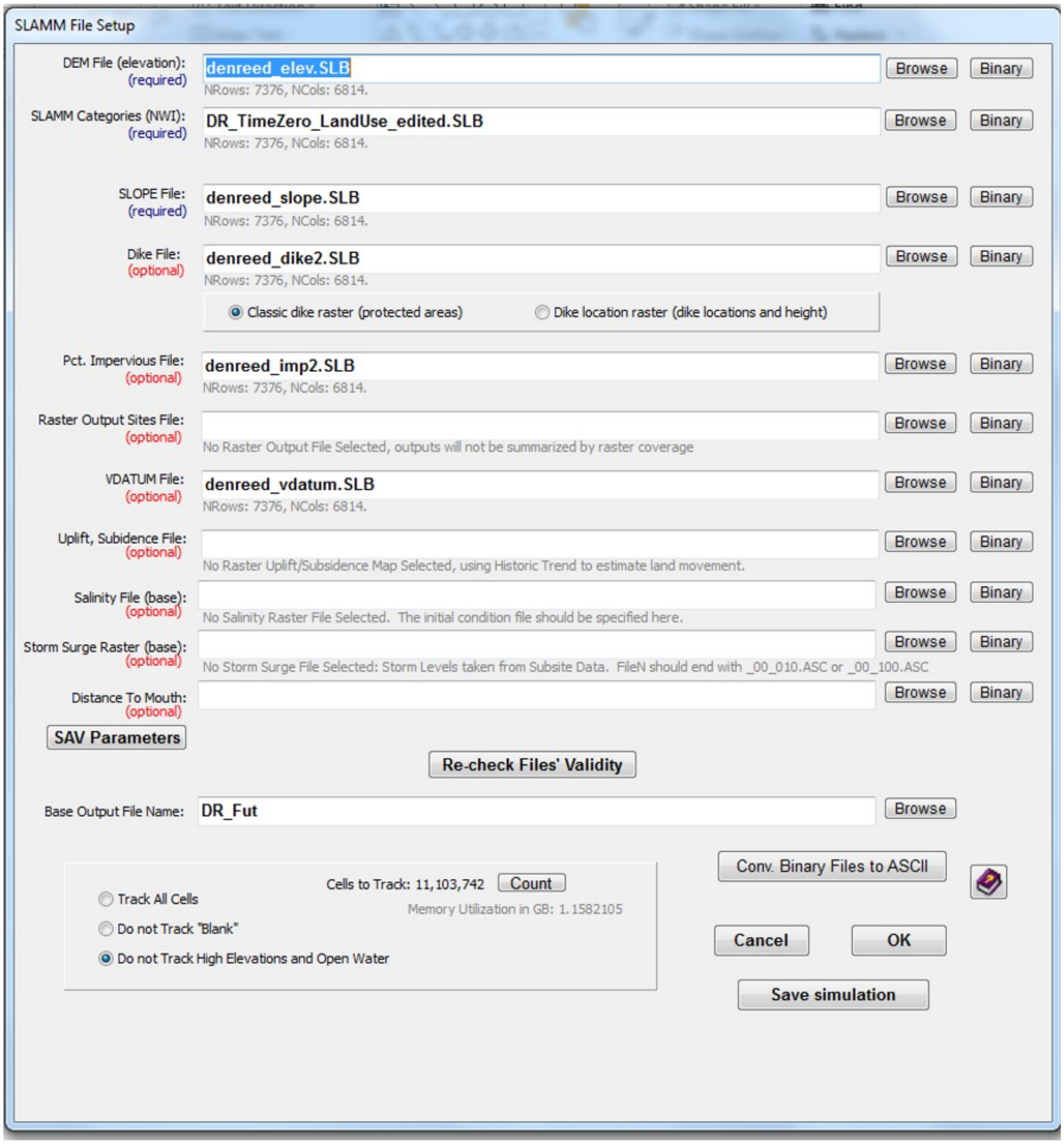


Figure A3. SLAMM File Setup for the Dennis-Reeds Beach block. For the SLAMM categories input file, we used the "time zero" land cover layer with some edits (based on local knowledge and aerial photographs, as described in Figures A5-A7). We decided to use the "time zero" file because we checked the original NWI land cover file and the "time zero" land cover file against aerial photographs, inundation GIS files and local knowledge and found the "time zero" land cover file to be more accurate.

Input subsites

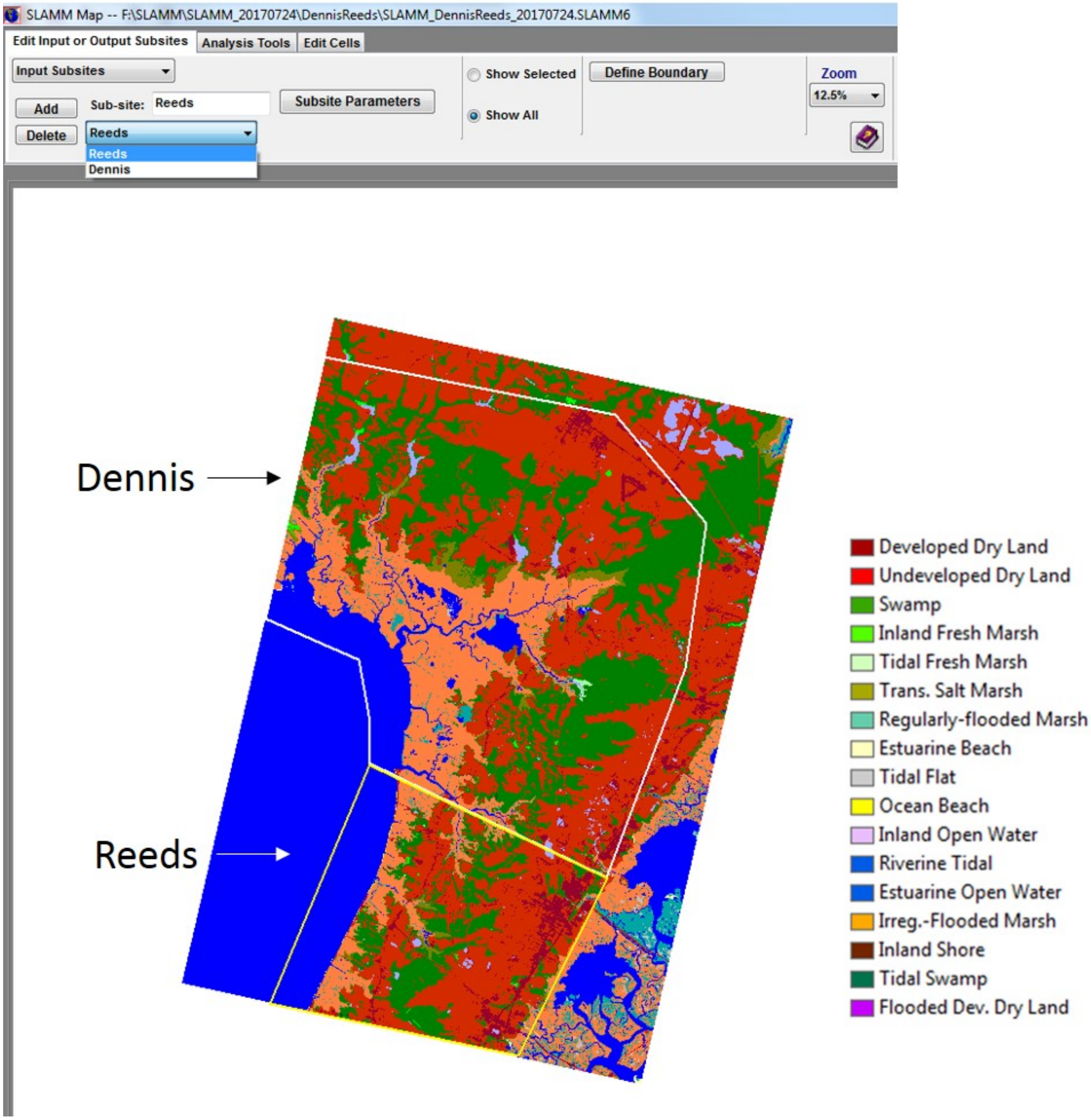


Figure A4. We set up two SLAMM input subsites for the Dennis-Reeds Beach block to account for the different marsh erosion rates at Dennis and Reeds Beach. The boundaries of the input subsites differ from the Dennis and Reeds output sites (shown in Figure A1). The output sites are delineated based on units used by PDE for monitoring and management, whereas the boundaries of the input sites are driven by differences in input parameters. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Table A3 lists the input parameters for the Dennis-Reeds Beach block. All subsite inputs are the same except for marsh erosion. The NWI photo date for both subsites is actually 2009, but we entered 2014 because the SLAMM land cover input file is based on the "time zero" file that utilizes the best available high-resolution elevation data through 2014.

Table A3. Input parameters for the Dennis-Reeds Beach block.

Parameter	Global	Subsite 1	Subsite 2
Description	Dennis Reeds	Reeds	Dennis
NWI Photo Date (YYYY)	2014	2014	2014
DEM Date (YYYY)	2014	2014	2014
Direction Offshore [n,s,e,w]	West	West	West
Historic Trend (mm/yr)	3.8	3.8	3.8
Historic Eustatic Trend (mm/yr)	1.7	1.7	1.7
MTL-NAVD88 (m)	0	0	0
GT Great Diurnal Tide Range (m)	1.918	1.918	1.918
Salt Elev. (m above MTL)	1.21	1.21	1.21
Marsh Erosion (horz. m/yr)	0.89	1.34	0.443
Marsh Erosion Fetch (km)	0.1	0.1	0.1
Swamp Erosion (horz. m/yr)	1	1	1
T.Flat Erosion (horz. m/yr)	0.5	0.5	0.5
Reg.-Flood Marsh Accr (mm/yr)	see below	see below	see below
Irreg.-Flood Marsh Accr (mm/yr)	see below	see below	see below
Tidal-Fresh Marsh Accr (mm/yr)	5	5	5
Inland-Fresh Marsh Accr (mm/yr)	1	1	1
Mangrove Accr (mm/yr)	0	0	0
Tidal Swamp Accr (mm/yr)	1.1	1.1	1.1
Swamp Accretion (mm/yr)	1.6	1.6	1.6
Beach Sed. Rate (mm/yr)	0.5	0.5	0.5
Irreg-Flood Collapse (m)	0	0	0
Reg-Flood Collapse (m)	0	0	0
Use Wave Erosion Model [True,False]	FALSE	FALSE	FALSE
Use Elev Pre-processor [True,False]	FALSE	FALSE	FALSE
H1 inundation (m above MTL)	0.48	0.48	0.48
H2 inundation (m above MTL; H2>H1)	0.96	0.96	0.96
H3 inundation (m above MTL: H3>H2)	1.17	1.17	1.17
H4 inundation (m above MTL; H4>H3)	2	2	2
H5 inundation (m above MTL; H5>H4)	5	5	5

Table A3. Input parameters for the Dennis-Reeds Beach block. (Continued)

Parameter	Global	Subsite 1	Subsite 2
Reg Flood Use Model [True,False]	TRUE	TRUE	TRUE
Reg Flood Max. Accr. (mm/year)	8	8	8
Reg Flood Min. Accr. (mm/year)	3.5	3.5	3.5
Reg Flood Elev a (mm/(year HTU^3))	1.3	1.3	1.3
Reg Flood Elev b (mm/(year HTU^2))	-4	-4	-4
Reg Flood Elev c (mm/(year*HTU))	1.3613	1.3613	1.3613
Reg Flood Elev d (mm/year)	7.6316	7.6316	7.6316
Irreg Flood Use Model [True,False]	TRUE	TRUE	TRUE
Irreg Flood Max. Accr. (mm/year)	4.6	4.6	4.6
Irreg Flood Min. Accr. (mm/year)	3.8	3.8	3.8
Irreg Flood Elev a (mm/(year HTU^3))	0	0	0
Irreg Flood Elev b (mm/(year HTU^2))	0	0	0
Irreg Flood Elev c (mm/(year*HTU))	-1.6386	-1.6386	-1.6386
Irreg Flood Elev d (mm/year)	0	0	0
T.Flat Use Model [True,False]	FALSE	FALSE	FALSE
Tidal Fresh Use Model [True,False]	FALSE	FALSE	FALSE

Table A4. Dennis time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2014)	Change (acres)	% Change
Developed Dry Land	747.8	747.8	0.0	0.0
Estuarine Beach	1.9	1.9	0.0	0.0
Estuarine Open Water	4127.0	4127.4	0.4	0.0
Flooded Developed Dry Land	9.6	9.6	0.0	0.0
Inland Open Water	320.6	320.2	-0.4	-0.1
Inland Shore	8.3	8.3	0.0	0.0
Inland-Fresh Marsh	53.6	53.3	-0.3	-0.5
Irreg.-Flooded Marsh	8348.4	8315.7	-32.6	-0.4
Ocean Beach	13.3	13.3	0.0	-0.1
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	400.8	421.6	20.8	5.2
Riverine Tidal	0.9	0.9	0.0	0.0
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	11409.2	11394.9	-14.3	-0.1
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	11.4	41.4	30.0	263.5
Tidal Swamp	17.8	17.8	0.0	0.0
Tidal-Fresh Marsh	39.3	39.3	0.0	0.0
Trans. Salt Marsh	838.9	836.8	-2.2	-0.3
Undeveloped Dry Land	15648.3	15646.8	-1.5	0.0

Table A5. Reeds Beach time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2014)	Change (acres)	% Change
Developed Dry Land	257.6	257.6	0.0	0.0
Estuarine Beach	5.0	5.0	0.0	0.0
Estuarine Open Water	2657.3	2660.1	2.8	0.1
Flooded Developed Dry Land	12.8	12.8	0.0	0.0
Inland Open Water	72.8	70.1	-2.8	-3.8
Inland Shore	1.8	1.8	0.0	0.0
Inland-Fresh Marsh	34.1	33.9	-0.2	-0.6
Irreg.-Flooded Marsh	3290.7	3277.8	-12.9	-0.4
Ocean Beach	19.6	19.6	0.0	-0.1
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	213.1	235.0	21.9	10.3
Riverine Tidal	0.0	0.0	0.0	--
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	3515.5	3512.8	-2.7	-0.1
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	0.0	20.3	20.3	--
Tidal Swamp	17.1	17.0	0.0	0.0
Tidal-Fresh Marsh	3.9	3.9	0.0	0.0
Trans. Salt Marsh	263.0	237.7	-25.3	-9.6
Undeveloped Dry Land	4553.4	4552.3	-1.1	0.0

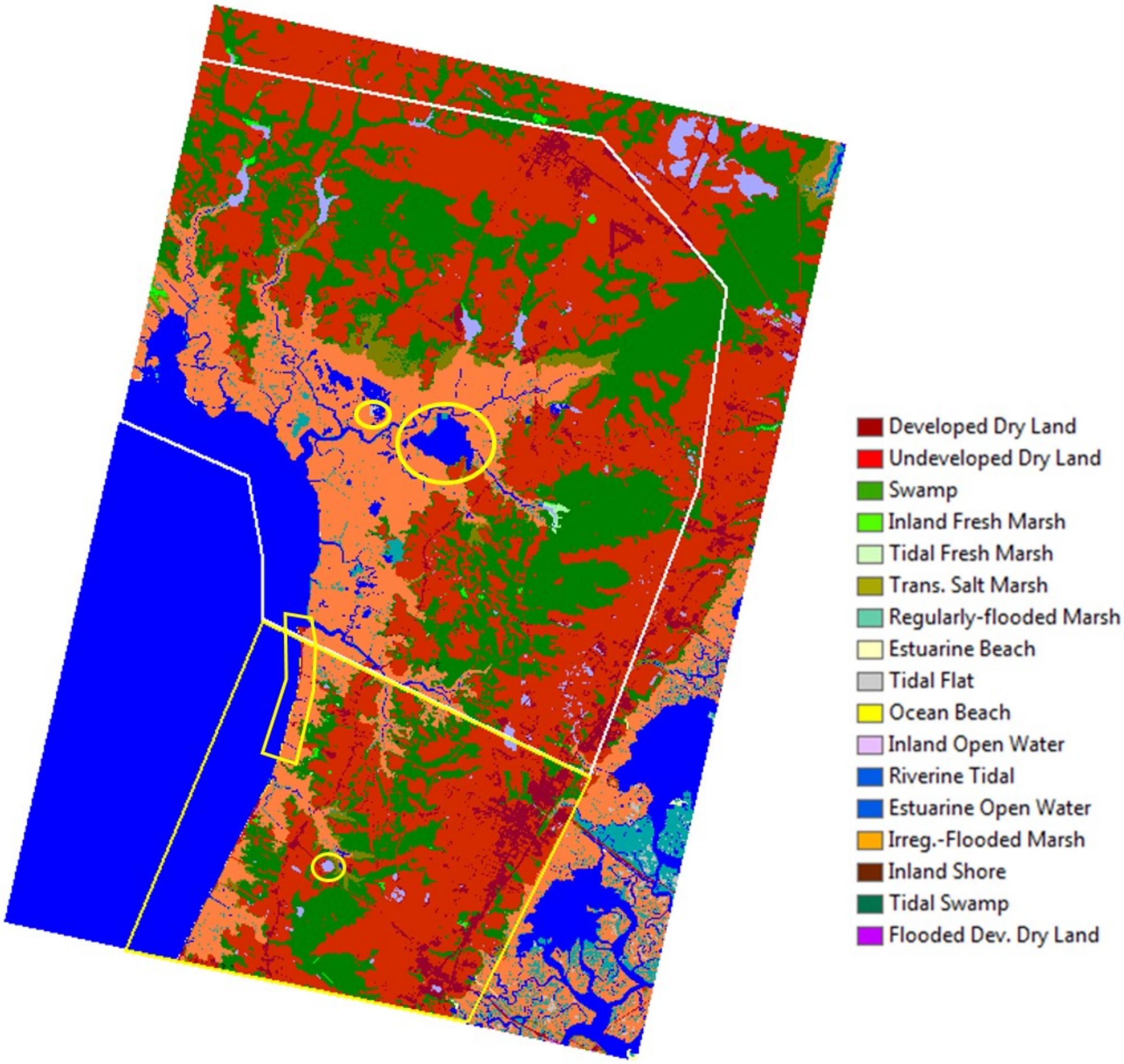


Figure A5. We made edits to the "time zero" land cover file in four places (delineated in yellow in this map) before running the SLAMM model. The edits are described in greater detail in Figure A6.

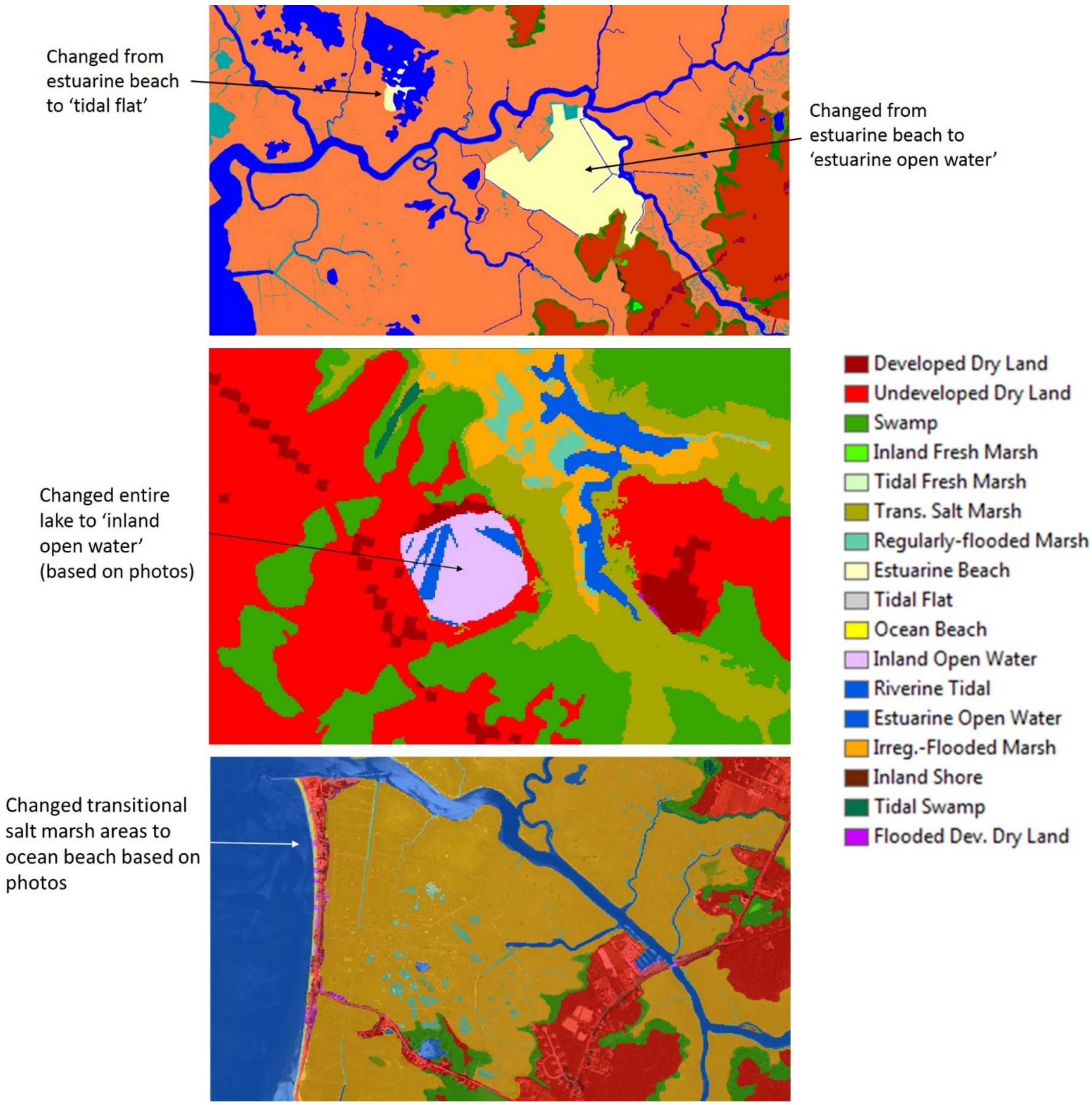


Figure A6. Four edits we made to the "time zero" land cover file before running the SLAMM model. The edits were based on aerial photos and feedback from the Partnership of the Delaware Estuary.

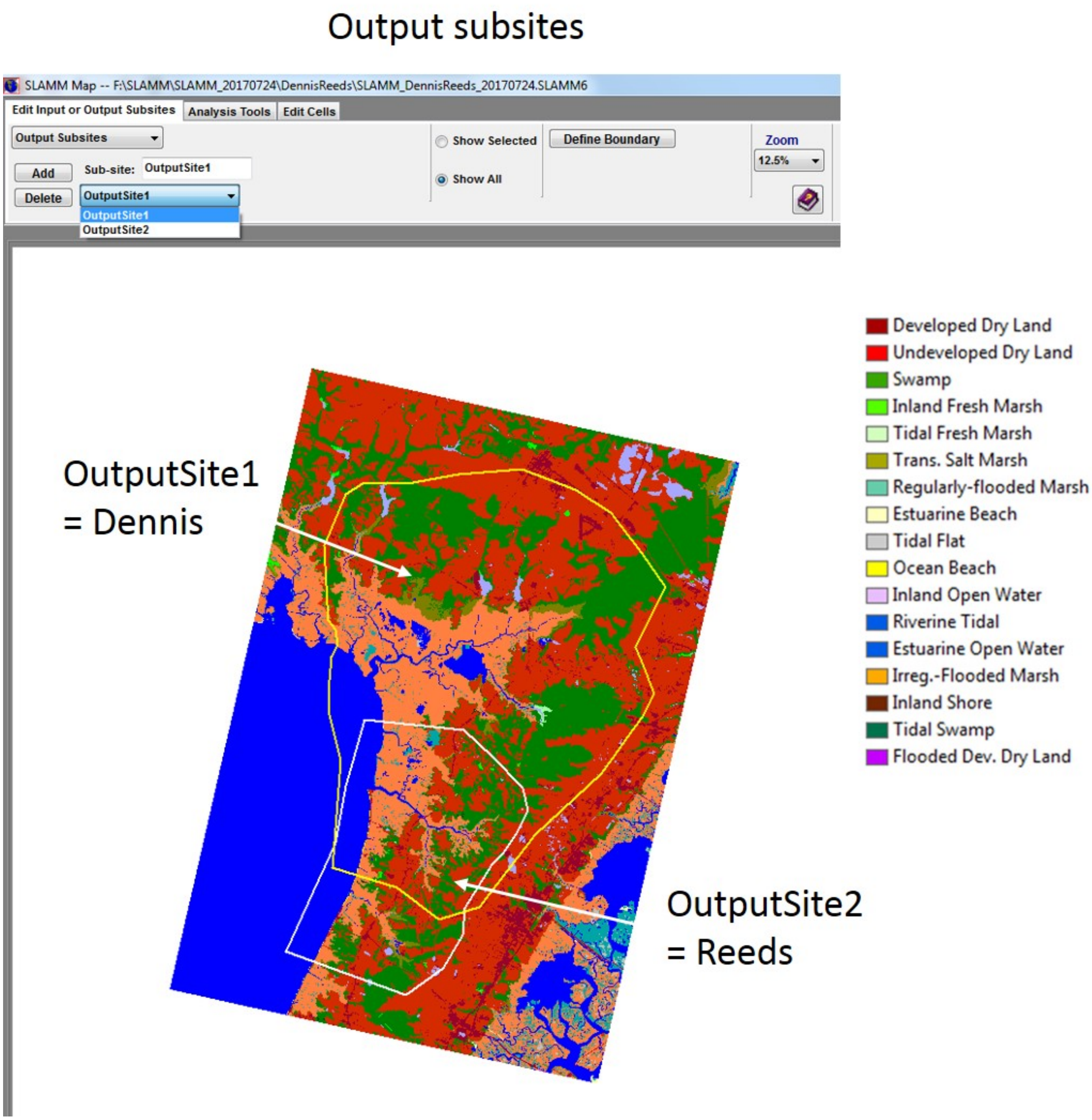


Figure A7. Results were generated for the Dennis and Reeds Beach output sites (Dennis is outlined in yellow; Reeds is outlined in white). The output site delineations are based on units used by PDE for monitoring and management. The overlap between the two sites does not affect the results because SLAMM generates results for each output site independently. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Dividing-Maurice block

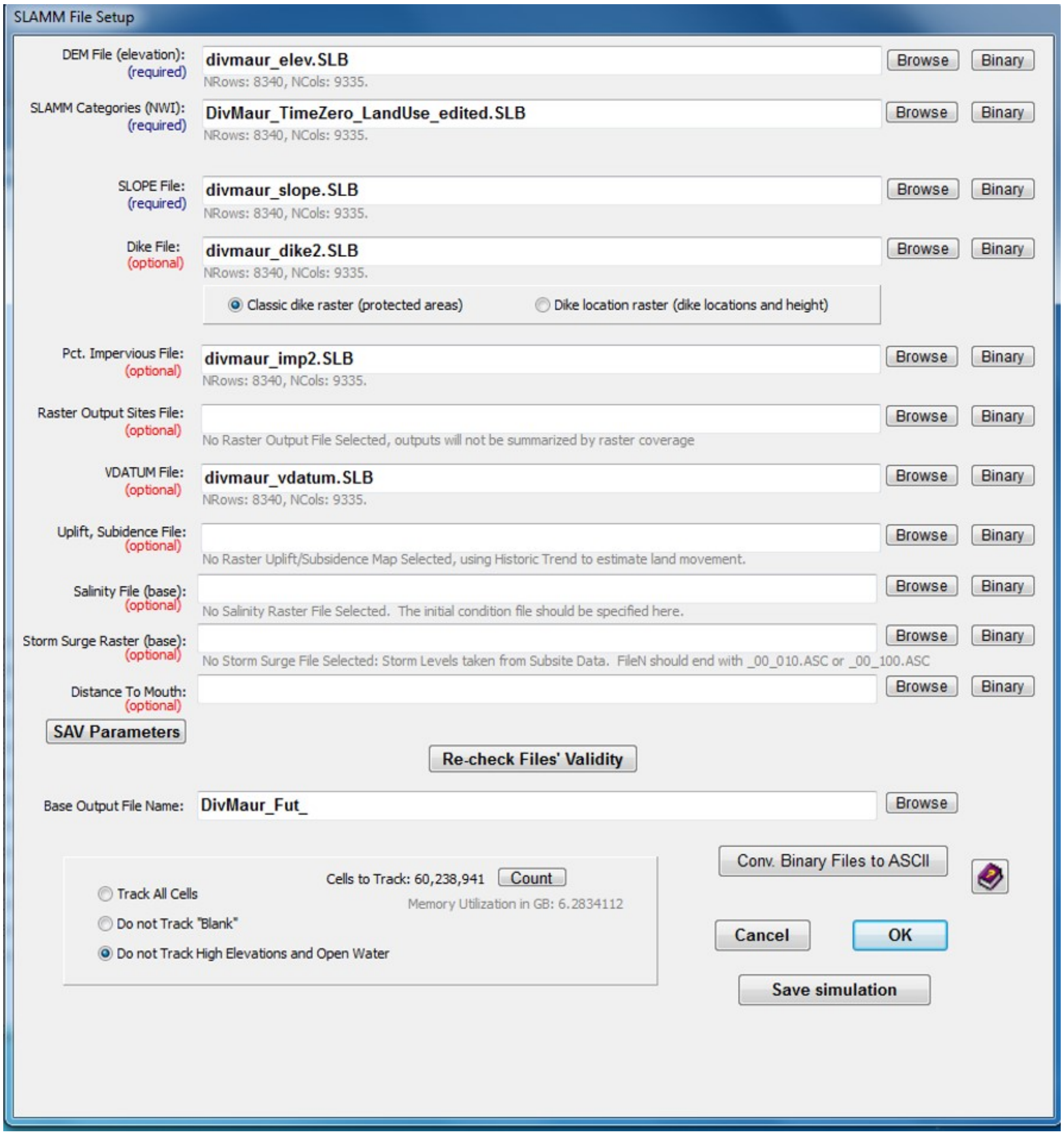


Figure A8. SLAMM File Setup for the Dividing-Maurice block. For the SLAMM categories input file, we used the "time zero" land cover layer with some edits (based on local knowledge and aerial photographs, as described in Figures A10-A17). We decided to use the "time zero" file because we checked the original NWI land cover file and the "time zero" land cover file against aerial photographs, inundation GIS files and local knowledge and found the "time zero" land cover file to be more accurate.

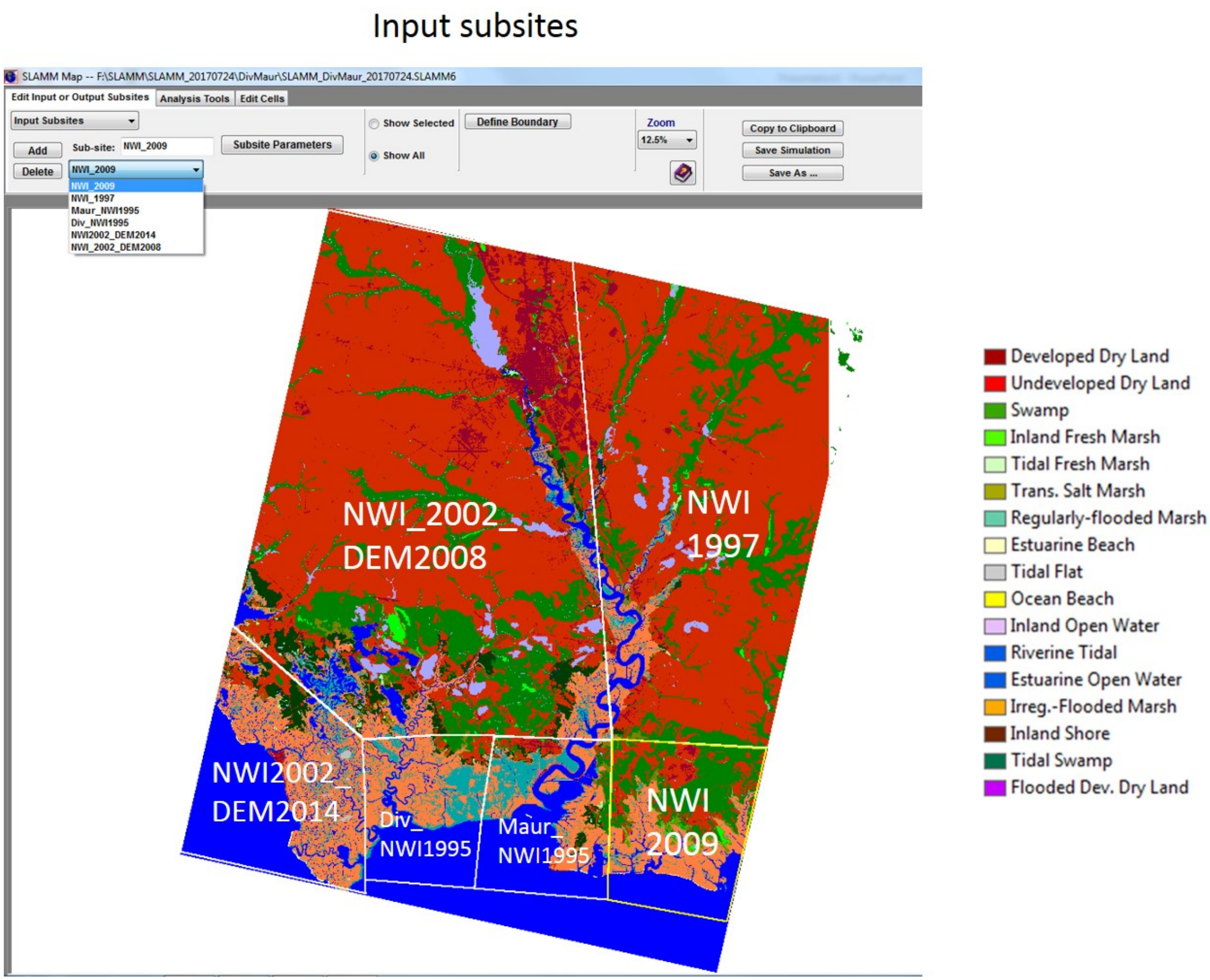


Figure A9. We set up six SLAMM input subsites for the Dividing-Maurice block to account for differences in NWI photo dates, elevation data dates, and marsh erosion rates. The names of the input subsites reflect the different NWI and elevation dates. The boundaries of the input subsites differ from the Dividing and Maurice output sites (shown in Figure A1). The output sites are delineated based on units used by PDE for monitoring and management, whereas the boundaries of the input sites are driven by differences in input parameters. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Table 6 lists the input parameters for the Dividing-Maurice block. The NWI photo dates range from 1995 to 2009. However, we entered 2008 for the inland areas and 2014 for the coastal areas because the SLAMM land cover input file is based on the “time zero” file that utilizes high resolution elevation data from 2008 (NJ statewide LiDAR) and 2014 (Post-Sandy (SC to NY)).

Table A6. Input parameters for the Dividing-Maurice block.

Parameter	Global	SubSite 1	SubSite 2	SubSite 3	SubSite 4	SubSite 5	SubSite 6
Description	All	NWI_2009	NWI_1997	Maur_NWI1995	Div_NWI1995	NWI2002_DEM2014	NWI_2002_DEM2008
NWI Photo Date (YYYY)	2014	2014	2008	2014	2014	2014	2008
DEM Date (YYYY)	2008	2014	2008	2014	2014	2014	2008
Direction Offshore [n,s,e,w]	South	South	South	South	South	South	South
Historic Trend (mm/yr)	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Historic Eustatic Trend (mm/yr)	1.7	1.7	1.7	1.7	1.7	1.7	1.7
MTL-NAVD88 (m)	0	0	0	0	0	0	0
GT Great Diurnal Tide Range (m)	1.96	1.96	1.96	1.96	1.96	1.96	1.96
Salt Elev. (m above MTL)	1.22	1.22	1.22	1.22	1.22	1.22	1.22
Marsh Erosion (horz. m/yr)	0.425	0.42	0.42	0.42	0.43	0.43	0.43
Marsh Erosion Fetch (km)	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Swamp Erosion (horz. m/yr)	1	1	1	1	1	1	1

Table A6. Input parameters for the Dividing-Maurice block. (Continued)

Parameter	Global	SubSite 1	SubSite 2	SubSite 3	SubSite 4	SubSite 5	SubSite 6
T.Flat Erosion (horz. m/yr)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Reg.-Flood Marsh Accr (mm/yr)	see below	see below	see below	see below	see below	see below	see below
Irreg.-Flood Marsh Accr (mm/yr)	see below	see below	see below	see below	see below	see below	see below
Tidal-Fresh Marsh Accr (mm/yr)	5	5	5	5	5	5	5
Inland-Fresh Marsh Accr (mm/yr)	1	1	1	1	1	1	1
Mangrove Accr (mm/yr)	0	0	0	0	0	0	0
Tidal Swamp Accr (mm/yr)	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Swamp Accretion (mm/yr)	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Beach Sed. Rate (mm/yr)	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Irreg-Flood Collapse (m)	0	0	0	0	0	0	0
Reg-Flood Collapse (m)	0	0	0	0	0	0	0
Use Wave Erosion Model [True,False]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Use Elev Pre-processor [True,False]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
H1 inundation (m above MTL)	0.49	0.49	0.49	0.49	0.49	0.49	0.49
H2 inundation (m above MTL; H2>H1)	0.98	0.98	0.98	0.98	0.98	0.98	0.98
H3 inundation (m above MTL: H3>H2)	1.169	1.169	1.169	1.169	1.169	1.169	1.169

Table A6. Input parameters for the Dividing-Maurice block. (Continued)

Parameter	Global	SubSite 1	SubSite 2	SubSite 3	SubSite 4	SubSite 5	SubSite 6
H4 inundation (m above MTL; H4>H3)	2	2	2	2	2	2	2
H5 inundation (m above MTL; H5>H4)	5	5	5	5	5	5	5
Reg Flood Use Model [True,False]	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Reg Flood Max. Accr. (mm/year)	8	8	8	8	8	8	8
Reg Flood Min. Accr. (mm/year)	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Reg Flood Elev a (mm/(year HTU^3))	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Reg Flood Elev b (mm/(year HTU^2))	-4	-4	-4	-4	-4	-4	-4
Reg Flood Elev c (mm/(year*HTU))	1.3613	1.3613	1.3613	1.3613	1.3613	1.3613	1.3613
Reg Flood Elev d (mm/year)	7.6316	7.6316	7.6316	7.6316	7.6316	7.6316	7.6316
Irreg Flood Use Model [True,False]	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE	TRUE
Irreg Flood Max. Accr. (mm/year)	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Irreg Flood Min. Accr. (mm/year)	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Irreg Flood Elev a (mm/(year HTU^3))	0	0	0	0	0	0	0

Table A6. Input parameters for the Dividing-Maurice block. (Continued)

Parameter	Global	SubSite 1	SubSite 2	SubSite 3	SubSite 4	SubSite 5	SubSite 6
Irreg Flood Elev b (mm/(year HTU^2))	0	0	0	0	0	0	0
Irreg Flood Elev c (mm/(year*HTU))	-1.6386	-1.6386	-1.6386	-1.6386	-1.6386	-1.6386	-1.6386
Irreg Flood Elev d (mm/year)	0	0	0	0	0	0	0
T.Flat Use Model [True,False]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE
Tidal Fresh Use Model [True,False]	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE	FALSE

Table A7. Dividing time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2014)	Change (acres)	% Change
Developed Dry Land	128.6	128.6	0.0	0.0
Estuarine Beach	0.0	0.0	0.0	0.0
Estuarine Open Water	2827.7	2968.7	141.1	5.0
Flooded Developed Dry Land	8.1	8.1	0.0	0.0
Inland Open Water	880.2	739.2	-141.0	-16.0
Inland Shore	100.6	100.6	0.0	0.0
Inland-Fresh Marsh	316.4	316.3	-0.1	0.0
Irreg.-Flooded Marsh	4788.7	4700.6	-88.1	-1.8
Ocean Beach	0.0	0.0	0.0	--
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	1977.7	1707.7	-269.9	-13.6
Riverine Tidal	7.2	7.2	0.0	-0.1
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	4599.5	4594.7	-4.8	-0.1
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	4.4	449.1	444.7	10026.1
Tidal Swamp	1082.6	1082.6	0.0	0.0
Tidal-Fresh Marsh	54.1	54.1	0.0	0.0
Trans. Salt Marsh	399.3	326.0	-73.4	-18.4
Undeveloped Dry Land	5857.3	5848.8	-8.5	-0.1

Table A8. Lower Maurice time zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2014)	Change (acres)	% Change
Developed Dry Land	394.8	394.8	0.0	0.0
Estuarine Beach	25.4	25.4	0.0	0.0
Estuarine Open Water	7543.7	7544.4	0.7	0.0
Flooded Developed Dry Land	35.9	35.9	0.0	0.0
Inland Open Water	32.2	31.7	-0.4	-1.3
Inland Shore	3.8	3.8	0.0	0.0
Inland-Fresh Marsh	80.3	63.4	-16.8	-21.0
Irreg.-Flooded Marsh	4854.1	4804.3	-49.8	-1.0
Ocean Beach	0.0	0.0	0.0	--
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	1550.8	1299.5	-251.3	-16.2
Riverine Tidal	6.0	5.7	-0.3	-4.4
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	3288.0	3269.5	-18.5	-0.6
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	11.5	376.3	364.8	3166.5
Tidal Swamp	584.6	584.6	0.0	0.0
Tidal-Fresh Marsh	17.6	17.6	0.0	0.0
Trans. Salt Marsh	440.2	421.1	-19.2	-4.4
Undeveloped Dry Land	5431.5	5422.3	-9.3	-0.2

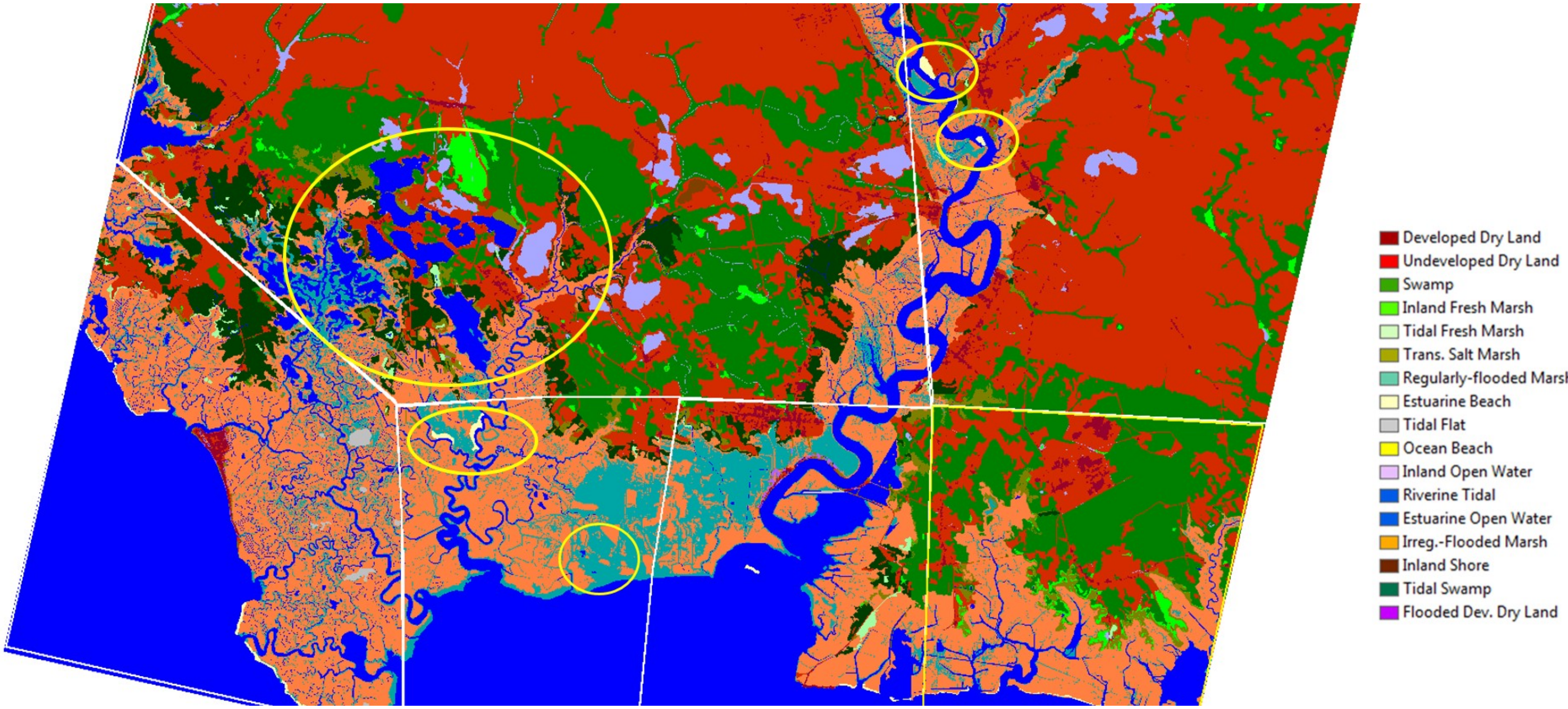


Figure A10. We made edits to the "time zero" land cover file in five areas (delineated in yellow in this map) before running the SLAMM model. The edits are described in greater detail in Figures A11-A17.

Highly modified area (sand pits, etc.). Based on this photo (and our best assessment of connectivity), we changed this lake from estuarine open water to inland fresh.

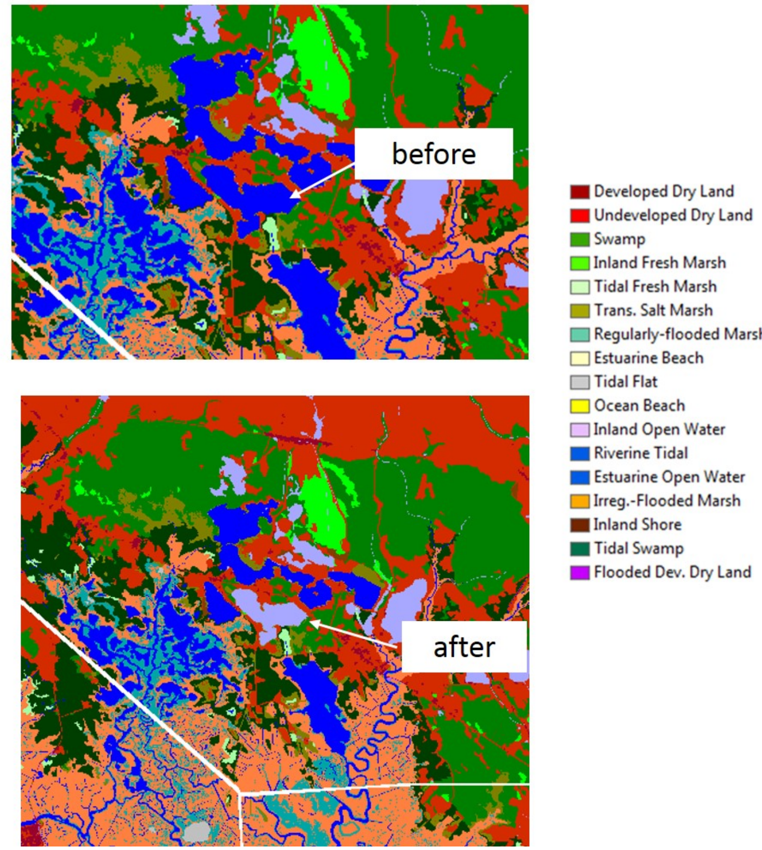


Figure A11. In the northwest part of the block, there is a highly modified area with sand pits, etc. We changed one of the lakes in this area from estuarine open water to inland (fresh) open water based on aerial photos and local knowledge.

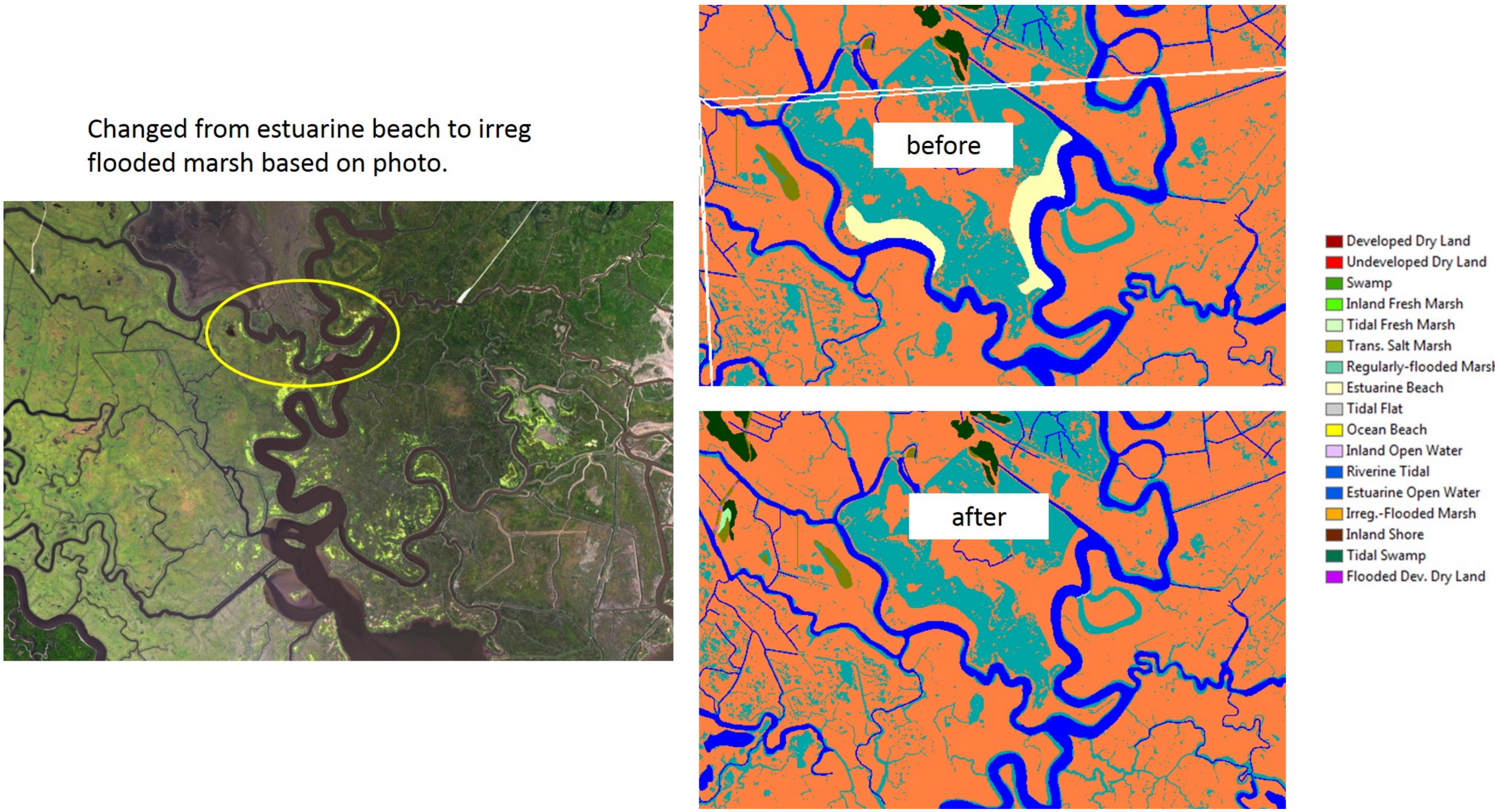


Figure A12. This is one of the areas that we changed from estuarine beach to irregularly flooded marsh based on aerial photos.

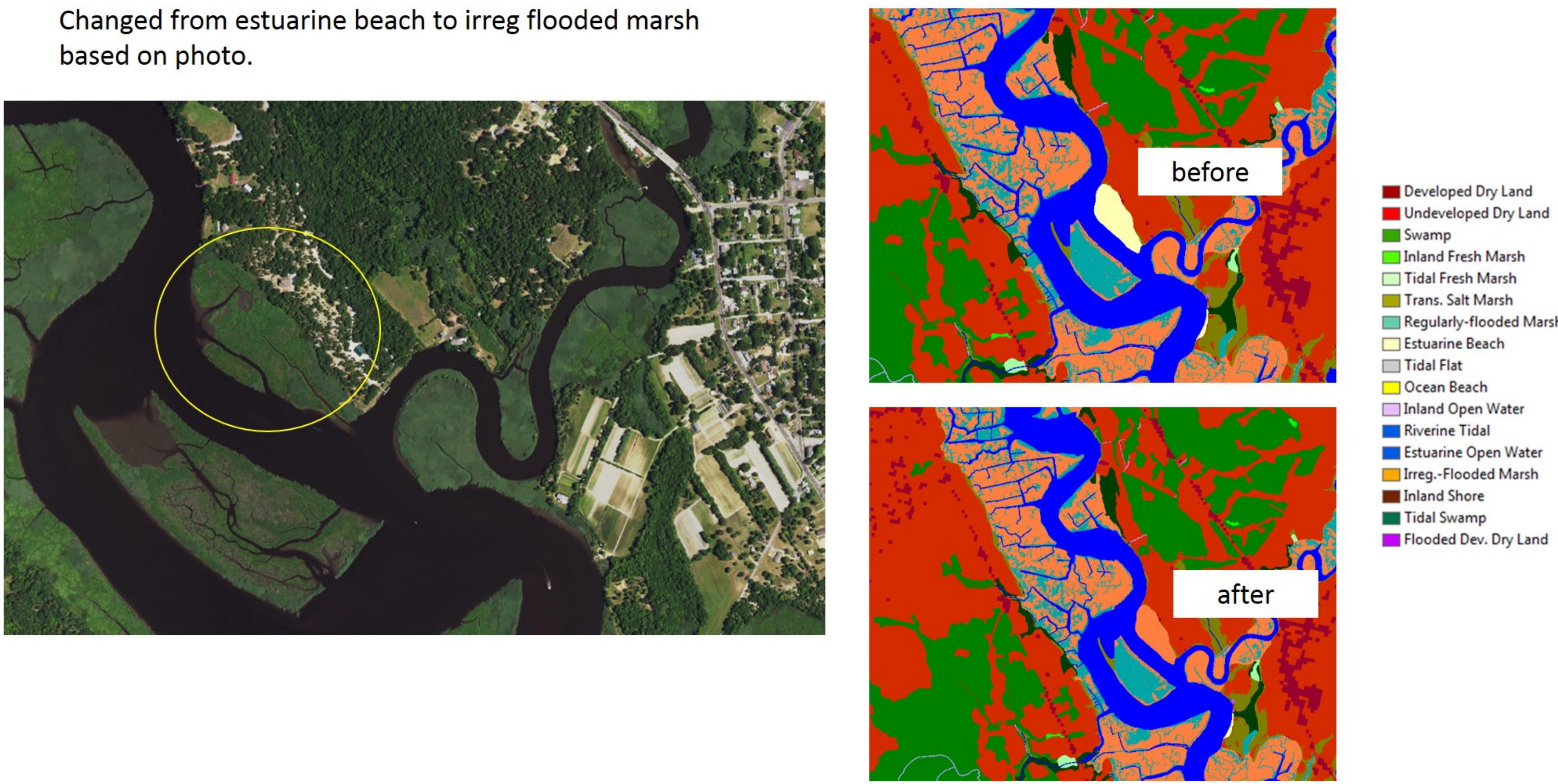


Figure A13. This is one of the areas that we changed from estuarine beach to irregularly flooded marsh based on aerial photos.

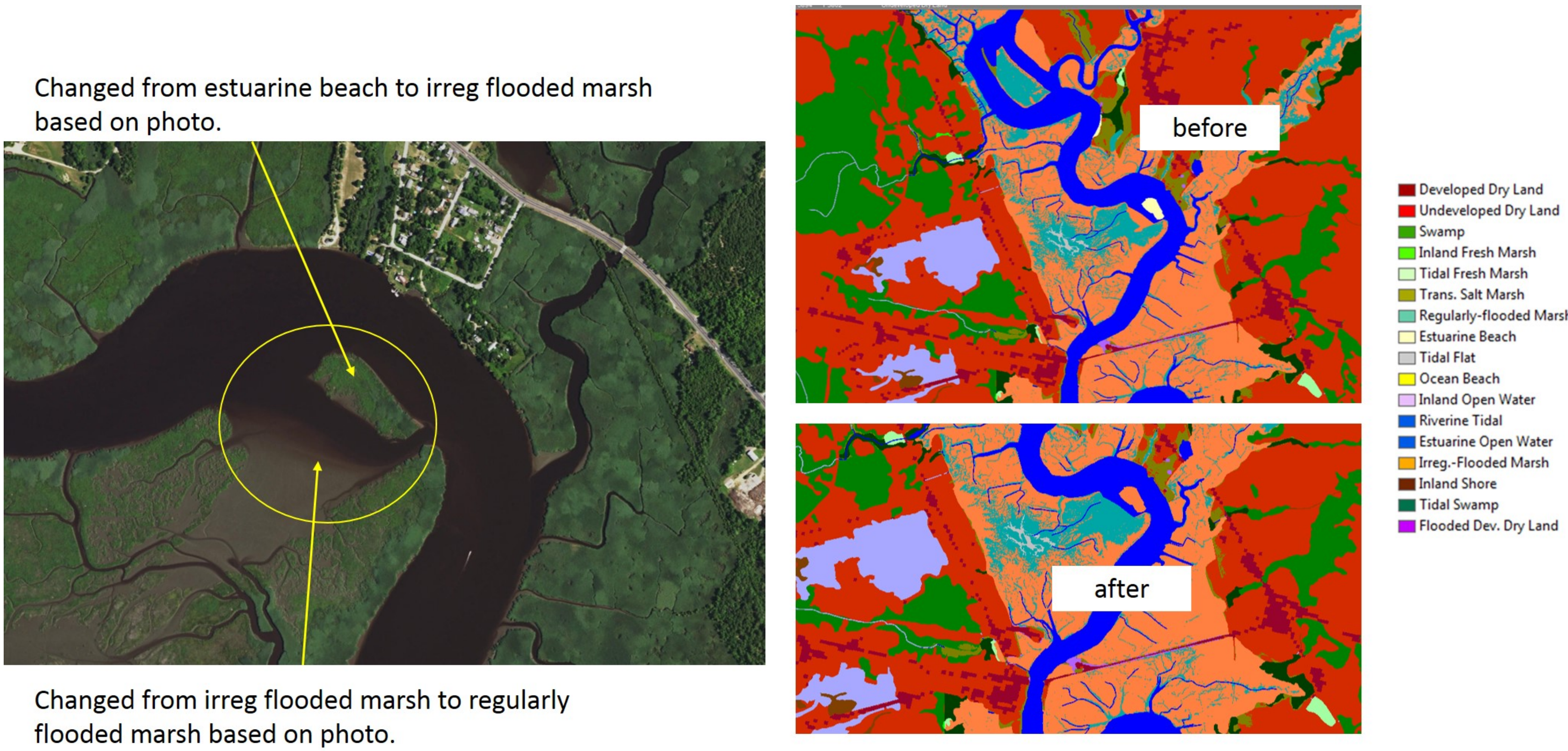


Figure A14. This is one of the areas that we changed from estuarine beach to irregularly flooded marsh based on aerial photos.

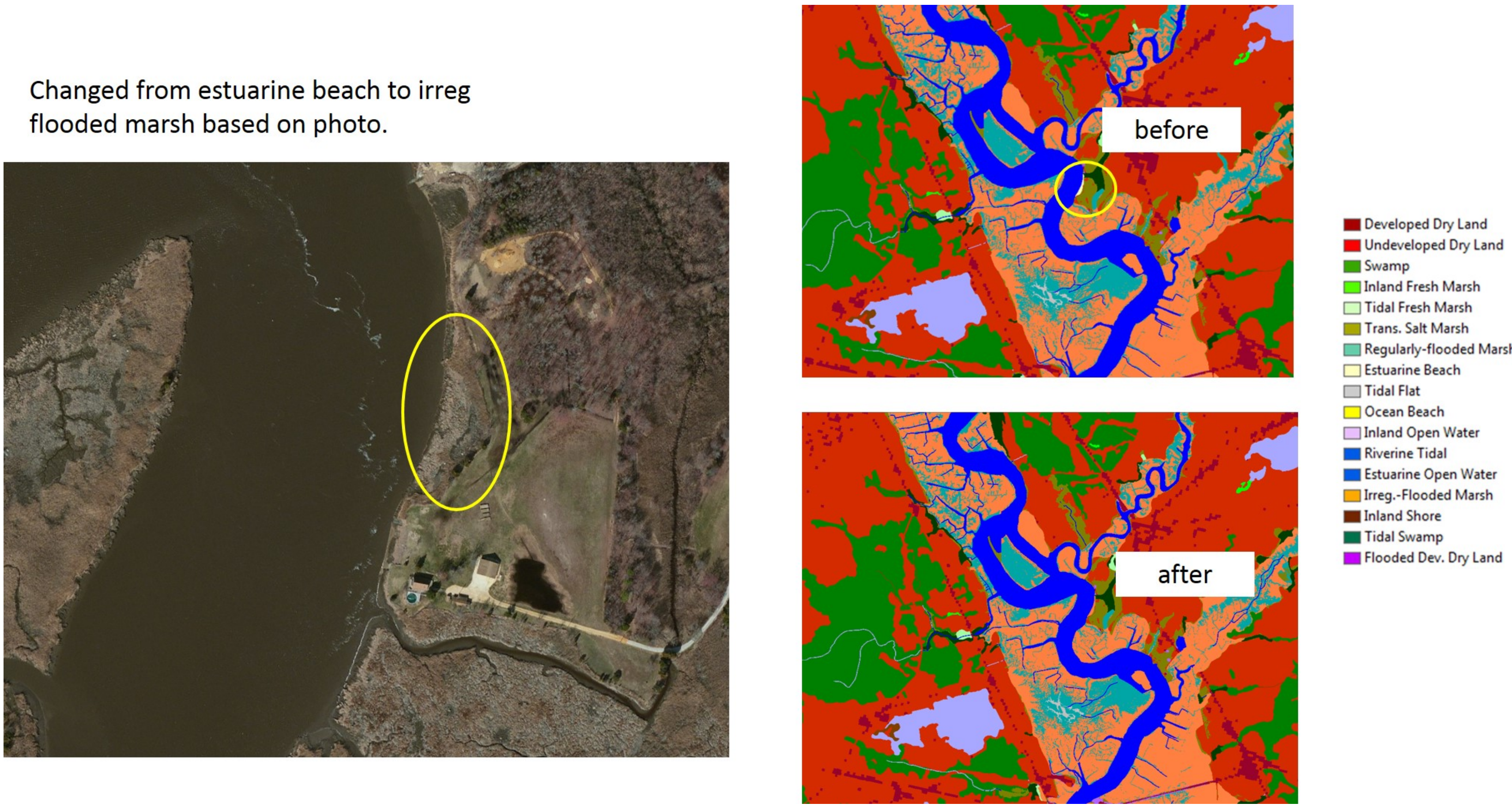


Figure A15. This is one of the areas that we changed from estuarine beach to irregularly flooded marsh based on aerial photos.

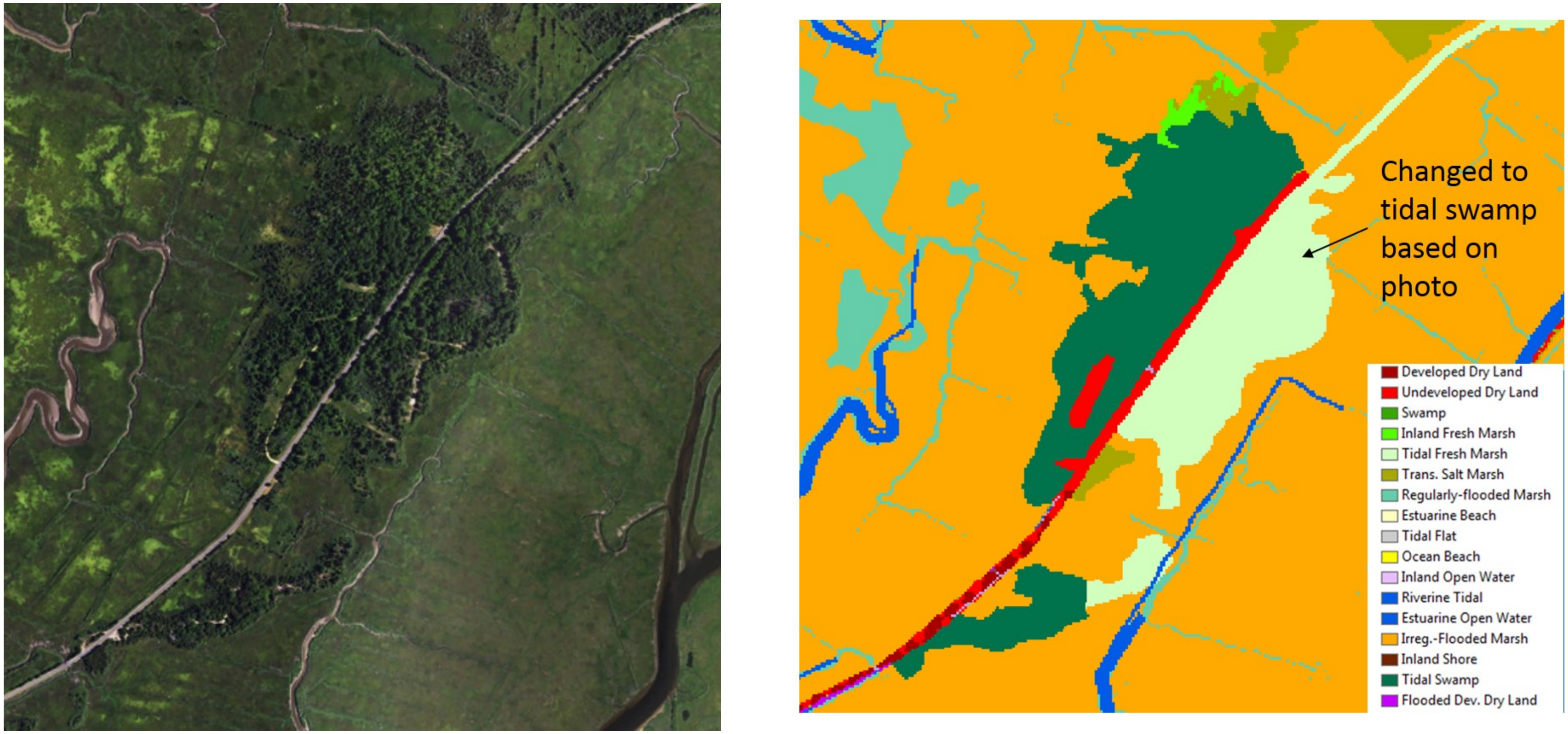


Figure A16. We changed this area from tidal fresh marsh to tidal swamp based on aerial photos.

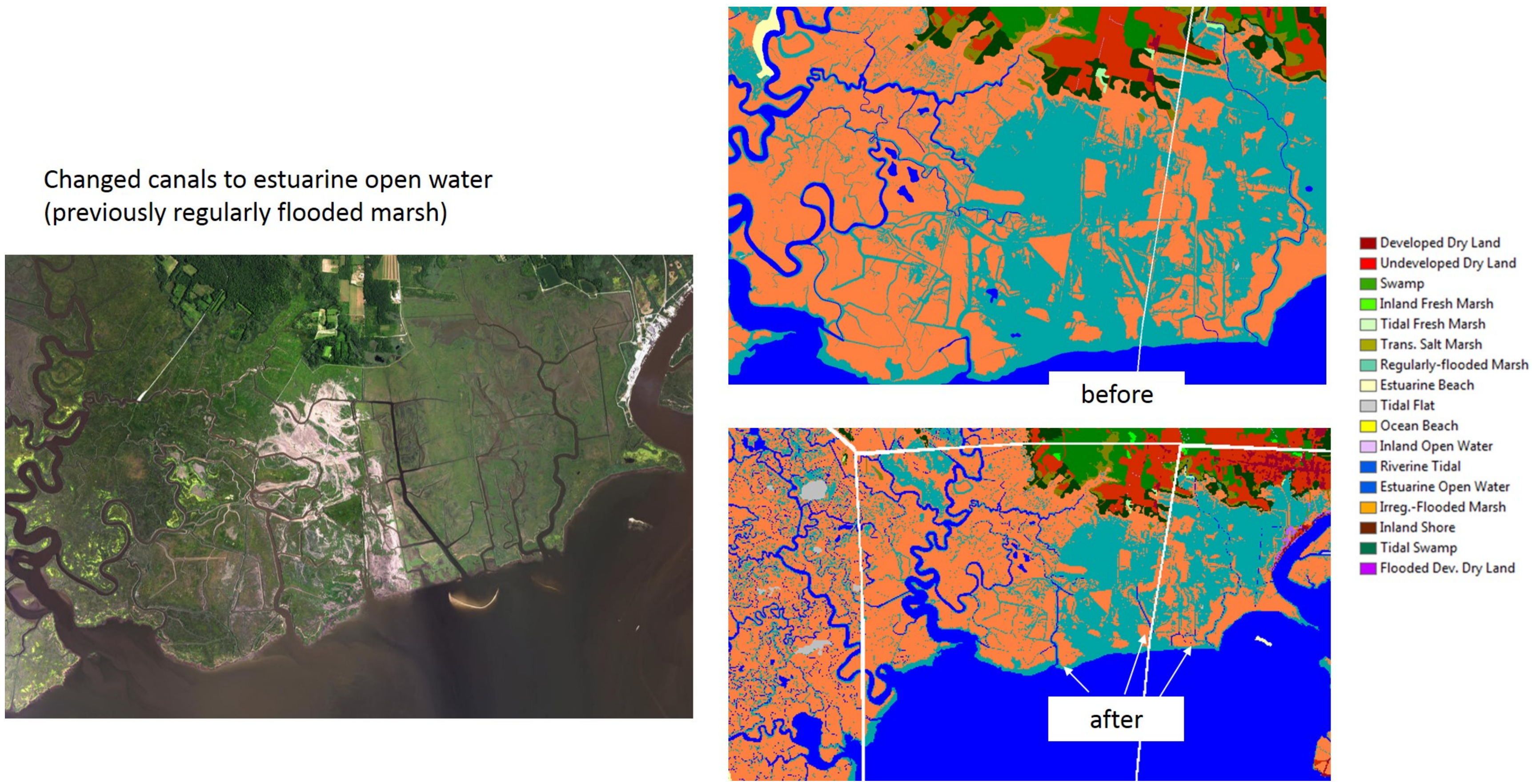


Figure A17. The southern part of the block (near the outlets of the Maurice and Dividing Rivers) has been highly modified. Based on aerial photos, we changed some of the areas that were clearly canals to estuarine open water (they had previously been labeled as regularly flooded marsh).

Output subsites

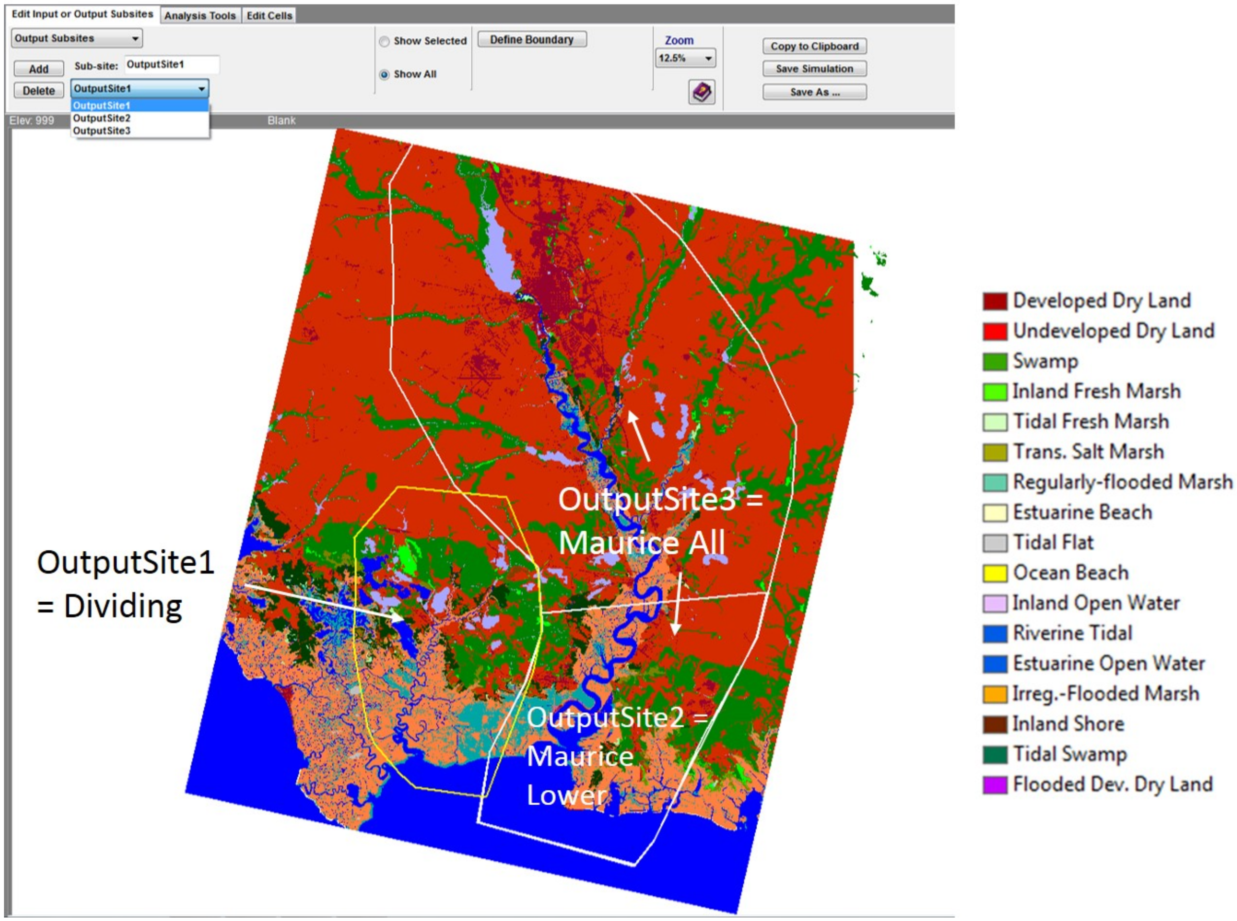


Figure A18. Results were generated for the Dividing and Maurice output sites (Dividing is outlined in yellow; "Lower Maurice" and "Maurice All" are outlined in white; later we ended up limiting results to the Lower Maurice only). The output site delineations are based on units used by PDE for monitoring and management. The overlap between the two sites does not affect the results because SLAMM generates results for each output site independently. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Broadkill-Mispillion block

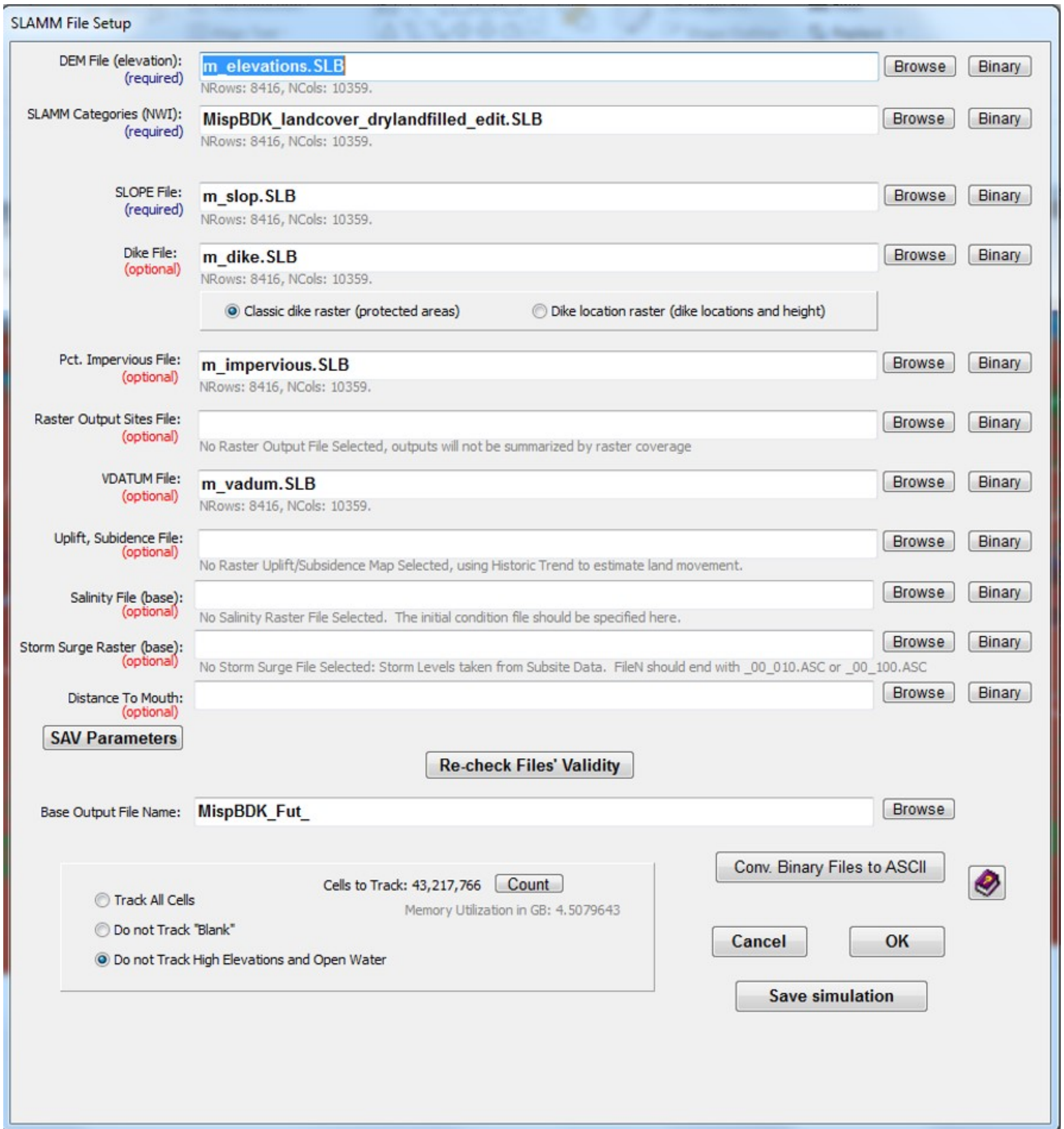


Figure A19. SLAMM File Setup for the Broadkill-Mispillion block. For the SLAMM categories input file, we used the NWI land cover layer (based on 2007 data) with one edit (which is described in Figure A21).

Input subsites

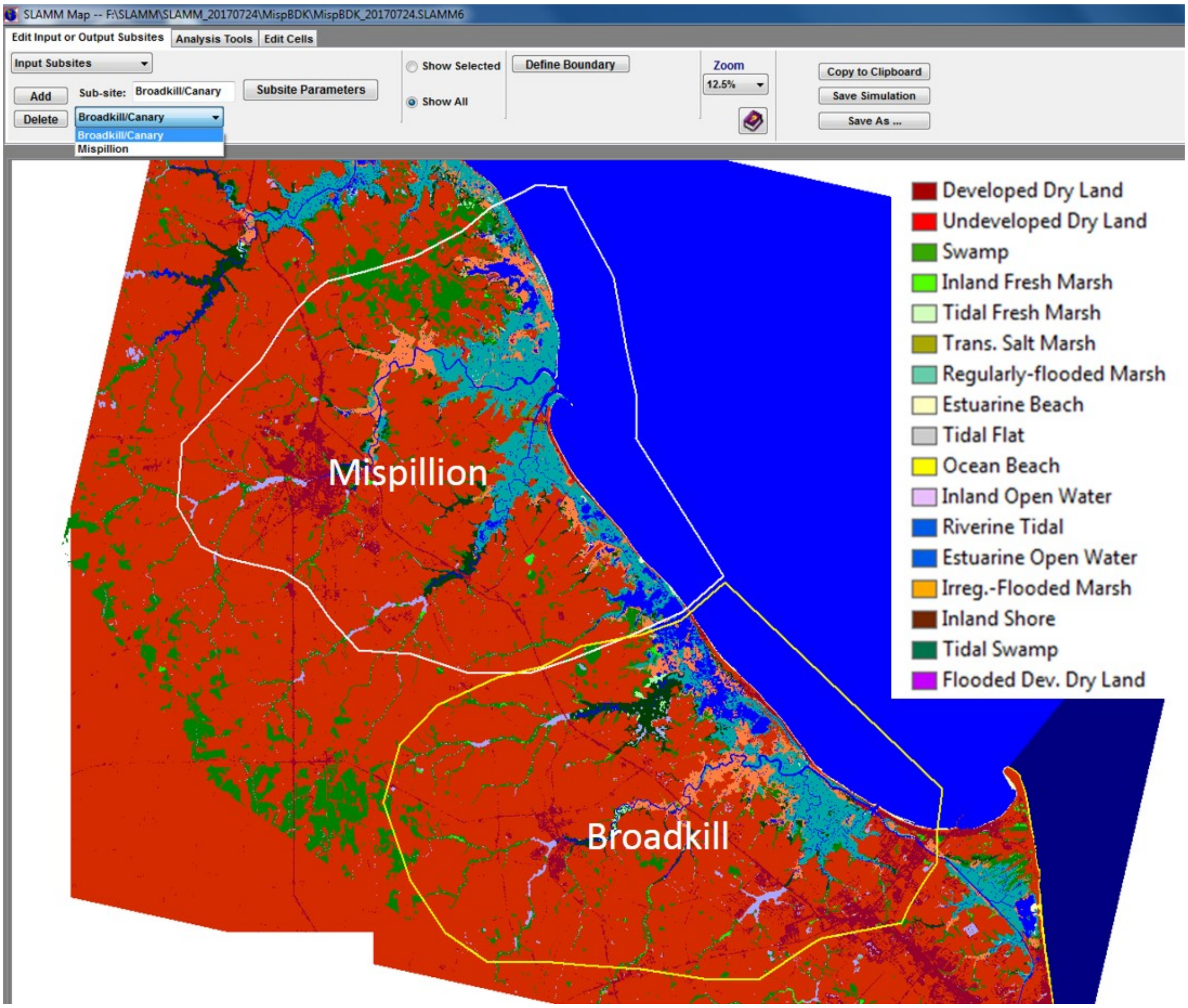


Figure A20. We set up two SLAMM input subsites for the Broadkill-Mispillion block to account for differences in Great Diurnal Tide Range (GT), salt elevation and marsh erosion rates. The boundaries of the input subsites differ from the Broadkill and Mispillion output sites (shown in Figure A1). The output sites are delineated based on units used by PDE for monitoring and management, whereas the boundaries of the input sites are driven by differences in input parameters. For a more detailed explanation of differences between input and output sites, see Text Box #1.

There are differences in Great Diurnal Tide Range (GT), salt elevation and marsh erosion rates across input subsites. During the “time zero” run, the SLAMM model was flooding some areas along the coast too aggressively (based on the aerial photos, too much dry land was being converted to transitional salt marsh). We tried making several adjustments (reductions) to the salt elevation entries to reduce these conversions, but they did not make a big difference. In the end, we used slightly reduced salt elevation entries (we changed the Broadkill from 1.05 to 1.04 and the Mispillion from 1.18 to 1.10). This is a difficult area to model due to the barrier/dunes along the coast and because a massive restoration project is underway in the Prime Hook NWR (where some marsh areas behind the barrier/dunes are very subsided due to many years of impoundments). Also there may be dikes or flow alterations not currently accounted for in the GIS layers.

Table A9. Input parameters for the Broadkill-Mispillion block.

Parameter	**Global**	**SubSite 1**	**SubSite 2**
Description	All	Broadkill	Mispillion
NWI Photo Date (YYYY)	2007	2007	2007
DEM Date (YYYY)	2014	2014	2014
Direction Offshore [n,s,e,w]	East	East	East
Historic Trend (mm/yr)	3.4	3.4	3.4
Historic Eustatic Trend (mm/yr)	1.7	1.7	1.7
MTL-NAVD88 (m)	0	0	0
GT Great Diurnal Tide Range (m)	1.614	1.418	1.811
Salt Elev. (m above MTL)	1.076	1.04	1.1
Marsh Erosion (horz. m/yr)	0.3399	0.115	0.563
Marsh Erosion Fetch (km)	0.1	0.1	0.1
Swamp Erosion (horz. m/yr)	1	1	1
T.Flat Erosion (horz. m /yr)	0.5	0.5	0.5
Reg.-Flood Marsh Accr (mm/yr)	see below	see below	see below
Irreg.-Flood Marsh Accr (mm/yr)	see below	see below	see below
Tidal-Fresh Marsh Accr (mm/yr)	see below	see below	see below
Inland-Fresh Marsh Accr (mm/yr)	1	1	1
Mangrove Accr (mm/yr)	0	0	0
Tidal Swamp Accr (mm/yr)	1.1	1.1	1.1
Swamp Accretion (mm/yr)	1.6	1.6	1.6
Beach Sed. Rate (mm/yr)	0.5	0.5	0.5
Irreg-Flood Collapse (m)	0	0	0
Reg-Flood Collapse (m)	0	0	0
Use Wave Erosion Model [True,False]	FALSE	FALSE	FALSE
Use Elev Pre-processor [True,False]	FALSE	FALSE	FALSE
H1 inundation (m above MTL)	0.4035	0.35	0.45
H2 inundation (m above MTL; H2>H1)	0.807	0.709	0.905
H3 inundation (m above MTL: H3>H2)	1.076	1.076	1.076
H4 inundation (m above MTL; H4>H3)	2	2	2
H5 inundation (m above MTL; H5>H4)	5	5	5

Table A9. Input parameters for the Broadkill-Mispillion block. (Continued)

Parameter	Global	SubSite 1	SubSite 2
Reg Flood Use Model [True,False]	TRUE	TRUE	TRUE
Reg Flood Max. Accr. (mm/year)	8	8	8
Reg Flood Min. Accr. (mm/year)	3.5	3.5	3.5
Reg Flood Elev a (mm/(year HTU^3))	1.3	1.3	1.3
Reg Flood Elev b (mm/(year HTU^2))	-4	-4	-4
Reg Flood Elev c (mm/(year*HTU))	1.3613	1.3613	1.3613
Reg Flood Elev d (mm/year)	7.6316	7.6316	7.6316
Irreg Flood Use Model [True,False]	TRUE	TRUE	TRUE
Irreg Flood Max. Accr. (mm/year)	4.6	4.6	4.6
Irreg Flood Min. Accr. (mm/year)	3.8	3.8	3.8
Irreg Flood Elev a (mm/(year HTU^3))	0	0	0
Irreg Flood Elev b (mm/(year HTU^2))	0	0	0
Irreg Flood Elev c (mm/(year*HTU))	-1.6386	-1.6386	-1.6386
Irreg Flood Elev d (mm/year)	0	0	0
T.Flat Use Model [True,False]	FALSE	FALSE	FALSE
Tidal Fresh Use Model [True,False]	FALSE	FALSE	FALSE

Table A10. Broadkill time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2007)	Change (acres)	% Change
Developed Dry Land	3232.2	3232.2	0.0	0.0
Estuarine Beach	148.9	114.0	-34.9	-23.5
Estuarine Open Water	8106.8	8415.7	309.0	3.8
Flooded Developed Dry Land	0.0	0.0	0.0	--
Inland Open Water	897.7	727.1	-170.5	-19.0
Inland Shore	37.0	37.0	0.0	0.0
Inland-Fresh Marsh	167.2	131.7	-35.4	-21.2
Irreg.-Flooded Marsh	2261.9	1613.0	-648.9	-28.7
Ocean Beach	0.0	0.0	0.0	--
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	3284.3	3955.8	671.5	20.4
Riverine Tidal	208.9	105.7	-103.2	-49.4
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	2348.6	1802.6	-546.0	-23.2
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	0.0	38.3	38.3	(increase from zero)
Tidal Swamp	1463.1	1445.9	-17.2	-1.2
Tidal-Fresh Marsh	164.3	159.3	-5.0	-3.0
Trans. Salt Marsh	64.7	1626.7	1562.0	2413.3
Undeveloped Dry Land	36833.4	35813.8	-1019.6	-2.8

Table A11. Mispillion time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2007)	Change (acres)	% Change
Developed Dry Land	2827.5	2827.5	0.0	0.0
Estuarine Beach	165.1	157.1	-8.0	-4.8
Estuarine Open Water	11159.9	11263.5	103.6	0.9
Flooded Developed Dry Land	0.0	0.0	0.0	--
Inland Open Water	668.2	612.1	-56.2	-8.4
Inland Shore	40.0	40.0	0.0	0.0
Inland-Fresh Marsh	162.2	127.3	-34.8	-21.5
Irreg.-Flooded Marsh	2622.4	2067.6	-554.8	-21.2
Ocean Beach	0.0	0.0	0.0	--
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	6440.0	7165.8	725.8	11.3
Riverine Tidal	137.1	103.0	-34.1	-24.9
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	4683.6	4134.0	-549.6	-11.7
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	93.5	119.2	25.7	27.4
Tidal Swamp	1127.6	1119.3	-8.2	-0.7
Tidal-Fresh Marsh	40.3	40.2	0.0	0.0
Trans. Salt Marsh	325.1	2194.0	1869.0	575.0
Undeveloped Dry Land	40211.5	38733.2	-1478.3	-3.7

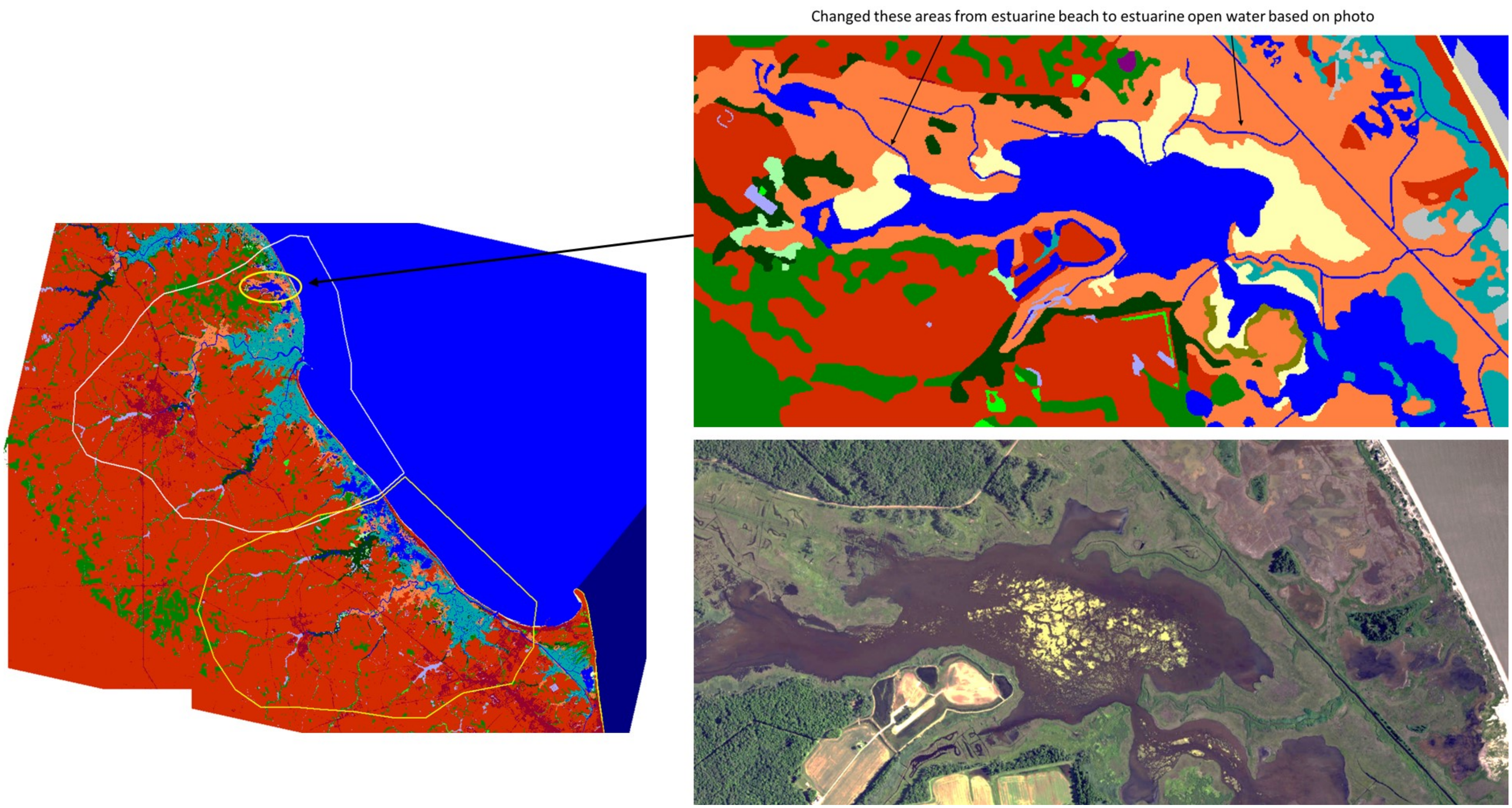


Figure A21. We changed the area outlined in yellow from estuarine beach to estuarine open water based on this aerial photo.

Output subsites

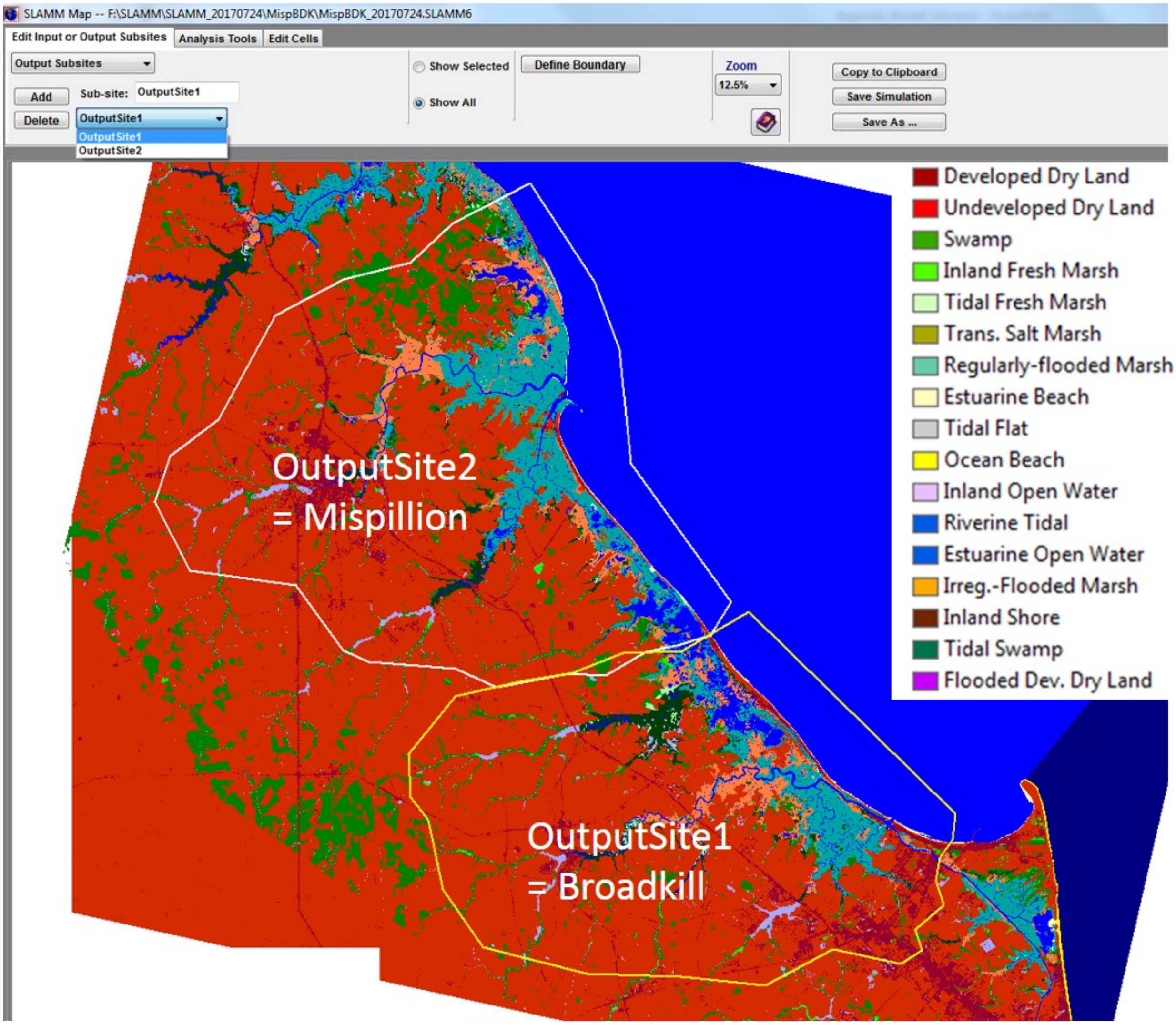


Figure A22. Results were generated for the Broadkill and Mispillion output sites (Broadkill is outlined in yellow; Mispillion in white). The output site delineations are based on units used by PDE for monitoring and management. The overlap between the two sites does not affect the results because SLAMM generates results for each output site independently. For a more detailed explanation of differences between input and output sites, see Text Box #1.

St. Jones block

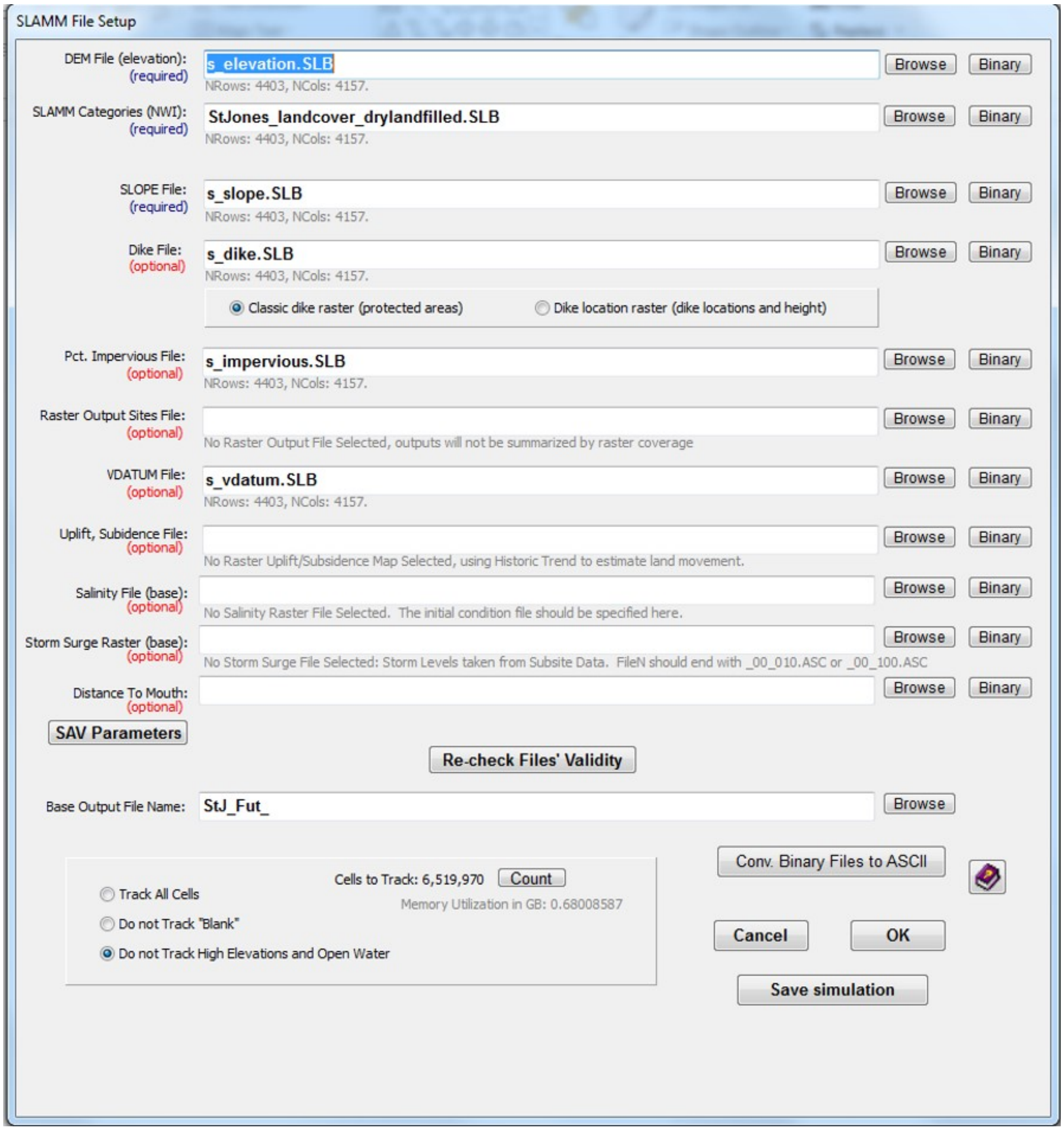


Figure A23. SLAMM File Setup for the St. Jones block. For the SLAMM categories input file, we used the NWI land cover layer (based on 2007 data), with no edits.

Input subsites (not needed)

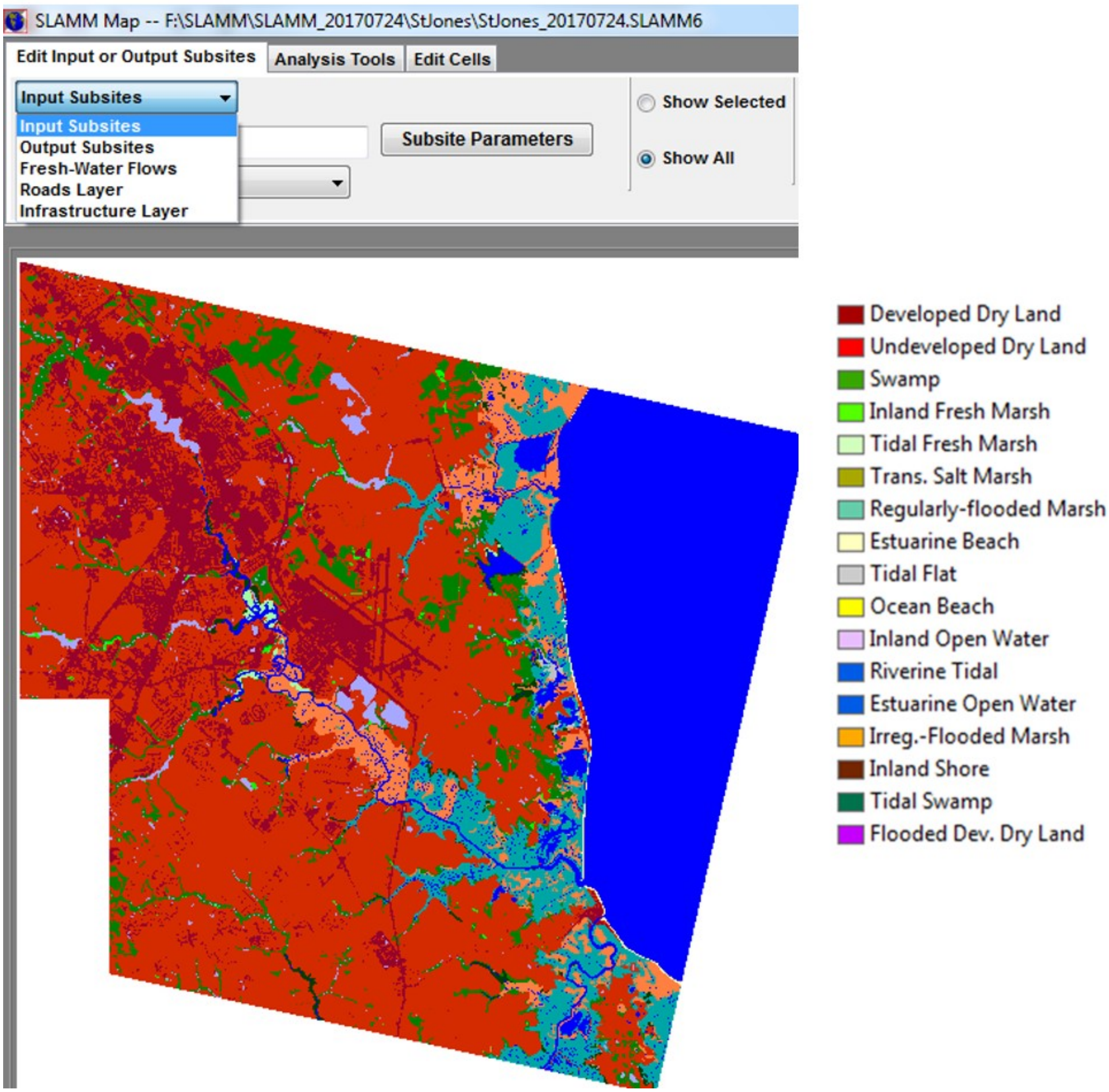


Figure A24. The input parameters were uniform within the St. Jones block, so we did not need to set up any SLAMM input subsites. This map differs from the St. Jones output site shown in Figure A1 because output sites are delineated based on units used by PDE for monitoring and management. If there had been input subsites within this block, those boundaries would have been driven by differences in input parameters. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Table A12. Input parameters for the St. Jones block.

Parameter	Global
Description	St. Jones
NWI Photo Date (YYYY)	2007
DEM Date (YYYY)	2014
Direction Offshore [n,s,e,w]	East
Historic Trend (mm/yr)	3.4
Historic Eustatic Trend (mm/yr)	1.7
MTL-NAVD88 (m)	0
GT Great Diurnal Tide Range (m)	1.811
Salt Elev. (m above MTL)	1.18
Marsh Erosion (horz. m /yr)	0.31
Marsh Erosion Fetch (km)	0.1
Swamp Erosion (horz. m /yr)	1
T.Flat Erosion (horz. m /yr)	0.5
Reg.-Flood Marsh Accr (mm/yr)	see below
Irreg.-Flood Marsh Accr (mm/yr)	see below
Tidal-Fresh Marsh Accr (mm/yr)	5
Inland-Fresh Marsh Accr (mm/yr)	1
Mangrove Accr (mm/yr)	0
Tidal Swamp Accr (mm/yr)	1.1
Swamp Accretion (mm/yr)	1.6
Beach Sed. Rate (mm/yr)	0.5
Irreg-Flood Collapse (m)	0
Reg-Flood Collapse (m)	0
Use Wave Erosion Model [True,False]	FALSE
Use Elev Pre-processor [True,False]	FALSE
H1 inundation (m above MTL)	0.4528
H2 inundation (m above MTL; H2>H1)	0.9055
H3 inundation (m above MTL: H3>H2)	1.076
H4 inundation (m above MTL; H4>H3)	2
H5 inundation (m above MTL; H5>H4)	5

Table A12. Input parameters for the St. Jones block. (Continued)

Parameter	Global
Reg Flood Use Model [True,False]	TRUE
Reg Flood Max. Accr. (mm/year)	8
Reg Flood Min. Accr. (mm/year)	3.5
Reg Flood Elev a (mm/(year HTU^3))	1.3
Reg Flood Elev b (mm/(year HTU^2))	-4
Reg Flood Elev c (mm/(year*HTU))	1.3613
Reg Flood Elev d (mm/year)	7.6316
Irreg Flood Use Model [True,False]	TRUE
Irreg Flood Max. Accr. (mm/year)	4.6
Irreg Flood Min. Accr. (mm/year)	3.8
Irreg Flood Elev a (mm/(year HTU^3))	0
Irreg Flood Elev b (mm/(year HTU^2))	0
Irreg Flood Elev c (mm/(year*HTU))	-1.6386
Irreg Flood Elev d (mm/year)	0
T.Flat Use Model [True,False]	FALSE
Tidal Fresh Use Model [True,False]	FALSE

Table A13. St. Jones time-zero results (acres).

SLAMM category	Initial coverage (acres)	Time Zero (2007)	Change (acres)	% Change
Developed Dry Land	1973.8	1973.8	0.0	0.0
Estuarine Beach	36.2	36.2	0.0	0.0
Estuarine Open Water	2194.0	2202.0	8.0	0.4
Flooded Developed Dry Land	0.0	0.0	0.0	--
Inland Open Water	349.1	341.1	-8.0	-2.3
Inland Shore	8.6	8.6	0.0	0.0
Inland-Fresh Marsh	42.8	39.7	-3.1	-7.3
Irreg.-Flooded Marsh	1357.3	1354.8	-2.5	-0.2
Ocean Beach	0.0	0.0	0.0	--
Ocean Flat	0.0	0.0	0.0	--
Open Ocean	0.0	0.0	0.0	--
Regularly-Flooded Marsh	1859.6	1865.2	5.6	0.3
Riverine Tidal	2.6	2.6	0.0	0.0
Rocky Intertidal	0.0	0.0	0.0	--
Swamp	732.2	657.5	-74.7	-10.2
Tidal Creek	0.0	0.0	0.0	--
Tidal Flat	10.1	10.1	0.0	0.0
Tidal Swamp	101.0	101.0	0.0	0.0
Tidal-Fresh Marsh	48.3	48.3	0.0	0.0
Trans. Salt Marsh	2.5	164.0	161.5	6406.2
Undeveloped Dry Land	9876.2	9789.5	-86.8	-0.9

Output subsites

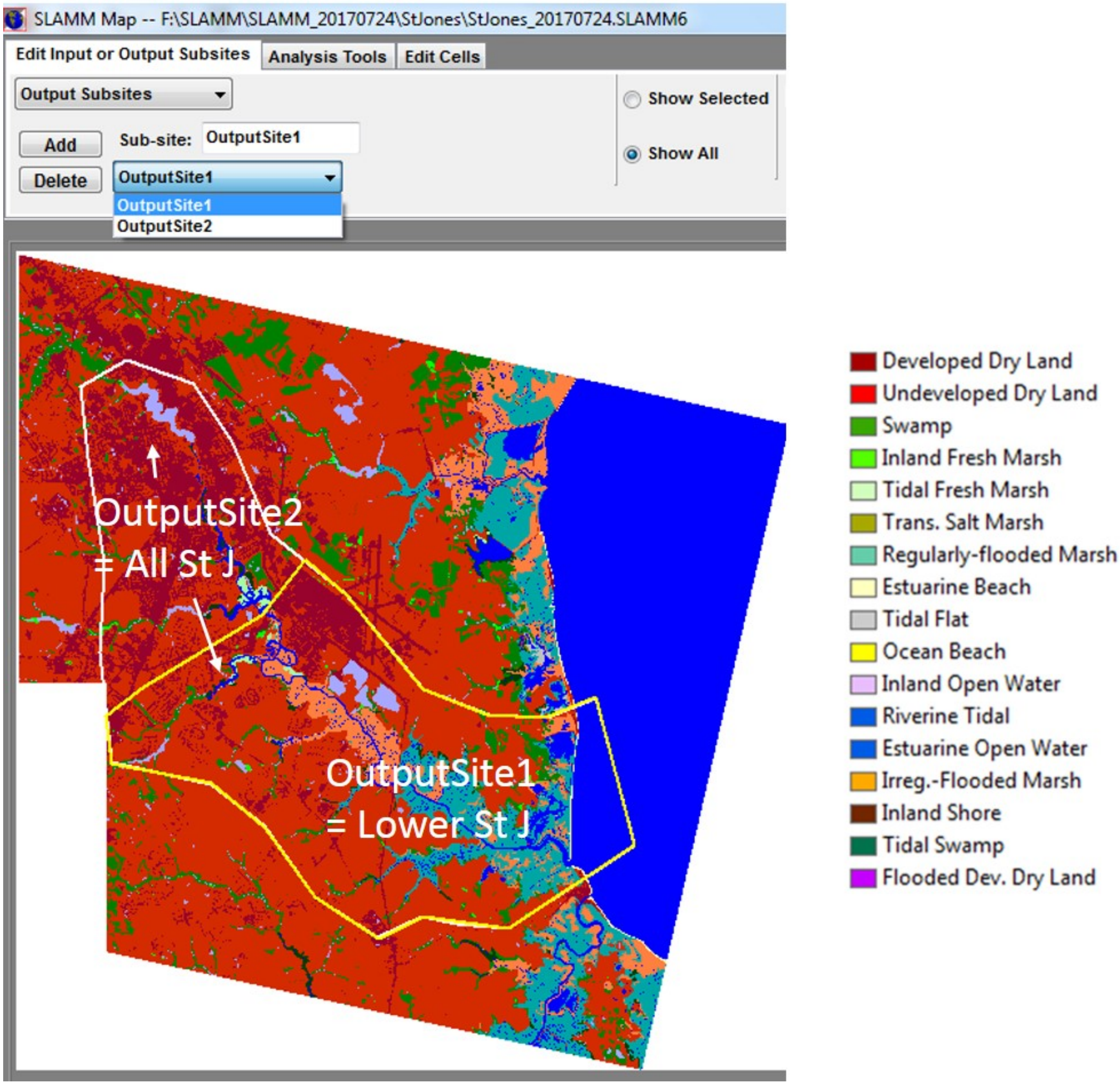


Figure A25. Outputs were generated for two output subsites: "Lower St. Jones" and "St. Jones All" ("Lower St. Jones" is outlined in yellow; "St. Jones All" is outlined in white; later we ended up limiting results to the Lower St. Jones only). The output site delineations are based on units used by PDE for monitoring and management. SLAMM generates results for each output site independently. For a more detailed explanation of differences between input and output sites, see Text Box #1.

Reference

Warren Pinnacle Consulting, Inc. (2016). "SLAMM 6.7 Technical Documentation." Available online: http://warrenpinnacle.com/prof/SLAMM6/SLAMM_6.7_Technical_Documentation.pdf

Appendix B

NWI Classes to SLAMM Categories

NWI Classes to SLAMM Categories

		NWI Code Characters					
SLAMM Code	Name	System	Subsystem	Class	Subclass[1]	Water Regime [2]	Notes
1	Developed Dry Land (upland)	U					SLAMM assumes developed land will be defended against sea-level rise. Categories 1 & 2 need to be distinguished manually.
2	Undeveloped Dry Land (upland)	U					
3	Nontidal Swamp	P	NA	FO, SS	1, 3, to 7, None	A, B, C, E, F, G, H, J, K None or U	Palustrine Forested and Scrub-Shrub (living or dead)
4	Cypress Swamp	P	NA	FO, SS	2	A, B, C, E, F, G, H, J, K None or U	Needle-leaved Deciduous forest and Scrub-Shrub (living or dead)
5	Inland Fresh Marsh	P	NA	EM, f*	All None	A, B, C, E, F, G, H, J, K None or U	Palustrine Emergents; Lacustrine and Riverine Nonpersistent Emergents
		L	2	EM	2 None	E, F, G, H, K, None or U	
		R	2, 3	EM	2 None	E, F, G, H, K, None or U	
6	Tidal Fresh Marsh	R	1	EM	2, None	Fresh Tidal N, T	Riverine and Palustrine Freshwater Tidal Emergents
		P	NA	EM	All, None	Fresh Tidal S, R, T	
7	Transitional Marsh /Scrub-Shrub	E	2	SS, FO	1, 2, 4 to 7, None	Tidal M, N, P None or U	Estuarine Intertidal, Scrub-shrub and Forested (ALL expect 3 subclass)
8	Regularly Flooded Marsh (Saltmarsh)	E	2	EM	1 None	Tidal N None or U	Only regularly flooded tidal marsh; No intermittently flooded "P" water regime
9	Mangrove Tropical settings only, otherwise 7	E	2	FO, SS	3	Tidal M, N, P None or U	Estuarine Intertidal Forested and Scrub-shrub, Broad-leaved Evergreen
10	Estuarine Beach (old code BB and FL = US)	E	2	US	1, 2	Tidal N, P	Estuarine Intertidal Unconsolidated Shores
		E	2	US	None	Tidal N, P	Only when shores (need images or base map)
11	Tidal Flat old code BB and FL = US	E	2	US	3, 4 None	Tidal M, N None or U	Estuarine Intertidal Unconsolidated Shore (mud or organic) and Aquatic Bed; Marine Intertidal Aquatic Bed
		E	2	AB	All Except 1	Tidal M, N None or U	
		E	2	AB	1	P	
		M	2	AB	1, 3 None	Tidal M, N None or U	
12	Ocean Beach (old code BB and FL = US)	M	2	US	1, 2 Important	Tidal N, P	Marine Intertidal Unconsolidated Shore, Cobble-gravel, sand
		M	2	US	None	Tidal P	
13	Ocean Flat (old code BB and FL = US)	M	2	US	3, 4 None	Tidal M, N None or U	Marine Intertidal Unconsolidated Shore, mud or organic (low energy coastline)

		NWI Code Characters					
SLAMM Code	Name	System	Subsystem	Class	Subclass	Water Regime	Notes
14	Rocky Intertidal	M	2	RS	All None	Tidal M, N, P None or U	Marine and Estuarine Intertidal Rocky Shore and Reef
		E	2	RS	All None	Tidal M, N, P None or U	
		E	2	RF	2, 3 None	Tidal M, N, P None or U	
		E	2	AB	1	Tidal M, N, P None or U	
15	Inland Open Water (old code OW = UB)	R	2	UB, AB	All, None	All, None	Riverine, Lacustrine, and Palustrine Unconsolidated Bottom, and Aquatic Beds
		R	3	UB, AB, RB	All, None	All, None	
		L	1, 2	UB, AB, RB	All, None	All, None	
		P	NA	UB, AB, RB	All, None	All, None	
		R	5	UB	All	Only U	
16	Riverine Tidal Open Water (old code OW = UB)	R	1	All Except EM	All, None Except 2	Fresh Tidal S, R, T, V	Riverine Tidal Open Water (R1EM2 falls under SLAMM Category 6)
17	Estuarine Open Water (no h** for diked / impounded, old code OW = UB)	E	1	All	All, None	Tidal L, M, N, P	Estuarine Subtidal
18	Tidal Creek	E	2	SB	All, None	Tidal M, N, P Fresh Tidal R, S	Estuarine Intertidal Streambed
19	Open Ocean (old code OW = UB)	M	1	All	All	Tidal L, M, N, P	Marine Subtidal and Marine Intertidal Aquatic Bed and Reef
		M	2	RF	1,3, None	Tidal M, N, P None or U	
20	Irregularly Flooded Marsh	E	2	EM	1, 5, None	P	Irregularly Flooded Estuarine Intertidal Emergent Marsh
		E	2	US	2, 3, 4, None	P	Only when these salt pans are associated with E2EMN or P
21	Not Used						
22	Inland Shore (old code BB and FL = US)	L	2	US, RS	All	All Nontidal	Shoreline nor pre-processed using Tidal Range Elevations.
		P	NA	US	All, None	All Nontidal None or U	
		R	2, 3	US, RS	All, None	All Nontidal None or U	
		R	4	SB	All, None	All Nontidal None or U	
23	Tidal Swamp	P	NA	SS, FO	All, None	Fresh Tidal R, S,T	Tidally influenced swamp

Note: * Farmed wetlands are coded as Pf

** h = Diked/Impounded – When it is desirable to model the protective effects of dikes, an additional raster layer must be specified.

[1] Subclasses: All - Valid components; None - no “Subclass” or “Water Regime” listed; U - Unknown Water regime; NA - Not applicable

[2] Water regimes: A, B, C, E, F, G, J, K – Nontidal; L, M, N, P – Saltwater Tidal; R, S, T, V – Fresh Tidal

Source: Bill Wilen. For more information on the NWI coding systems, see Appendix A of Dahl et al. (2009)

Appendix C

Elevation change and accretion rate calculations

Surface Elevation Table (SET) data were used to determine models of wetland elevation-change rates for the study area. This appendix contains elevation change data for each site with SET data (see list below).

Table C1. Sites with Surface Elevation Table (SET) data.

Lat	Long	State	Site name	SET	SLAMM category*	Date of first measurement**	Date of last measurement**
38.78110	-75.16995	DE	Canary Creek	BDK3	RF	2014-05-28	2016-08-24
38.78632	-75.16978	DE	Canary Creek	BDK2	RF		
38.78733	-75.16603	DE	Canary Creek	BDK1	RF		
39.07065	-75.41741	DE	St. Jones - Impoundment	SJIP	RF	2007-06-07	2015-09-02
39.08807	-75.43750	DE	St. Jones - Boardwalk	SJBW	RF	2004-06-22	2015-09-02
39.11576	-75.49751	DE	St. Jones - Wildcat	SJWC	IRF	2007-06-18	2015-03-18
39.16974	-74.87750	NJ	Dennis Creek	DNSET1	IRF	2011-05-13	2015-09-11
39.17344	-74.86976	NJ	Dennis Creek	DNSET2	IRF		
39.18449	-74.84963	NJ	Dennis Creek	DNSET3	IRF		
39.22728	-75.10800	NJ	Dividing Creek	DIVSET1	IRF	2012-05-31	2015-10-21
39.23281	-75.11678	NJ	Dividing Creek	DIVSET2	IRF		
39.23983	-75.10400	NJ	Dividing Creek	DIVSET3	IRF		
39.24200	-75.01034	NJ	Maurice River	MCSET3	IRF	2011-04-18	2015-10-06
39.24378	-75.01386	NJ	Maurice River	MCSET2	IRF		
39.24418	-75.01483	NJ	Maurice River	MCSET1	IRF		

* SLAMM categories: RF = Regularly-flooded Marsh, IRF = Irreg.-Flooded Marsh

**Additional data may be available. This table only reflects the date range of the data we were able to obtain at the time of this case study.

New Jersey SET sites

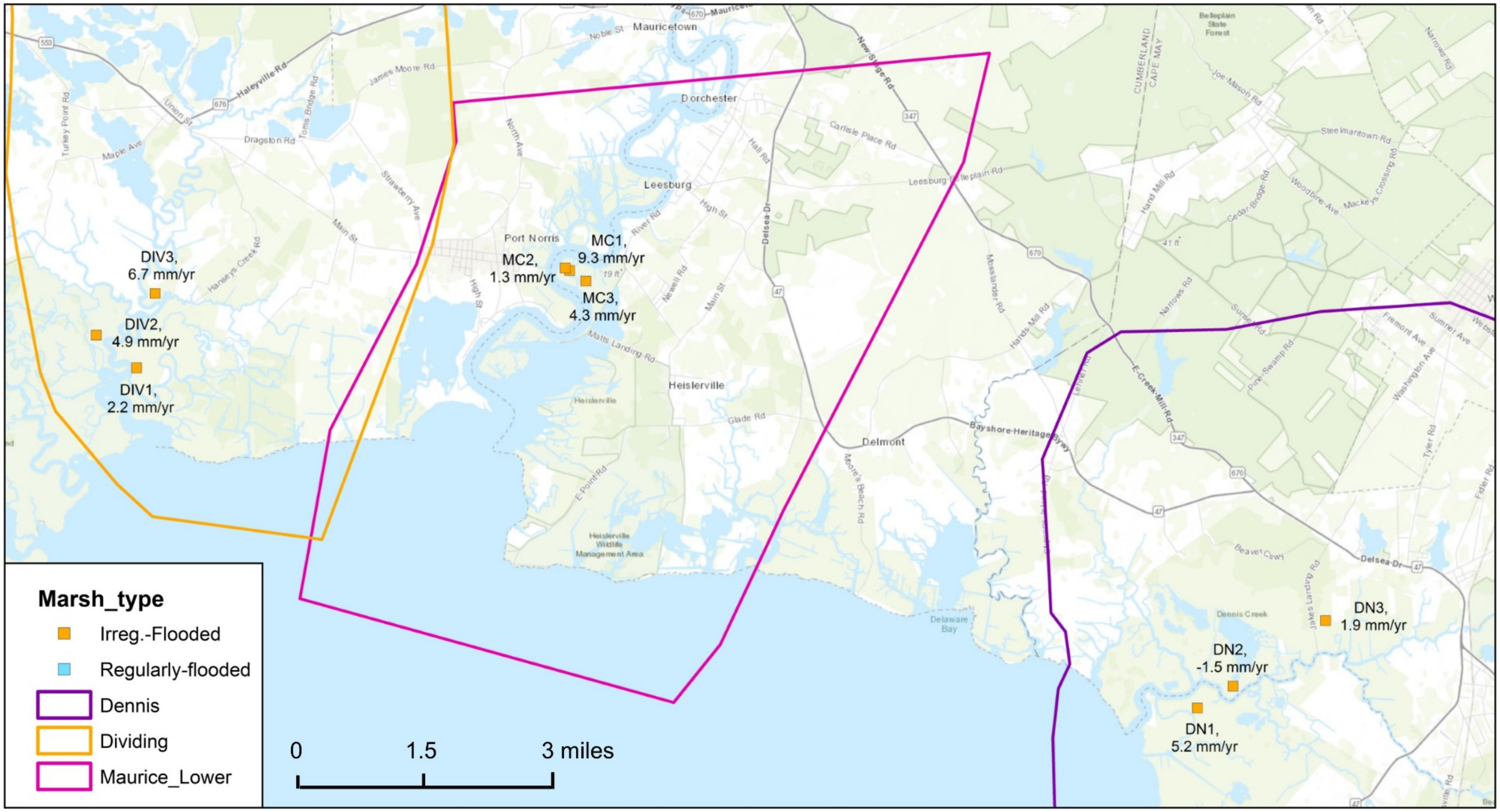


Figure C1. Locations of SET sites in the New Jersey marshes (Dividing (DIV), Maurice (MC) and Dennis (DN)). Values equal elevation change (mm/yr) averaged across the period of record.

Dennis (DN) Subsite

Average of position/pin data for each set & date (mm)

Date	DN1	DN2	DN3
2011-03-18	Installation date		
2011-05-13	165.58	127.67	84.56
2011-10-06	163.64	113.83	97.08
2012-08-02	165.08	119.42	85.33
2012-09-10	168.33	114.47	89.31
2012-10-23	170.08	116.39	89.17
2012-11-15	165.97	118.36	89.81
2013-04-17	173.56	108.11	98.50
2013-08-29	174.75	110.00	88.67
2014-05-23	174.92	113.53	89.19
2014-10-02	182.36	116.67	98.47
2015-04-28	179.33	111.25	98.72
2015-07-07	185.08	116.56	94.86
2015-09-11	186.11	114.33	94.67
Set Elev. (HTU)[1]	1.040	1.317	0.949
Elev. Change (mm/yr)[2]	5.205	-1.473	1.883

Elevation change from starting point (converted to cm)

2011-03-18 installation date

Starting point 2011-05-13	165.58 (mm)	127.67 (mm)	84.56 (mm)	
Date	DN1 (cm)	DN2 (cm)	DN3 (cm)	Average (cm)
2011-10-06	-0.19	-1.38	1.25	-0.11
2012-08-02	-0.05	-0.83	0.08	-0.27
2012-09-10	0.28	-1.32	0.48	-0.19
2012-10-23	0.45	-1.13	0.46	-0.07
2012-11-15	0.04	-0.93	0.53	-0.12
2013-04-17	0.80	-1.96	1.39	0.08
2013-08-29	0.92	-1.77	0.41	-0.15
2014-05-23	0.93	-1.41	0.46	-0.01
2014-10-02	1.68	-1.10	1.39	0.66
2015-04-28	1.38	-1.64	1.42	0.38
2015-07-07	1.95	-1.11	1.03	0.62
2015-09-11	2.05	-1.33	1.01	0.58

Elev. NAVD88 (m)*	0.869	1.134	0.782
NAVD88-MTL**	-0.129	-0.129	-0.128
Tide Range (GT) (m)	1.918	1.918	1.918

*2013 RTK, adjusted for 2011 installation date

**Used in VDATUM

Tide range data is from NOAA Station (ID 8536581), Bidwell Creek

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

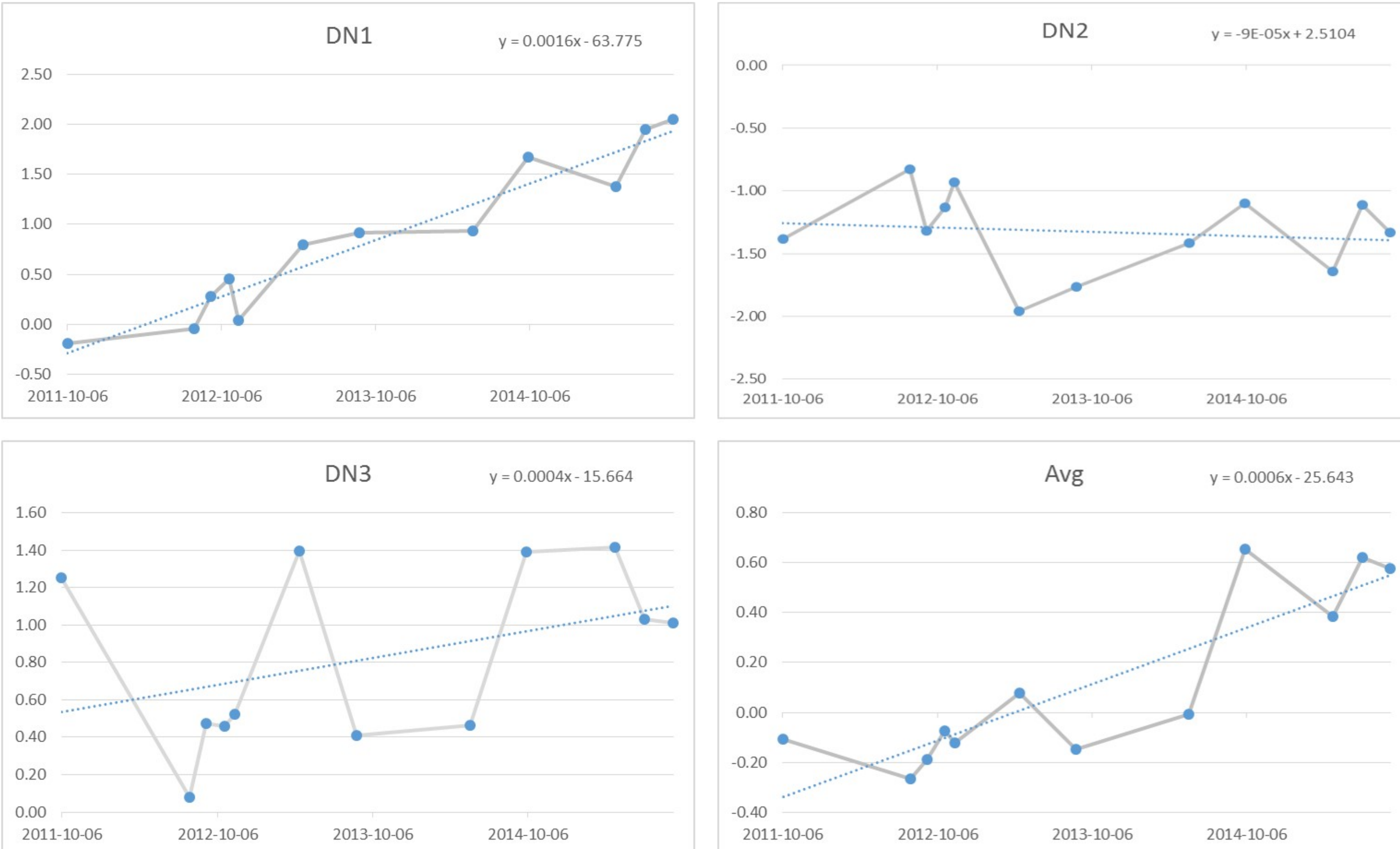


Figure C2. Elevation change plots for the three Dennis SET sites, fit with a linear trendlines. The average across all three sites (Avg) is also included. The y-axis shows elevation change (cm) from the starting point, and the x-axis shows measurement dates.

Maurice (MC) Subsite

Average of position/pin data for each set & date (mm)

Date	MR1	MR2	MR3
2010-10-13	installation date		
2011-04-18	191.47	252.49	185.25
2011-09-20	194.47	252.17	187.31
2012-05-29	199.31	250.67	185.83
2012-09-07	201.14	252.81	182.00
2012-10-25	205.58	255.50	190.14
2012-11-14	190.14	231.53	165.94
2013-04-25	202.72	248.56	188.56
2013-09-11	209.64	246.36	187.50
2014-04-22	205.50	248.19	187.31
2014-09-30	223.64	255.53	196.28
2015-04-29	223.08	252.25	197.28
2015-07-24	230.19	257.22	202.22
2015-10-06	233.92	256.53	200.58
Set Elev. (HTU)[1]	0.788	1.002	0.978
Elev. Change (mm/yr)[2]	9.31	1.31	4.30

Elevation change from starting point (converted to cm)

2010-10-13 installation date

Starting point 2011-04-18	191.47 (mm)	252.49 (mm)	185.25 (mm)	
Date	MR1 (cm)	MR2 (cm)	MR3 (cm)	Average (cm)
2011-09-20	0.30	-0.03	0.21	0.16
2012-05-29	0.78	-0.18	0.06	0.22
2012-09-07	0.97	0.03	-0.33	0.22
2012-10-25	1.41	0.30	0.49	0.73
2012-11-14	-0.13	-2.10	-1.93	-1.39
2013-04-25	1.13	-0.39	0.33	0.35
2013-09-11	1.82	-0.61	0.23	0.48
2014-04-22	1.40	-0.43	0.21	0.39
2014-09-30	3.22	0.30	1.10	1.54
2015-04-29	3.16	-0.02	1.20	1.45
2015-07-24	3.87	0.47	1.70	2.01
2015-10-06	4.24	0.40	1.53	2.06

Elev. NAVD88 (m)*	0.667	0.877	0.852
NAVD88-MTL**	-0.105	-0.105	-0.106
Tide Range (GT) (m)	1.96	1.96	1.96

*2013 RTK, adjusted for 2010 installation date

**=VDATUM

Tide range data is from NOAA Station (ID 8536931), Fortescue

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

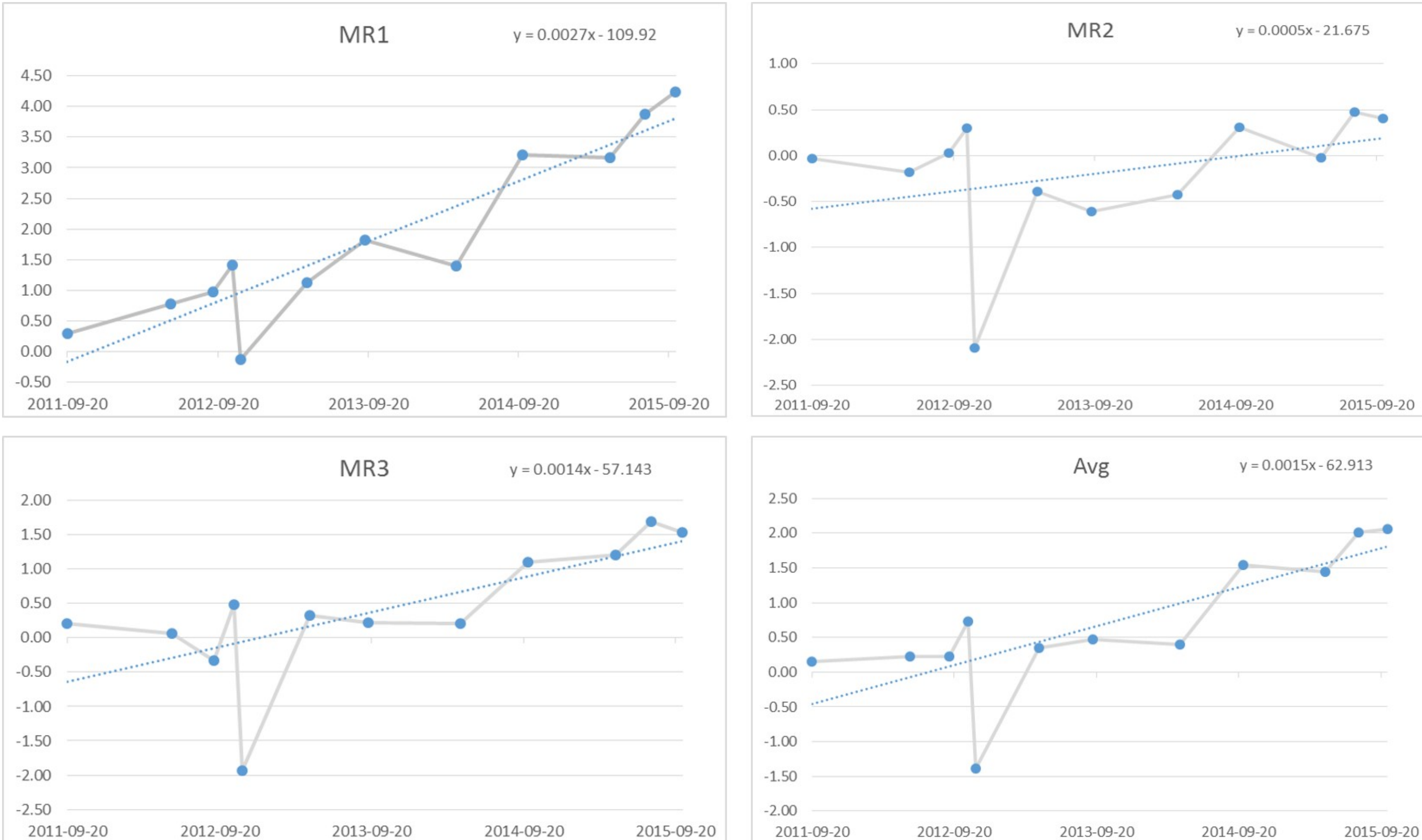


Figure C3. Elevation change plots for the three Maurice SET sites, fit with a linear trendlines. The average across all three sites (Avg) is also included. The y-axis shows elevation change (cm) from the starting point, and the x-axis shows measurement dates.

Dividing (DIV) Subsite

Average of position/pin data for each set & date (mm)

Date	DV1	DV2	DV3
2012-01-09	installation date		
2012-05-31	139.25	179.47	71.28
2012-08-17	138.28	172.92	74.89
2012-10-23	153.53	171.94	80.33
2012-11-14	149.39	179.42	77.61
2013-05-29	143.83	181.92	78.64
2013-08-19	140.78	175.97	78.08
2014-04-28	148.78	184.19	85.47
2014-09-23	154.11	188.83	92.17
2015-04-21	147.69	189.22	94.08
2015-08-10	151.14	194.67	97.17
2015-10-21	149.08	186.42	92.31
Set Elev. (HTU)[1]	1.234	0.849	0.889
Elev. Change (mm/yr)[2]	2.23	4.91	6.69

Elev. NAVD88 (m)*	1.137	0.763	0.799
NAVD88-MTL**	-0.072	-0.069	-0.072
Tide Range (GT) (m)	1.96	1.96	1.96

*2013 RTK, adjusted for 2012 installation date

**=VDATUM

Tide range data is from NOAA Station (ID 8536931), Fortescue

Elevation change from starting point (converted to cm)

2012-01-09 installation date

Starting point 2012-05-31	139.25 (mm)	179.47 (mm)	71.28 (mm)	130.00 (mm)
Date	DV1 (cm)	DV2 (cm)	DV3 (cm)	Average (cm)
2012-08-17	-0.10	-0.66	0.36	-0.13
2012-10-23	1.43	-0.75	0.91	0.53
2012-11-14	1.01	-0.01	0.63	0.55
2013-05-29	0.46	0.24	0.74	0.48
2013-08-19	0.15	-0.35	0.68	0.16
2014-04-28	0.95	0.47	1.42	0.95
2014-09-23	1.49	0.94	2.09	1.50
2015-04-21	0.84	0.98	2.28	1.37
2015-08-10	1.19	1.52	2.59	1.77
2015-10-21	0.98	0.69	2.10	1.26

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

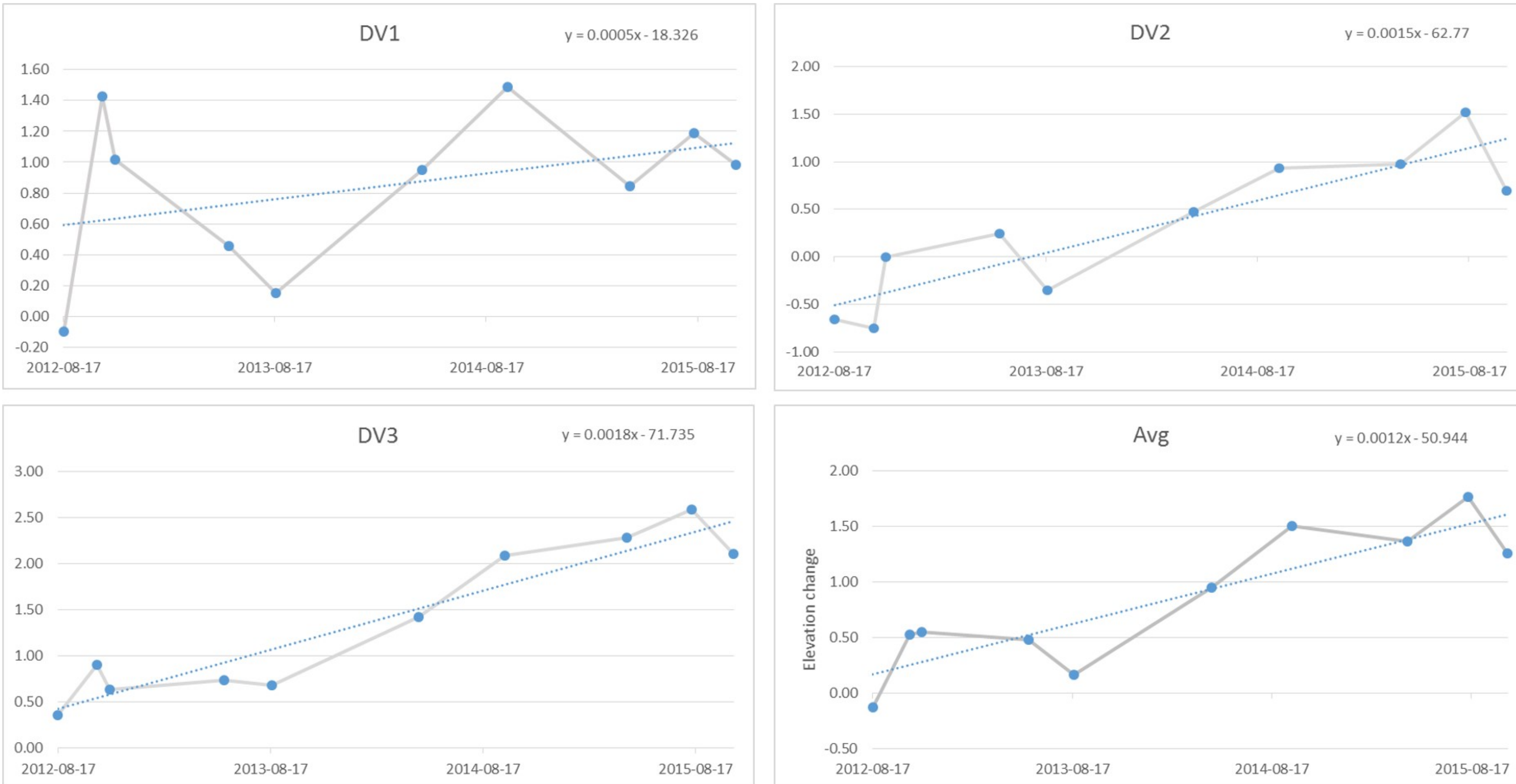


Figure C4. Elevation change plots for the three Dividing SET sites, fit with a linear trendlines. The average across all three sites (Avg) is also included. The y-axis shows elevation change (cm) from the starting point, and the x-axis shows measurement dates.

Delaware SET sites

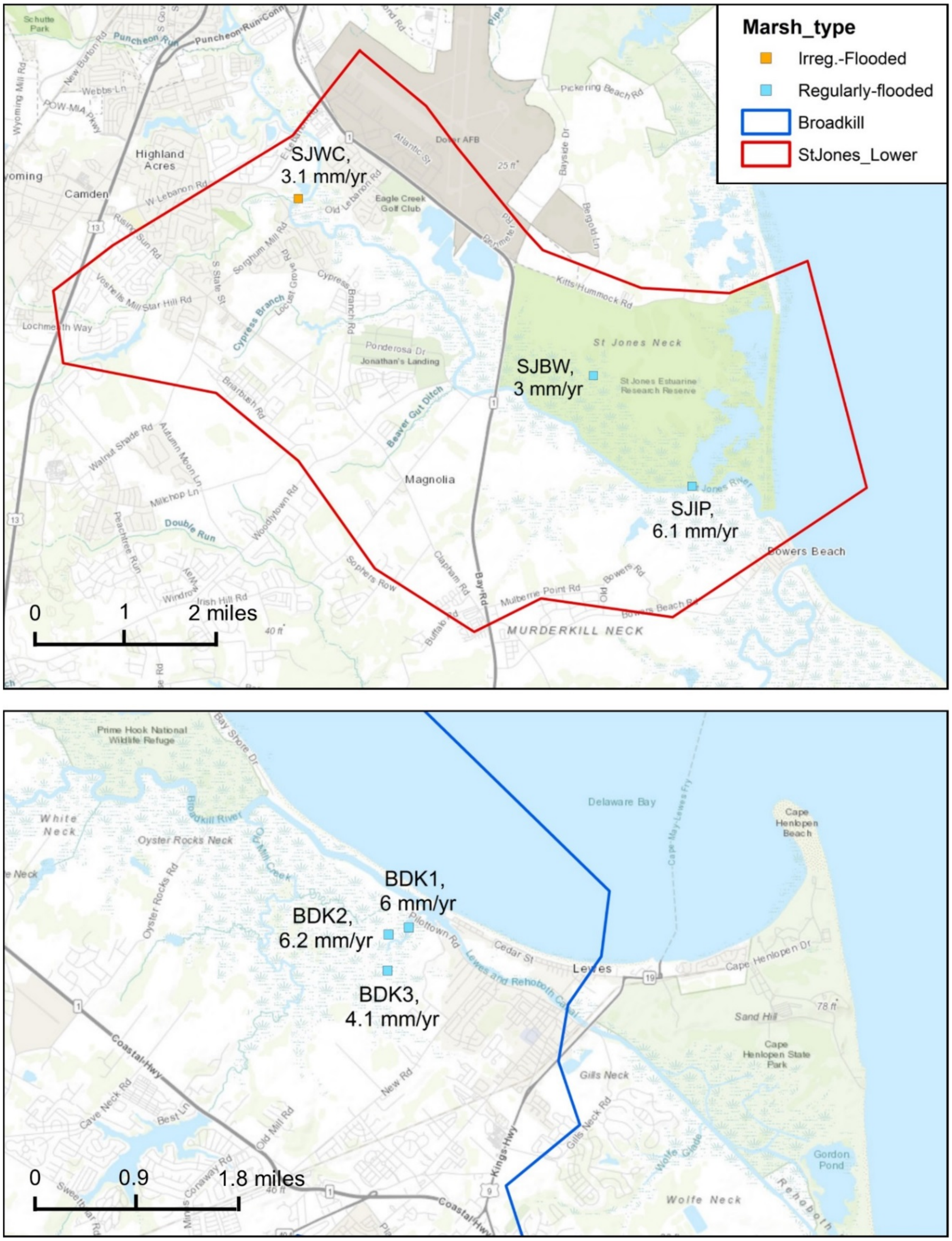


Figure C5. Locations of SET sites in the Delaware marshes (St. Jones (SJ) and Broadkill (BDK)). Values equal elevation change (mm/yr) averaged across the period of record.

Broadkill (BDK) Subsite

Average of position/pin data for each set & date (mm)

Date	BDK1	BDK2	BDK3
2014-05-28	164.89	167.47	266.94
2014-06-30	163.61	180.31	266.17
2014-11-19	168.83	180.33	267.06
2015-03-19	169.72	181.31	266.11
2015-08-24	173.36	183.53	272.06
2015-11-17	173.89	184.33	271.36
2016-03-30	176.86	184.97	271.39
2016-08-24	176.67	188.06	276.36
Set Elev. (HTU)[1]	1.250	1.074	0.964
Elev. Change (mm/yr)[2]	6.028	6.152	4.093

Elevation change from starting point (converted to cm)

Starting point 2014-05-28	164.89 (mm)	167.47 (mm)	266.94 (mm)	
Date	BDK1 (cm)	BDK2 (cm)	BDK3 (cm)	Average (cm)
2014-06-30	-0.13	1.28	-0.08	0.36
2014-11-19	0.39	1.29	0.01	0.56
2015-03-19	0.48	1.38	-0.08	0.59
2015-08-24	0.85	1.61	0.51	0.99
2015-11-17	0.90	1.69	0.44	1.01
2016-03-30	1.20	1.75	0.44	1.13
2016-08-24	1.18	2.06	0.94	1.39

Elev. NAVD88 (m)*	0.77	0.65	0.57
NAVD88-MTL**	-0.117	-0.116	-0.116
Tide Range (GT) (m)	1.418	1.418	1.418

*2015 RTK, adjusted for installation date

**=VDATUM

Tide range data is from NOAA Station (ID 8557390), Lewes

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

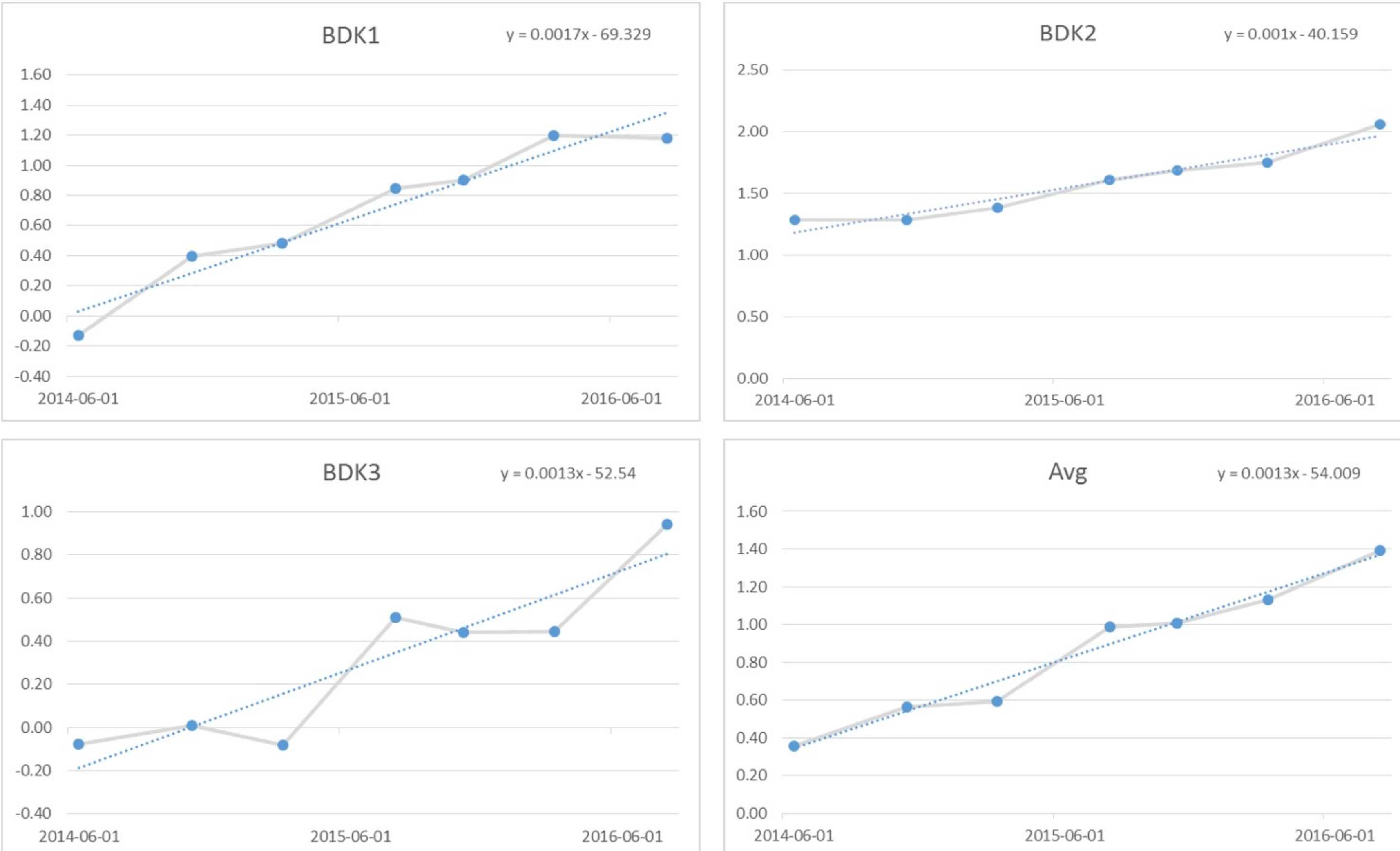


Figure C6. Elevation change plots for the three Broadkill SET sites, fit with a linear trendlines. The average across all three sites (Avg) is also included. The y-axis shows elevation change (cm) from the starting point, and the x-axis shows measurement dates.

St. Jones Impoundment (SJIP) Area

Average of position/pin data for each set & date.

Date	SJIP (mm)
2007-06-07	238.21
2007-06-18	243.40
2007-08-27	242.72
2008-01-16	248.85
2008-06-25	238.63
2008-10-22	252.04
2009-04-02	235.19
2009-11-06	278.96
2010-07-16	281.35
2011-02-11	279.51
2011-09-16	285.75
2012-03-13	287.72
2012-09-19	292.28
2013-03-14	298.22
2014-05-30	283.89
2015-03-19	265.89
2015-09-02	283.35
Set Elev. (HTU)[1]	1.01
Elev Change (mm/yr)[2]	6.11

Elevation change from starting point.

Starting point 2007-06-07	238.21 (mm)
Date	SJIP (cm)
2007-06-18	0.52
2007-08-27	0.45
2008-01-16	1.06
2008-06-25	0.04
2008-10-22	1.38
2009-04-02	-0.30
2009-11-06	4.08
2010-07-16	4.31
2011-02-11	4.13
2011-09-16	4.75
2012-03-13	4.95
2012-09-19	5.41
2013-03-14	6.00
2014-05-30	4.57
2015-03-19	2.77
2015-09-02	4.51

Elevation NAVD88 (m)*	0.858
NAVD88-MTL**	-0.060
Tide Range (GT) (m)	1.811

*no RTK measurement; used LiDAR instead (2014)

**=VDATUM

Tide range data is from NOAA Station (ID 8554399), Mahon River Entrance

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

St. Jones Boardwalk (SJBW) Area

Average of position/pin data for each set & date.

Date	SJBW (mm)
2004-06-22	254.61
2004-08-13	257.24
2005-07-26	263.03
2007-06-21	261.63
2007-10-03	265.94
2008-01-17	266.29
2008-07-14	263.75
2008-09-22	239.52
2009-04-27	270.56
2009-11-10	278.32
2010-04-20	281.94
2010-07-15	268.86
2011-02-11	279.72
2011-09-15	286.25
2012-03-13	285.18
2012-09-19	276.51
2013-03-14	285.33
2013-12-06	285.07
2014-05-30	285.97
2014-09-12	283.85
2015-03-19	286.42
2015-09-01	277.49
Set Elev. (HTU)[1]	0.42
Elev. Change (mm/yr)[2]	2.97

Elevation change from starting point.

Starting point 2004-06-22	254.61 (mm)
Date	SJBW (cm)
2004-08-13	0.26
2005-07-26	0.84
2007-06-21	0.70
2007-10-03	1.13
2008-01-17	1.17
2008-07-14	0.91
2008-09-22	-1.51
2009-04-27	1.59
2009-11-10	2.37
2010-04-20	2.73
2010-07-15	1.43
2011-02-11	2.51
2011-09-15	3.16
2012-03-13	3.06
2012-09-19	2.19
2013-03-14	3.07
2013-12-06	3.05
2014-05-30	3.14
2014-09-12	2.92
2015-03-19	3.18
2015-09-01	2.29

Elevation NAVD88 (m)*	0.32
NAVD88-MTL**	-0.060
Tide Range (GT) (m)	1.811

*2016 RTK, adjusted for installation

**=VDATUM

Tide range data is from NOAA Station (ID 8554399), Mahon River Entrance

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)

[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

St. Jones Wildcat (SJWC) Area

Average of position/pin data for each set & date.

Date	SJWC (mm)
2007-06-18	201.00
2007-08-27	198.47
2008-01-16	189.06
2008-06-25	207.86
2008-10-22	207.57
2009-04-02	208.00
2010-04-19	219.78
2011-02-10	222.94
2011-09-16	224.68
2012-03-14	216.60
2012-09-20	225.65
2013-03-15	208.21
2013-12-05	229.50
2014-09-10	212.96
2015-03-18	222.32
Set Elev. (HTU)[1]	0.250
Elev Change (mm/yr)[2]	3.129

Elevation change from starting point.

2007-06-18	201.00 (mm)
Date	STWC (cm)
2007-08-27	-0.25
2008-01-16	-1.19
2008-06-25	0.69
2008-10-22	0.66
2009-04-02	0.70
2010-04-19	1.88
2011-02-10	2.19
2011-09-16	2.37
2012-03-14	1.56
2012-09-20	2.47
2013-03-15	0.72
2013-12-05	2.85
2014-09-10	1.20
2015-03-18	2.13

Elevation NAVD88 (m)*	0.166
NAVD88-MTL**	-0.060
Tide Range (GT) (m)	1.811

*2016 RTK, adjusted for installation
**=VDATUM
Tide range data is from NOAA Station (ID 8554399), Mahon River Entrance

[1] Excel formula for Set Elev. = [(Elev NAVD88-(NAVD88-MTL))]/(Tide Range/2)
[2] Excel formula for Elev. Change = LINEST(first measurement:last measurement, first measurement date:last date)*365.25

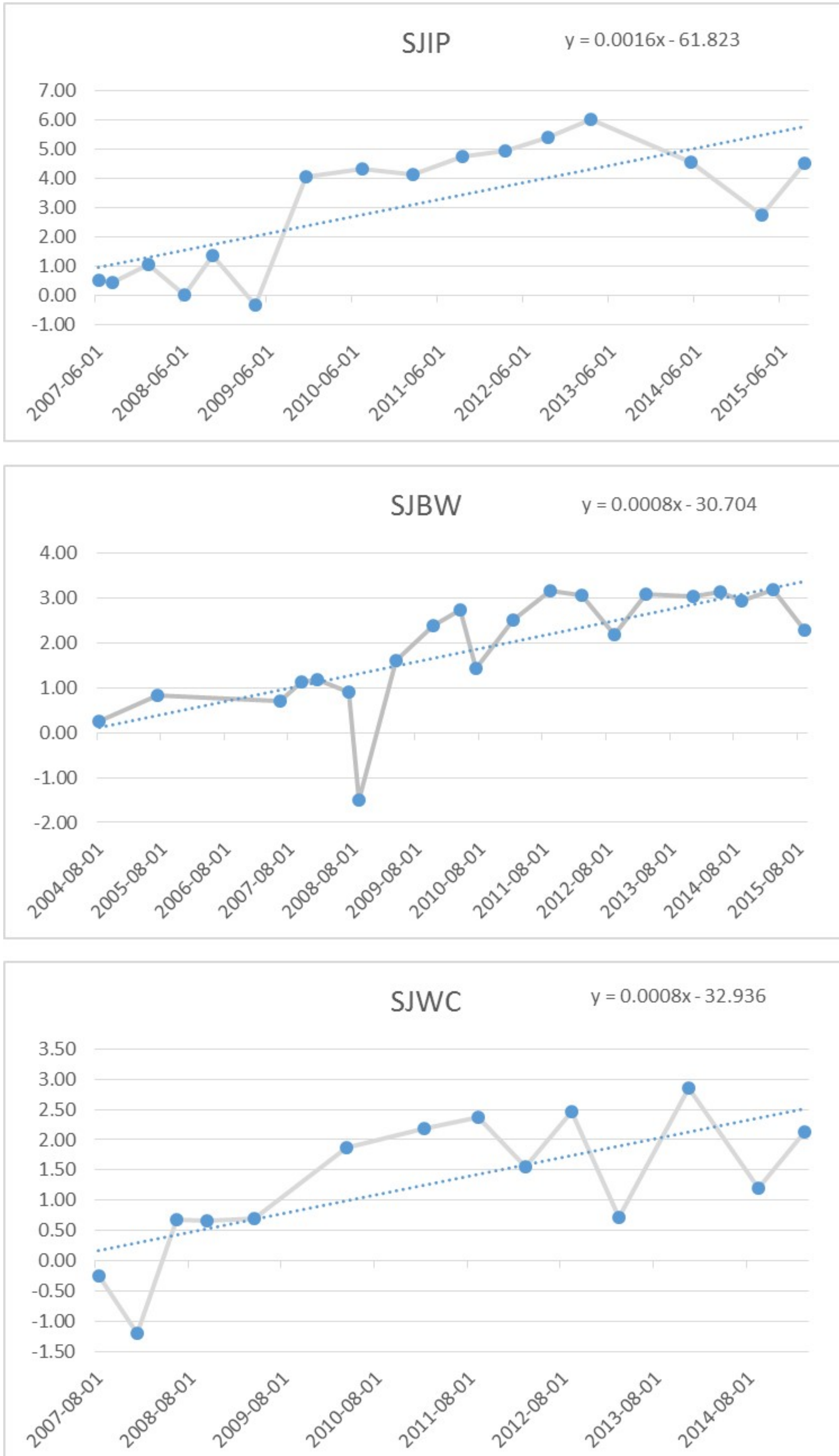


Figure C7. Elevation change plots for the three SET sites in the Lower St. Jones, fit with a linear trendlines. The y-axis shows elevation change (cm) from the starting point, and the x-axis shows measurement dates

Appendix D

Results – Broadkill (DE)

At time zero (2007), 12% of the Broadkill marsh area is composed of saltmarsh (6.7% regularly-flooded marsh, 2.7% irregularly-flooded marsh and 2.7% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2007 to 2100, the SLAMM model projects the following changes in saltmarsh habitat (Table D1, Figure D1):

Regularly-flooded marsh: projected to experience an overall net gain from 2007 to 2100 due primarily to inundation/conversion of irregularly-flooded marsh. However, after steady gains in acreage from 2007 to 2075 (3956 to 6932 acres), the marsh reaches a tipping point and large areas along the bay convert to tidal flat and estuarine open water between 2075 and 2100.

Irregularly-flooded marsh: by 2050, over half (66%) of the irregularly-flooded marsh is projected to be lost due to inundation (converting to regularly-flooded marsh). From 2050 to 2075, the acreage of irregularly-flooded marsh increases slightly due to the conversion of an area of tidal swamp to irregularly-flooded marsh. However irregularly-flooded marsh is once again lost between 2075 and 2100, with an overall decrease in acreage from 1613 acres in 2007 to 348 acres in 2100.

Transitional salt marsh: projected to experience an overall net gain from 2007 to 2100. After decreasing slightly from 2007 to 2025, acreage increases from 2025 to 2075 (from 1627 to 2221 acres) due to inundation/conversion of undeveloped dry land and swamp. From 2075 to 2100, transitional salt marsh loses acreage due to conversion to regularly-flooded marsh.

Tables D2 and D3 contain results for the low and high SLR scenarios, and Table D4 has results for three model protection scenarios.

Table D1. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Broadkill. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes).

SLAMM category	Acres					% Change			
	2007	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**1613.0**	**1301.0**	**547.8**	**832.2**	**348.4**	**-19.3**	**-66.0**	**-48.4**	**-78.4**
Trans. Salt Marsh	**1626.7**	**1583.3**	**1974.1**	**2220.6**	**1813.1**	**-2.7**	**21.4**	**36.5**	**11.5**
Regularly-Flooded Marsh	**3955.8**	**4678.8**	**5907.4**	**6931.7**	**5036.7**	**18.3**	**49.3**	**75.2**	**27.3**
Tidal Flat	38.3	54.1	113.6	462.7	4458.9	41.4	196.8	1108.4	11545.8
Estuarine Open Water	8415.7	8509.8	8630.6	8804.5	9264.4	1.1	2.6	4.6	10.1
Undeveloped Dry Land	35813.8	35472.2	34774.4	33708.7	32557.3	-1.0	-2.9	-5.9	-9.1
Swamp	1802.6	1752.8	1669.4	1599.8	1531.2	-2.8	-7.4	-11.2	-15.1
Tidal Swamp	1445.9	1428.2	1254.8	426.4	107.2	-1.2	-13.2	-70.5	-92.6
Inland Open Water	727.1	718.3	708.7	698.4	682.5	-1.2	-2.5	-3.9	-6.1
Tidal-Fresh Marsh	159.3	157.3	147.2	108.4	20.3	-1.2	-7.6	-32.0	-87.3
Inland-Fresh Marsh	131.7	128.5	123.3	113.2	105.9	-2.5	-6.4	-14.0	-19.6
Estuarine Beach	114.0	92.7	67.3	43.5	28.3	-18.6	-41.0	-61.8	-75.2
Riverine Tidal	105.7	72.5	33.1	3.9	0.9	-31.4	-68.7	-96.4	-99.2
Inland Shore	37.0	37.0	37.0	37.0	36.7	0.0	0.0	0.0	-0.7
Ocean Beach	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Open Ocean	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Developed Dry Land	3232.2	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	0.0	--	--	--	--	--	--	--	--

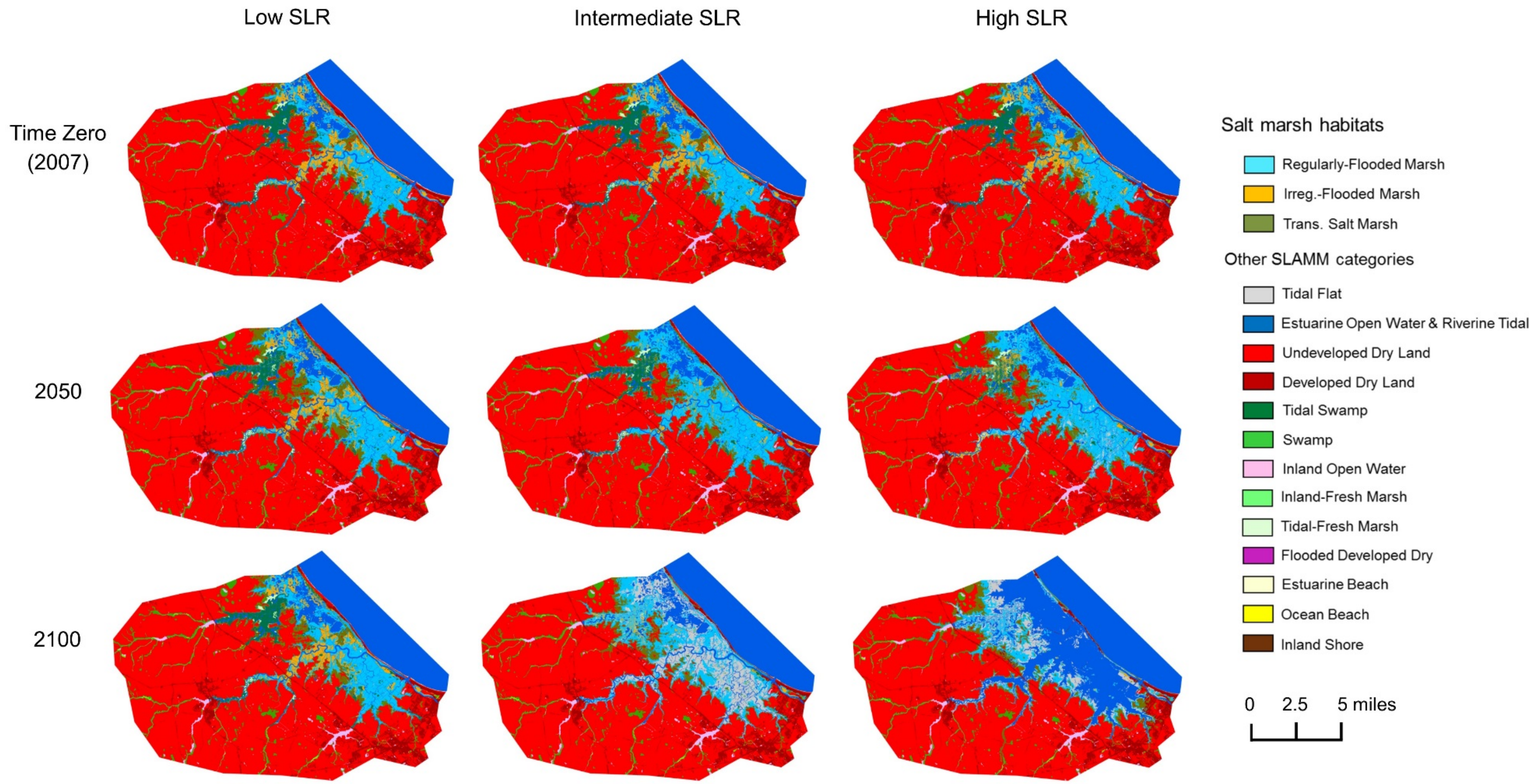


Figure D1. SLAMM land use categories from early to late century for the Broadkill under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

Table D2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Broadkill under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2
Estuarine Beach	148.9	114.0	93.2	67.9	48.1	37.4
Estuarine Open Water	8106.8	8415.7	8494.5	8581.2	8654.8	8719.3
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	897.7	727.1	720.3	711.7	709.1	705.8
Inland Shore	37.0	37.0	37.0	37.0	37.0	37.0
Inland-Fresh Marsh	167.2	131.7	130.0	126.4	124.0	123.2
Irreg.-Flooded Marsh	2261.9	1613.0	1590.3	1522.5	1516.6	1531.8
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	3284.3	3955.8	4280.5	4374.3	4422.4	4466.7
Riverine Tidal	208.9	105.7	83.3	61.8	43.9	23.9
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	2348.6	1802.6	1777.5	1737.5	1699.1	1666.3
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	0.0	38.3	44.9	54.9	58.4	72.1
Tidal Swamp	1463.1	1445.9	1437.7	1411.7	1355.7	1259.6
Tidal-Fresh Marsh	164.3	159.3	158.8	158.1	157.3	156.6
Trans. Salt Marsh	64.7	1626.7	1542.1	1885.0	2228.6	2565.5
Undeveloped Dry Land	36833.4	35813.8	35596.7	35256.9	34932.8	34624.0

Table D3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Broadkill under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2
Estuarine Beach	148.9	114.0	92.2	63.4	31.8	9.8
Estuarine Open Water	8106.8	8415.7	8516.5	8733.1	9519.3	15880.6
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	897.7	727.1	717.0	703.6	674.9	640.0
Inland Shore	37.0	37.0	37.0	37.0	36.5	32.8
Inland-Fresh Marsh	167.2	131.7	127.9	121.3	105.1	81.8
Irreg.-Flooded Marsh	2261.9	1613.0	1146.5	651.1	706.7	72.4
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	3284.3	3955.8	4885.2	6241.3	2899.2	2768.0
Riverine Tidal	208.9	105.7	69.3	10.0	0.8	0.2
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	2348.6	1802.6	1743.9	1618.3	1469.9	1259.6
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	0.0	38.3	64.5	741.3	6138.5	2744.6
Tidal Swamp	1463.1	1445.9	1421.8	772.1	84.6	16.6
Tidal-Fresh Marsh	164.3	159.3	156.2	115.1	2.4	0.4
Trans. Salt Marsh	64.7	1626.7	1600.7	1995.4	2033.3	2289.0
Undeveloped Dry Land	36833.4	35813.8	35407.8	34187.8	32288.5	30195.8

Table D4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Broadkill under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017).

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100
Developed Dry Land	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2	3232.2	3200.4	3188.8	3163.9	3091.9	2994.8
Estuarine Beach	113.7	92.6	67.1	43.2	28.2	114.0	92.7	67.3	43.5	28.3	114.0	92.7	67.3	43.4	28.6
Estuarine Open Water	8415.7	8508.4	8626.0	8795.2	9246.0	8415.7	8509.8	8630.6	8804.5	9264.4	8415.7	8509.8	8630.1	8786.7	9255.4
Flooded Developed Dry Land	0	0	0	0	0	0	0	0	0	0	31.8	43.4	68.2	140.2	237.4
Inland Open Water	727.1	718.3	708.7	698.4	682.5	727.1	718.3	708.7	698.4	682.5	727.1	718.3	708.7	698.4	682.5
Inland Shore	37.0	37.0	37.0	37.0	36.7	37.0	37.0	37.0	37.0	36.7	37.0	37.0	37.0	37.0	36.7
Inland-Fresh Marsh	131.7	128.5	123.3	113.2	105.9	131.7	128.5	123.3	113.2	105.9	131.7	128.5	123.3	113.2	105.9
Irreg.-Flooded Marsh	1613.0	1301.0	547.9	832.2	348.3	1613.0	1301.0	547.8	832.2	348.4	1613.0	1301.0	547.9	832.6	348.3
Ocean Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ocean Flat	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Open Ocean	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Regularly-Flooded Marsh	3955.4	4485.1	5495.3	5839.3	2573.2	3955.8	4678.8	5907.4	6931.7	5036.7	3955.8	4678.8	5907.8	6948.0	5037.4
Riverine Tidal	105.7	72.5	33.1	3.9	0.9	105.7	72.5	33.1	3.9	0.9	105.7	72.5	33.1	3.9	0.9
Rocky Intertidal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Swamp	1802.6	1752.8	1669.4	1599.8	1531.2	1802.6	1752.8	1669.4	1599.8	1531.2	1802.6	1752.8	1669.4	1599.8	1531.2
Tidal Creek	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tidal Flat	38.3	54.0	108.3	449.6	4368.0	38.3	54.1	113.6	462.7	4458.9	38.3	54.1	113.6	462.8	4468.5
Tidal Swamp	1445.9	1428.2	1254.8	426.4	107.2	1445.9	1428.2	1254.8	426.4	107.2	1445.9	1428.2	1254.8	426.4	107.2
Tidal-Fresh Marsh	159.3	157.3	147.2	108.4	20.2	159.3	157.3	147.2	108.4	20.3	159.3	157.3	147.2	108.6	20.3
Trans. Salt Marsh	607.9	417.5	337.0	210.9	110.0	1626.7	1583.3	1974.1	2220.6	1813.1	1626.7	1583.3	1974.1	2221.5	1811.4
Undeveloped Dry Land	36833.4	36833.4	36833.4	36833.4	36833.4	35813.8	35472.2	34774.4	33708.7	32557.3	35813.8	35472.2	34774.4	33708.7	32557.3

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix E

Results – Mispillion (DE)

At time zero (2007), 16% of the Mispillion marsh area is composed of saltmarsh (10% regularly-flooded marsh, 3% irregularly-flooded marsh and 3% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2007 to 2100, the SLAMM model projects the following changes (Table E1, Figure E1):

Regularly-flooded marsh: projected to gain acreage from 2007 to 2100 (increasing from 7166 to 12115 acres) due primarily to inundation/conversion of irregularly-flooded marsh. From 2075 to 2100, the rate of increase slows due to the conversion of areas of regularly-flooded marsh in the southern portion of the marsh to tidal flat and estuarine open water.

Irregularly-flooded marsh: by 2075, over half (62%) of the irregularly-flooded marsh is projected to be lost due to inundation (converting to regularly-flooded marsh). Losses in acreage occur across each time period (from 2068 acres in 2007 to 357 acres in 2100). The conversion of an area of tidal swamp to irregularly-flooded marsh slightly lessens the rate of loss.

Transitional salt marsh: projected to experience a mix of gains and losses, with an overall net loss (-11%). After decreasing slightly from 2007 to 2025, the acreage increases from 2025 to 2050 (from 1903 to 2482 acres) due primarily to inundation/conversion of undeveloped dry land and swamp. From 2050 to 2100, acreage decreases (to 1953 acres) due to conversion to regularly-flooded marsh.

Tables D2 and D3 contain results for the low and high SLR scenarios, and Table D4 has results for three model protection scenarios.

Table E1. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Mispillion. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes).

SLAMM category	Acres					% Change			
	2007	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**2067.6**	**1943.1**	**1670.4**	**784.6**	**356.5**	**-6.0**	**-19.2**	**-62.1**	**-82.8**
Trans. Salt Marsh	**2194.0**	**1902.6**	**2482.1**	**2199.6**	**1953.2**	**-13.3**	**13.1**	**0.3**	**-11.0**
Regularly-Flooded Marsh	**7165.8**	**8166.8**	**9188.7**	**11991.7**	**12114.5**	**14.0**	**28.2**	**67.3**	**69.1**
Tidal Flat	119.2	113.3	139.9	426.3	2937.0	-5.0	17.3	257.6	2363.8
Estuarine Open Water	11263.5	11417.3	11570.0	11792.5	12074.2	1.4	2.7	4.7	7.2
Undeveloped Dry Land	38733.2	38252.4	37333.6	35939.9	34359.5	-1.2	-3.6	-7.2	-11.3
Swamp	4134.0	3979.3	3647.1	3394.2	3147.0	-3.7	-11.8	-17.9	-23.9
Tidal Swamp	1119.3	1104.2	923.9	552.6	216.6	-1.4	-17.5	-50.6	-80.6
Inland Open Water	612.1	590.1	580.3	574.8	565.6	-3.6	-5.2	-6.1	-7.6
Tidal-Fresh Marsh	40.2	39.5	38.7	34.3	19.4	-1.8	-3.9	-14.7	-51.8
Inland-Fresh Marsh	127.3	115.4	101.8	90.6	89.1	-9.4	-20.1	-28.8	-30.0
Estuarine Beach	157.1	124.9	93.0	68.6	43.3	-20.5	-40.8	-56.4	-72.5
Riverine Tidal	103.0	87.5	70.8	13.9	4.7	-15.1	-31.3	-86.5	-95.4
Inland Shore	40.0	40.0	40.0	39.9	39.9	0.0	0.0	0.0	-0.1
Ocean Beach	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Open Ocean	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Developed Dry Land	2827.5	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	0.0	--	--	--	--	--	--	--	--

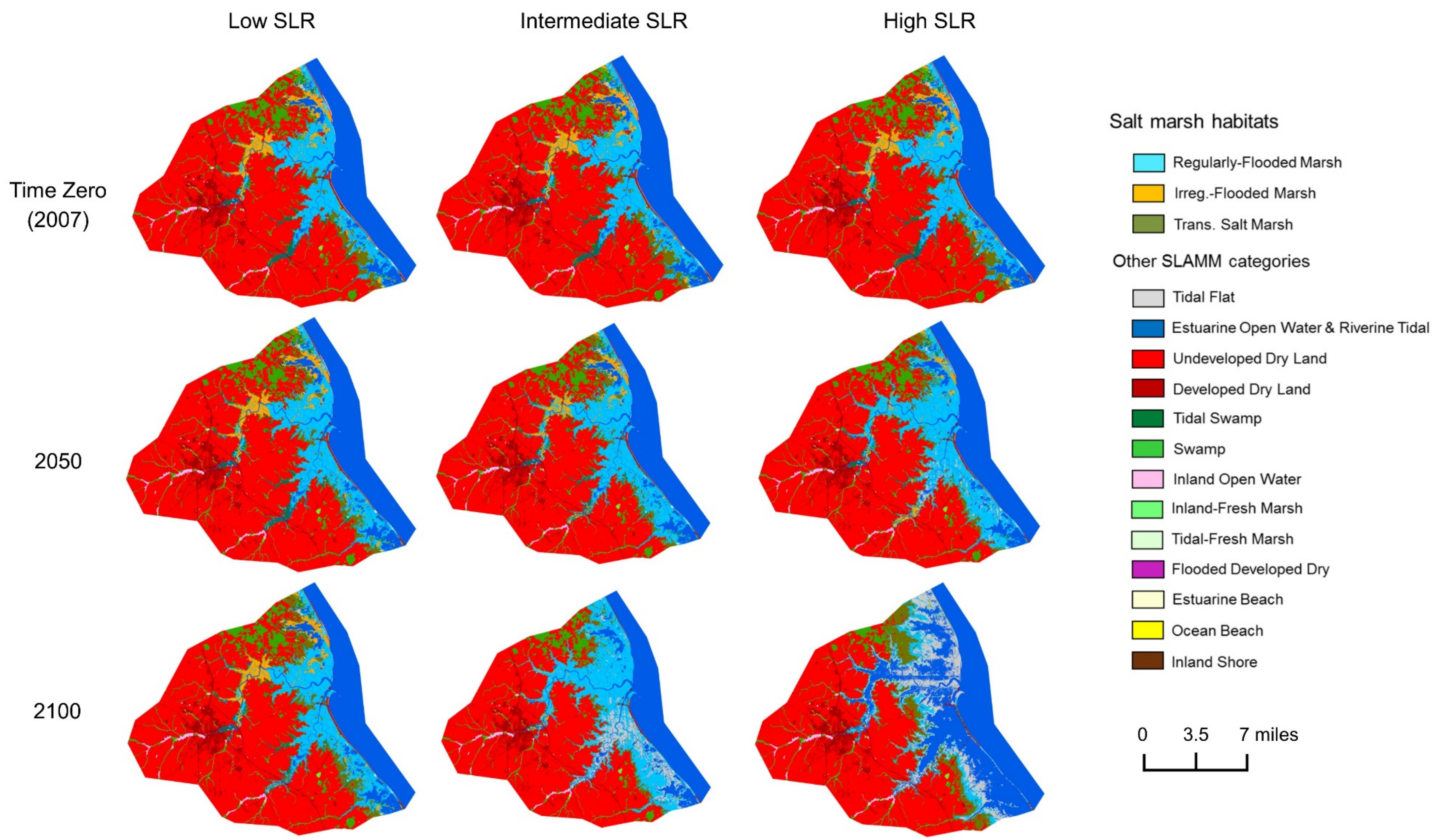


Figure E1. SLAMM land use categories from early to late century for the Mispillion under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the “protect dry developed land” modeling scenario.

Table E2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Mispillion under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5
Estuarine Beach	165.1	157.1	125.1	95.9	82.5	74.9
Estuarine Open Water	11159.9	11263.5	11406.4	11536.3	11639.8	11740.4
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	668.2	612.1	593.0	585.3	582.1	580.0
Inland Shore	40.0	40.0	40.0	40.0	40.0	40.0
Inland-Fresh Marsh	162.2	127.3	117.9	112.5	104.4	101.9
Irreg.-Flooded Marsh	2622.4	2067.6	2048.0	2014.3	2018.8	2025.0
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	6440.0	7165.8	7875.5	7941.0	7971.4	7979.4
Riverine Tidal	137.1	103.0	93.2	81.4	73.8	67.4
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4683.6	4134.0	4046.4	3924.9	3770.8	3676.5
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	93.5	119.2	110.9	109.1	108.3	121.6
Tidal Swamp	1127.6	1119.3	1112.8	1087.1	1022.7	927.8
Tidal-Fresh Marsh	40.3	40.2	39.6	38.8	38.2	37.6
Trans. Salt Marsh	325.1	2194.0	1845.3	2344.1	2873.7	3376.4
Undeveloped Dry Land	40211.5	38733.2	38422.3	37965.8	37551.2	37135.4

Table E3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Mispillion under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5
Estuarine Beach	165.1	157.1	124.7	91.0	48.7	13.9
Estuarine Open Water	11159.9	11263.5	11424.3	11670.0	12231.6	20323.4
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	668.2	612.1	586.5	578.2	564.2	546.8
Inland Shore	40.0	40.0	40.0	40.0	39.9	38.8
Inland-Fresh Marsh	162.2	127.3	114.3	93.4	87.6	75.7
Irreg.-Flooded Marsh	2622.4	2067.6	1894.1	976.2	546.3	113.1
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	6440.0	7165.8	8307.7	10781.2	5961.9	3568.1
Riverine Tidal	137.1	103.0	85.6	30.3	4.0	1.1
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4683.6	4134.0	3948.4	3461.2	3041.5	1915.4
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	93.5	119.2	119.0	699.2	8317.7	6258.0
Tidal Swamp	1127.6	1119.3	1097.9	681.8	134.7	23.5
Tidal-Fresh Marsh	40.3	40.2	39.5	36.0	10.0	1.1
Trans. Salt Marsh	325.1	2194.0	1928.5	2201.1	2980.6	4571.4
Undeveloped Dry Land	40211.5	38733.2	38165.9	36557.2	33952.0	30470.3

Table E4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Mispillion under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017).

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100
Developed Dry Land	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5	2827.5	2783.2	2768.8	2741.2	2701.9	2656.3
Estuarine Beach	156.8	124.9	93.0	68.6	43.3	157.1	124.9	93.0	68.6	43.3	157.1	124.9	93.0	68.6	43.5
Estuarine Open Water	11263.5	11413.6	11505.4	11721.9	12039.4	11263.5	11417.3	11570.0	11792.5	12074.2	11263.5	11417.3	11510.3	11665.1	12000.2
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	44.3	58.6	86.3	125.6	171.2
Inland Open Water	612.1	590.1	580.3	574.8	565.6	612.1	590.1	580.3	574.8	565.6	612.1	590.1	580.3	574.8	565.6
Inland Shore	40.0	40.0	40.0	39.9	39.9	40.0	40.0	40.0	39.9	39.9	40.0	40.0	40.0	39.9	39.9
Inland-Fresh Marsh	127.3	115.4	101.8	90.6	89.1	127.3	115.4	101.8	90.6	89.1	127.3	115.4	101.8	90.6	89.1
Irreg.-Flooded Marsh	2067.6	1943.1	1678.9	786.9	356.4	2067.6	1943.1	1670.4	784.6	356.5	2067.6	1943.1	1678.9	789.4	356.6
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	7164.4	7547.1	8159.7	9556.6	8066.3	7165.8	8166.8	9188.7	11991.7	12114.5	7165.8	8166.8	9237.8	12107.4	12151.0
Riverine Tidal	103.0	87.5	70.8	13.9	4.7	103.0	87.5	70.8	13.9	4.7	103.0	87.5	70.8	13.9	4.7
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4134.0	3979.3	3647.1	3394.2	3147.0	4134.0	3979.3	3647.1	3394.2	3147.0	4134.0	3979.3	3647.1	3394.2	3147.0
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	119.2	113.2	138.2	420.6	2849.1	119.2	113.3	139.9	426.3	2937.0	119.2	113.3	139.9	428.5	2974.6
Tidal Swamp	1119.3	1104.2	923.9	552.6	216.6	1119.3	1104.2	923.9	552.6	216.6	1119.3	1104.2	923.9	552.6	216.6
Tidal-Fresh Marsh	40.2	39.5	39.4	34.9	19.4	40.2	39.5	38.7	34.3	19.4	40.2	39.5	39.4	35.6	19.5
Trans. Salt Marsh	717.5	566.8	690.3	436.5	272.0	2194.0	1902.6	2482.1	2199.6	1953.2	2194.0	1902.6	2483.5	2203.1	1952.6
Undeveloped Dry Land	40211.5	40211.5	40211.5	40211.5	40211.5	38733.2	38252.4	37333.6	35939.9	34359.5	38733.2	38252.4	37333.6	35939.9	34359.5

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix F

Results – Lower St. Jones (DE)

At time zero (2007), 18% of the Lower St. Jones marsh area is composed of saltmarsh (10% regularly-flooded marsh, 7% irregularly-flooded marsh and 1% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2007 to 2100, the SLAMM model projects the following changes (Table F1, Figure F1):

Regularly-flooded marsh: projected to experience slow, steady gains from 2007 to 2100 (increasing from 1865 to 3934 acres) due primarily to inundation/conversion of irregularly-flooded marsh. While net gains are occurring, from 2075 to 2100, small areas of regularly-flooded marsh are lost due to conversion to tidal flat or estuarine open water.

Irregularly-flooded marsh: by 2075, over half (57%) of the irregularly-flooded marsh is projected to be lost due to inundation (converting to regularly-flooded marsh). Losses in acreage occur across each time period (from 1355 acres in 2007 to 109 acres in 2100).

Transitional salt marsh: projected to increase across each time period (increasing from 164 acres in 2007 to 444 acres in 2100) due to inundation/conversion of undeveloped dry land and swamp. While net gains are occurring, small areas of transitional salt marsh are lost over time due to conversion to regularly-flooded marsh.

Tables F2 and F3 contain results for the low and high SLR scenarios, and Table F4 has results for three model protection scenarios.

Table F1. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Lower St. Jones. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and “protect dry developed land” modeling scenario (which prevents the developed dry land categories from changing thus the hashes).

SLAMM category	Acres					% Change			
	2007	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**1354.8**	**1344.6**	**1258.6**	**581.5**	**108.8**	**-0.7**	**-7.1**	**-57.1**	**-92.0**
Trans. Salt Marsh	**164.0**	**197.7**	**304.6**	**359.0**	**444.4**	**20.6**	**85.7**	**118.9**	**171.0**
Regularly-Flooded Marsh	**1865.2**	**1922.3**	**2102.1**	**3076.5**	**3933.5**	**3.1**	**12.7**	**64.9**	**110.9**
Tidal Flat	10.1	6.6	3.4	3.2	18.9	-35.1	-66.6	-68.8	86.4
Estuarine Open Water	2202.0	2268.3	2378.7	2443.5	2465.2	3.0	8.0	11.0	12.0
Undeveloped Dry Land	9789.5	9729.9	9588.5	9325.7	8958.6	-0.6	-2.1	-4.7	-8.5
Swamp	657.5	620.6	559.6	474.9	384.1	-5.6	-14.9	-27.8	-41.6
Tidal Swamp	101.0	101.0	101.0	98.1	75.1	0.0	0.0	-2.9	-25.6
Inland Open Water	341.1	305.9	212.2	161.0	151.9	-10.3	-37.8	-52.8	-55.5
Tidal-Fresh Marsh	48.3	47.4	47.1	46.9	39.1	-1.8	-2.5	-2.9	-19.0
Inland-Fresh Marsh	39.7	35.1	29.0	23.0	20.7	-11.6	-26.9	-42.0	-47.7
Estuarine Beach	36.2	30.0	24.8	16.7	10.2	-17.2	-31.6	-53.9	-71.9
Riverine Tidal	2.6	2.6	2.6	2.1	1.5	0.0	0.0	-20.7	-44.0
Inland Shore	8.6	8.6	8.6	8.6	8.6	0.0	0.0	0.0	0.0
Ocean Beach	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Open Ocean	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Developed Dry Land	1973.8	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	0.0	--	--	--	--	--	--	--	--

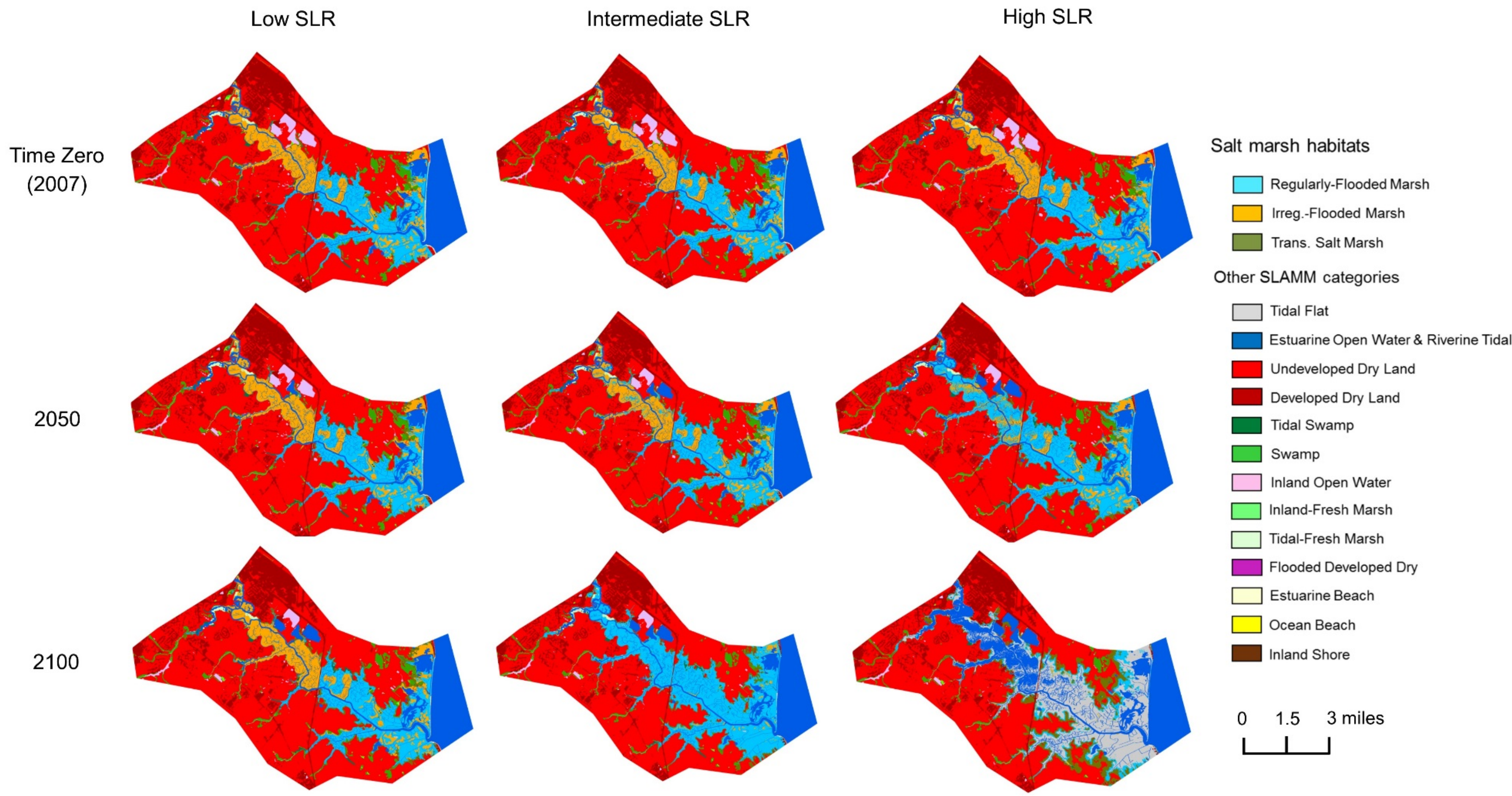


Figure F1. SLAMM land use categories from early to late century for the Lower St. Jones under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

Table F2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower St. Jones under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8
Estuarine Beach	36.2	36.2	30.1	26.6	22.1	19.6
Estuarine Open Water	2194.0	2202.0	2226.3	2285.2	2381.2	2451.9
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	349.1	341.1	326.5	298.3	213.1	168.2
Inland Shore	8.6	8.6	8.6	8.6	8.6	8.6
Inland-Fresh Marsh	42.8	39.7	35.9	33.5	31.2	29.0
Irreg.-Flooded Marsh	1357.3	1354.8	1354.7	1346.5	1345.1	1337.3
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1859.6	1865.2	1915.3	1913.8	1919.7	1911.9
Riverine Tidal	2.6	2.6	2.6	2.6	2.6	2.6
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	732.2	657.5	637.3	608.3	587.4	567.4
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	10.1	10.1	6.6	3.4	2.9	2.8
Tidal Swamp	101.0	101.0	101.0	101.0	101.0	101.0
Tidal-Fresh Marsh	48.3	48.3	48.3	47.3	47.0	46.1
Trans. Salt Marsh	2.5	164.0	175.6	253.7	332.3	421.2
Undeveloped Dry Land	9876.2	9789.5	9751.7	9691.8	9626.4	9552.9

Table F3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower St. Jones under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2007)	2007	2025	2050	2075	2100
Developed Dry Land	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8
Estuarine Beach	36.2	36.2	29.9	22.6	14.5	6.8
Estuarine Open Water	2194.0	2202.0	2270.0	2448.3	2563.3	3579.0
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0
Inland Open Water	349.1	341.1	304.4	163.4	149.2	71.4
Inland Shore	8.6	8.6	8.6	8.6	8.6	8.6
Inland-Fresh Marsh	42.8	39.7	34.7	27.0	20.5	15.3
Irreg.-Flooded Marsh	1357.3	1354.8	1341.7	701.3	51.4	36.5
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1859.6	1865.2	1933.8	2769.0	3069.4	793.7
Riverine Tidal	2.6	2.6	2.6	2.4	1.3	0.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	732.2	657.5	613.3	502.9	358.3	263.5
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	10.1	10.1	6.6	3.7	734.1	2883.0
Tidal Swamp	101.0	101.0	101.0	100.8	62.0	24.2
Tidal-Fresh Marsh	48.3	48.3	47.4	46.4	18.8	5.3
Trans. Salt Marsh	2.5	164.0	207.0	381.6	707.2	1190.0
Undeveloped Dry Land	9876.2	9789.5	9719.7	9442.6	8862.0	7743.6

Table F4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower St. Jones under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017).

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100	2007	2025	2050	2075	2100
Developed Dry Land	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8	1973.8	1969.2	1967.6	1963.0	1955.3	1947.8
Estuarine Beach	36.2	30.0	24.8	16.7	10.2	36.2	30.0	24.8	16.7	10.2	36.2	30.0	24.8	16.7	10.2
Estuarine Open Water	2202.0	2266.4	2390.6	2472.9	2495.1	2202.0	2268.3	2378.7	2443.5	2465.2	2202.0	2268.3	2378.7	2465.2	2511.1
Flooded Developed Dry Land	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.6	6.2	10.8	18.4	25.9
Inland Open Water	341.1	305.9	212.2	161.0	151.9	341.1	305.9	212.2	161.0	151.9	341.1	305.9	212.2	161.0	151.9
Inland Shore	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6
Inland-Fresh Marsh	39.7	35.1	29.0	23.0	20.7	39.7	35.1	29.0	23.0	20.7	39.7	35.1	29.0	23.0	20.7
Irreg.-Flooded Marsh	1354.8	1344.6	1253.1	576.4	108.1	1354.8	1344.6	1258.6	581.5	108.8	1354.8	1344.6	1258.6	578.8	107.8
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1862.6	1882.1	1998.3	2766.9	3344.1	1865.2	1922.3	2102.1	3076.5	3933.5	1865.2	1922.3	2102.1	3058.6	3890.7
Riverine Tidal	2.6	2.6	2.6	2.1	1.5	2.6	2.6	2.6	2.1	1.5	2.6	2.6	2.6	2.1	1.5
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	657.5	620.6	559.6	474.9	384.1	657.5	620.6	559.6	474.9	384.1	657.5	620.6	559.6	474.9	384.1
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	10.1	6.6	3.4	3.1	17.3	10.1	6.6	3.4	3.2	18.9	10.1	6.6	3.4	3.2	18.7
Tidal Swamp	101.0	101.0	101.0	98.1	75.1	101.0	101.0	101.0	98.1	75.1	101.0	101.0	101.0	98.1	75.1
Tidal-Fresh Marsh	48.3	47.4	46.4	45.5	38.0	48.3	47.4	47.1	46.9	39.1	48.3	47.4	47.1	46.1	37.9
Trans. Salt Marsh	79.8	93.5	114.9	95.2	89.5	164.0	197.7	304.6	359.0	444.4	164.0	197.7	304.6	358.6	443.7
Undeveloped Dry Land	9876.2	9876.2	9876.2	9876.2	9876.2	9789.5	9729.9	9588.5	9325.7	8958.6	9789.5	9729.9	9588.5	9325.7	8958.6

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). “Global and regional sea level rise scenarios for the United States”. NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix G

Results – Dennis (NJ)

At time zero (2014), 23% of the Dennis marsh area is composed of saltmarsh (1% regularly-flooded marsh, 20% irregularly-flooded marsh and 2% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2014 to 2100, the SLAMM model projects the following changes (Table G1, Figure G1):

Regularly-flooded marsh: projected to experience large gains from 2014 to 2100 (increasing from 422 to 10283 acres by 2100) due primarily to inundation/conversion of irregularly-flooded marsh. The rate of conversion starts slowly (with limited change by 2025) but increases dramatically from 2050 onward.

Irregularly-flooded marsh: the rate of loss is projected to start slowly (-5% by 2050) but then increases dramatically by late century. Acreage decreases from 8316 acres in 2014 to 323 acres in 2100 due to inundation/conversion to regularly-flooded marsh.

Transitional salt marsh: projected to increase across each time period (increasing from 837 acres in 2014 to 2393 acres in 2100) due to inundation/conversion of undeveloped dry land and swamp. While net gains are occurring, small areas of transitional salt marsh are lost over time due to conversion to regularly-flooded marsh.

Tables G2 and G3 contain results for the low and high SLR scenarios, and Table D4 has results for three model protection scenarios.

Table G11. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Dennis. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes). It should be noted that Dennis is not fully independent of Reeds (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Acres					% Change			
	2014	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**8315.7**	**8274.9**	**7891.6**	**4619.4**	**323.1**	**-0.5**	**-5.1**	**-44.4**	**-96.1**
Trans. Salt Marsh	**836.8**	**965.8**	**1315.0**	**2229.5**	**2392.9**	**15.4**	**57.1**	**166.4**	**186.0**
Regularly-Flooded Marsh	**421.6**	**472.0**	**939.3**	**4814.4**	**10282.6**	**11.9**	**122.8**	**1041.9**	**2338.8**
Tidal Flat	41.4	36.1	43.3	82.2	241.7	-12.8	4.4	98.4	483.1
Estuarine Open Water	4127.4	4136.7	4183.5	4248.1	4319.3	0.2	1.4	2.9	4.7
Undeveloped Dry Land	15646.8	15626.9	15526.0	15311.4	14913.9	-0.1	-0.8	-2.1	-4.7
Swamp	11394.9	11277.6	10904.3	9521.0	8353.0	-1.0	-4.3	-16.4	-26.7
Tidal Swamp	17.8	17.8	17.8	17.8	16.5	0.0	0.0	-0.2	-7.7
Inland Open Water	320.2	317.3	310.3	295.4	294.5	-0.9	-3.1	-7.8	-8.0
Tidal-Fresh Marsh	39.3	39.3	39.3	39.2	39.2	0.0	0.0	0.0	0.0
Inland-Fresh Marsh	53.3	51.3	45.8	37.8	37.0	-3.7	-14.0	-29.1	-30.5
Estuarine Beach	1.9	1.5	1.1	0.9	0.6	-23.0	-42.0	-54.5	-66.0
Riverine Tidal	0.9	0.9	0.9	0.8	0.8	0.0	-0.2	-2.1	-3.9
Inland Shore	8.3	8.3	8.3	8.3	8.3	0.0	0.0	0.0	0.0
Ocean Beach	13.3	9.7	6.3	3.7	4.8	-27.3	-52.5	-72.3	-63.6
Open Ocean	0.0	3.6	7.0	9.6	11.3	36787.5	70725.0	97337.5	114240.0
Developed Dry Land	747.8	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	9.6	--	--	--	--	--	--	--	--

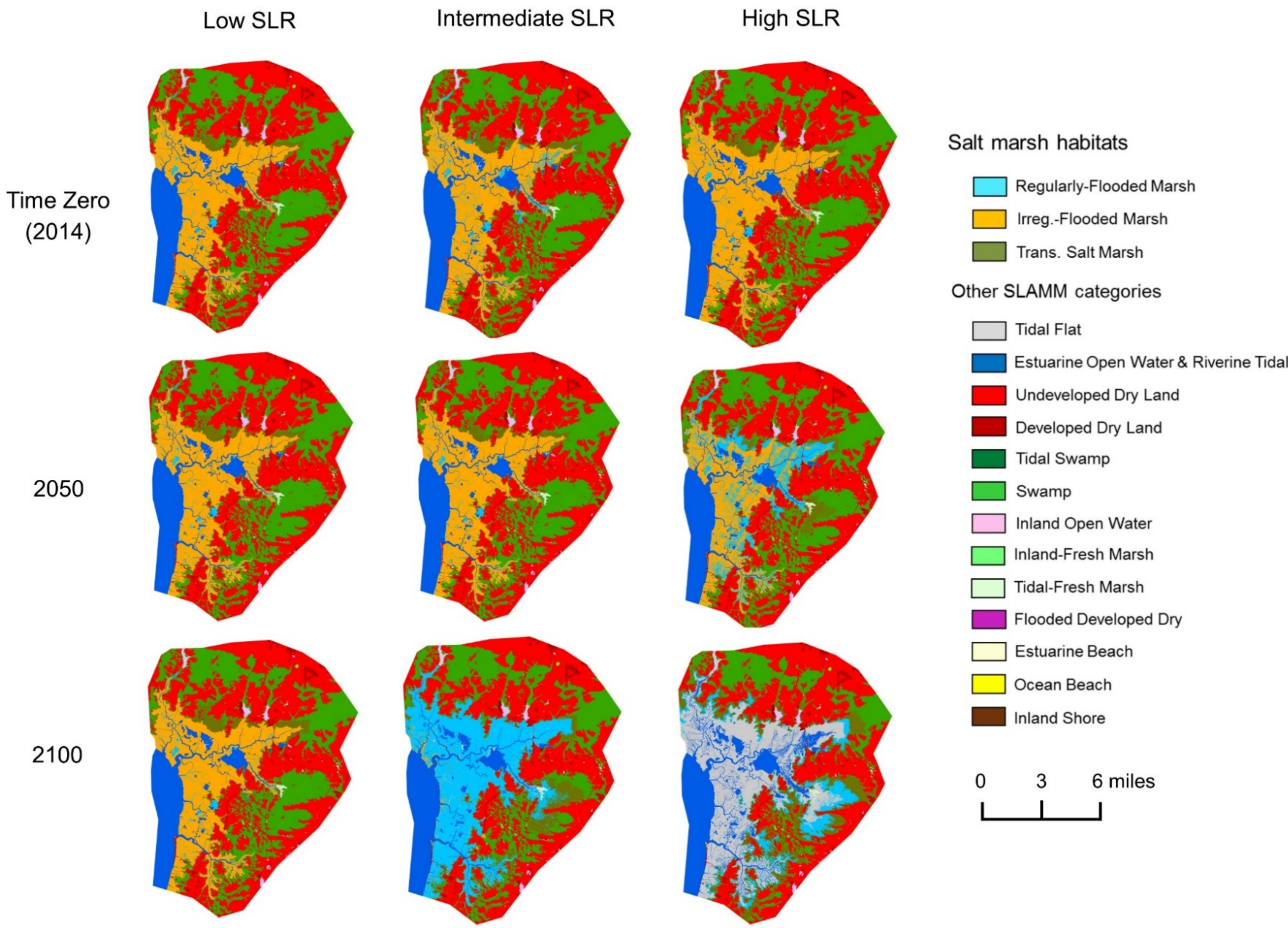


Figure G1. SLAMM land use categories from early to late century for Dennis under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the "protect dry developed land" modeling scenario. The lower third of Dennis overlaps with Reeds; the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

Table G2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dennis under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario. It should be noted that Dennis is not fully independent of Reeds (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	747.8	747.8	747.8	747.8	747.8	747.8
Estuarine Beach	1.9	1.9	1.5	1.1	0.8	0.6
Estuarine Open Water	4127.0	4127.4	4171.0	4189.5	4227.1	4270.5
Flooded Developed Dry Land	9.6	9.6	9.6	9.6	9.6	9.6
Inland Open Water	320.6	320.2	318.2	313.5	311.7	305.8
Inland Shore	8.3	8.3	8.3	8.3	8.3	8.3
Inland-Fresh Marsh	53.6	53.3	52.2	49.7	47.3	44.9
Irreg.-Flooded Marsh	8348.4	8315.7	8292.9	8263.4	8225.2	8194.3
Ocean Beach	13.3	13.3	9.7	6.4	4.0	4.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	3.6	6.9	9.3	10.9
Regularly-Flooded Marsh	400.8	421.6	411.9	437.9	449.9	450.4
Riverine Tidal	0.9	0.9	0.9	0.9	0.9	0.9
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	11409.2	11394.9	11331.3	11182.2	11034.3	10891.1
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	11.4	41.4	35.7	33.5	32.3	31.0
Tidal Swamp	17.8	17.8	17.8	17.8	17.8	17.8
Tidal-Fresh Marsh	39.3	39.3	39.3	39.3	39.3	39.3
Trans. Salt Marsh	838.9	836.8	909.7	1095.2	1283.8	1482.5
Undeveloped Dry Land	15648.3	15646.8	15635.8	15594.1	15547.6	15487.4

Table G3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dennis under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario. It should be noted that Dennis is not fully independent of Reeds (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	747.8	747.8	747.8	747.8	747.8	747.8
Estuarine Beach	1.9	1.9	1.5	1.1	0.8	0.4
Estuarine Open Water	4127.0	4127.4	4173.0	4217.1	4305.4	5743.6
Flooded Developed Dry Land	9.6	9.6	9.6	9.6	9.6	9.6
Inland Open Water	320.6	320.2	316.7	297.4	294.0	285.8
Inland Shore	8.3	8.3	8.3	8.3	8.3	8.2
Inland-Fresh Marsh	53.6	53.3	50.9	40.1	37.0	27.0
Irreg.-Flooded Marsh	8348.4	8315.7	8229.2	5898.9	40.9	15.6
Ocean Beach	13.3	13.3	9.7	6.3	3.6	2.3
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	3.7	7.0	9.7	12.2
Regularly-Flooded Marsh	400.8	421.6	488.0	3338.6	7980.7	3037.1
Riverine Tidal	0.9	0.9	0.9	0.9	0.8	0.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	11409.2	11394.9	11247.1	10110.5	7777.8	5351.2
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	11.4	41.4	38.4	102.0	3001.8	9576.0
Tidal Swamp	17.8	17.8	17.8	17.8	13.8	0.6
Tidal-Fresh Marsh	39.3	39.3	39.3	39.2	39.2	34.9
Trans. Salt Marsh	838.9	836.8	993.1	1734.0	2969.0	4127.9
Undeveloped Dry Land	15648.3	15646.8	15622.2	15420.5	14756.7	13016.9

Table G4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dennis under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017). It should be noted that Dennis is not fully independent of Reeds (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100
Developed Dry Land	747.8	747.8	747.8	747.8	747.8	747.8	747.8	747.8	747.8	747.8	747.6	744.9	735.1	719.9	704.2
Estuarine Beach	1.9	1.5	1.1	0.8	0.6	1.9	1.5	1.1	0.9	0.6	1.9	1.5	1.1	0.9	0.6
Estuarine Open Water	4127.4	4172.2	4195.1	4256.7	4326.4	4127.4	4136.7	4183.5	4248.1	4319.3	4127.4	4172.2	4195.3	4257.6	4328.6
Flooded Developed Dry Land	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.6	9.8	12.5	22.3	37.5	53.2
Inland Open Water	320.2	317.3	310.3	295.4	294.5	320.2	317.3	310.3	295.4	294.5	320.2	317.3	310.3	295.4	294.5
Inland Shore	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3	8.3
Inland-Fresh Marsh	53.3	51.3	45.8	37.8	37.0	53.3	51.3	45.8	37.8	37.0	53.3	51.3	45.8	37.8	37.0
Irreg.-Flooded Marsh	8315.7	8256.9	7885.3	4614.8	321.7	8315.7	8274.9	7891.6	4619.4	323.1	8315.7	8256.9	7885.3	4614.8	321.7
Ocean Beach	13.3	9.7	6.3	3.7	2.0	13.3	9.7	6.3	3.7	4.8	13.3	9.7	6.3	3.7	4.8
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	3.6	7.0	9.6	11.3	0.0	3.6	7.0	9.6	11.3	0.0	3.6	7.0	9.6	11.3
Regularly-Flooded Marsh	421.6	455.7	934.4	4782.2	10043.2	421.6	472.0	939.3	4814.4	10282.6	421.6	455.7	934.6	4810.2	10275.4
Riverine Tidal	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.9	0.8	0.8	0.9	0.9	0.9	0.8	0.8
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	11394.9	11277.6	10904.3	9521.0	8353.0	11394.9	11277.6	10904.3	9521.0	8353.0	11394.9	11277.6	10904.3	9521.0	8353.0
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	41.4	36.1	42.6	81.6	241.0	41.4	36.1	43.3	82.2	241.7	41.4	36.1	42.6	81.6	241.0
Tidal Swamp	17.8	17.8	17.8	17.8	16.5	17.8	17.8	17.8	17.8	16.5	17.8	17.8	17.8	17.8	16.5
Tidal-Fresh Marsh	39.3	39.3	39.3	39.2	39.2	39.3	39.3	39.3	39.2	39.2	39.3	39.3	39.3	39.2	39.2
Trans. Salt Marsh	835.3	943.2	1192.8	1921.4	1895.7	836.8	965.8	1315.0	2229.5	2392.9	836.8	964.6	1314.8	2229.5	2392.9
Undeveloped Dry Land	15648.3	15648.3	15648.3	15648.3	15648.3	15646.8	15626.9	15526.0	15311.4	14913.9	15646.8	15626.9	15526.0	15311.4	14913.9

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix H

Results – Reeds Beach (NJ)

At time zero (2014), 26% of the Reeds Beach marsh area is composed of saltmarsh (2% regularly-flooded marsh, 22% irregularly-flooded marsh and 2% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2014 to 2100, the SLAMM model projects the following changes (Table H1, Figure H1):

Regularly-flooded marsh: projected to experience large gains from 2014 to 2100 (increasing from 235 to 3961 acres by 2100) due primarily to inundation/conversion of irregularly-flooded marsh. The rate of conversion starts slowly (with limited change by 2025) but increases dramatically from 2050 onward.

Irregularly-flooded marsh: the rate of loss is projected to start slowly (-5% by 2050) but then increases dramatically by late century. Acreage decreases from 3278 acres in 2014 to 153 acres in 2100 due to inundation/conversion to regularly-flooded marsh.

Transitional salt marsh: projected to increase across each time period (increasing from 238 acres in 2014 to 1074 acres in 2100) due to inundation/conversion of undeveloped dry land and swamp. While net gains are occurring, small areas of transitional salt marsh are lost over time due to conversion to regularly-flooded marsh.

Tables H2 and H3 contain results for the low and high SLR scenarios, and Table H4 has results for three model protection scenarios.

Table H1. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Reeds Beach. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes). It should be noted that Reeds is not fully independent of Dennis (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Acres					% Change			
	2014	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**3277.8**	**3264.0**	**3115.3**	**1841.9**	**152.5**	**-0.4**	**-5.0**	**-43.8**	**-95.3**
Trans. Salt Marsh	**237.7**	**266.8**	**413.0**	**729.7**	**1073.7**	**12.3**	**73.8**	**207.0**	**351.8**
Regularly-Flooded Marsh	**235.0**	**262.4**	**467.0**	**1861.9**	**3961.4**	**11.7**	**98.7**	**692.4**	**1585.9**
Tidal Flat	20.3	17.4	20.8	36.1	90.3	-14.2	2.4	77.6	344.2
Estuarine Open Water	2660.1	2676.0	2696.8	2725.2	2758.7	0.6	1.4	2.4	3.7
Undeveloped Dry Land	4552.3	4541.9	4493.3	4382.3	4149.6	-0.2	-1.3	-3.7	-8.8
Swamp	3512.8	3481.7	3316.4	2957.0	2348.8	-0.9	-5.6	-15.8	-33.1
Tidal Swamp	17.0	17.0	17.0	17.0	15.0	0.0	0.0	-0.4	-11.8
Inland Open Water	70.1	59.1	53.6	47.0	46.5	-15.7	-23.5	-32.9	-33.7
Tidal-Fresh Marsh	3.9	3.9	3.9	3.9	3.9	0.0	0.0	0.0	0.0
Inland-Fresh Marsh	33.9	32.1	26.8	22.5	21.2	-5.1	-20.8	-33.4	-37.4
Estuarine Beach	5.0	3.5	2.0	1.4	0.8	-31.1	-60.3	-72.8	-83.8
Riverine Tidal	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Inland Shore	1.8	1.8	1.8	1.8	1.8	0.0	0.0	0.0	0.0
Ocean Beach	19.6	14.5	9.8	6.2	7.1	-25.7	-50.0	-68.4	-63.5
Open Ocean	0.0	5.0	9.8	13.4	15.7	50857.5	98982.5	135337.5	158620.0
Developed Dry Land	257.6	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	12.8	--	--	--	--	--	--	--	--

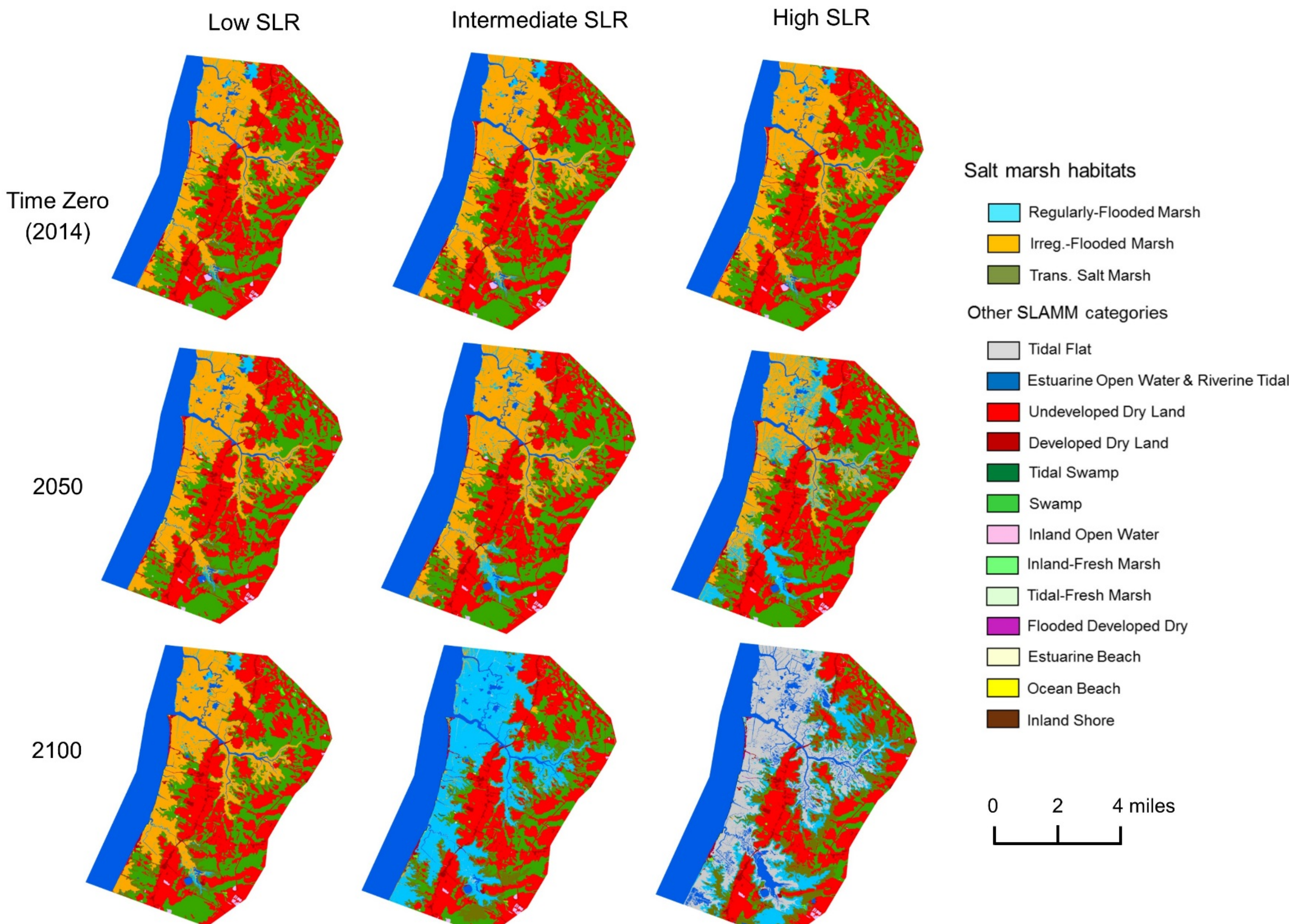


Figure H1. SLAMM land use categories from early to late century for the Reeds Beach under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the "protect dry developed land" modeling scenario. The upper two-thirds of Reeds overlaps with Dennis; the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

Table H2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Reeds Beach under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario. It should be noted that Reeds is not fully independent of Dennis (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	257.6	257.6	257.6	257.6	257.6	257.6
Estuarine Beach	5.0	5.0	3.5	1.8	1.2	0.9
Estuarine Open Water	2657.3	2660.1	2685.2	2698.7	2713.2	2730.9
Flooded Developed Dry Land	12.8	12.8	12.8	12.8	12.8	12.8
Inland Open Water	72.8	70.1	60.6	55.5	54.3	50.1
Inland Shore	1.8	1.8	1.8	1.8	1.8	1.8
Inland-Fresh Marsh	34.1	33.9	32.9	30.4	28.1	26.1
Irreg.-Flooded Marsh	3290.7	3277.8	3273.7	3265.1	3256.4	3249.0
Ocean Beach	19.6	19.6	14.6	9.9	6.7	6.2
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	5.0	9.6	12.8	15.1
Regularly-Flooded Marsh	213.1	235.0	230.2	242.3	245.5	243.7
Riverine Tidal	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3515.5	3512.8	3498.3	3436.2	3374.8	3310.2
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	0.0	20.3	17.2	16.0	15.4	14.6
Tidal Swamp	17.1	17.0	17.0	17.0	17.0	17.0
Tidal-Fresh Marsh	3.9	3.9	3.9	3.9	3.9	3.9
Trans. Salt Marsh	263.0	237.7	257.3	333.2	414.2	503.8
Undeveloped Dry Land	4553.4	4552.3	4546.2	4526.0	4501.8	4474.0

Table H3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Reeds Beach under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario. It should be noted that Reeds is not fully independent of Dennis (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	257.6	257.6	257.6	257.6	257.6	257.6
Estuarine Beach	5.0	5.0	3.5	1.8	1.2	0.7
Estuarine Open Water	2657.3	2660.1	2687.7	2712.9	2754.0	3396.5
Flooded Developed Dry Land	12.8	12.8	12.8	12.8	12.8	12.8
Inland Open Water	72.8	70.1	58.4	47.8	46.1	34.1
Inland Shore	1.8	1.8	1.8	1.8	1.8	1.8
Inland-Fresh Marsh	34.1	33.9	31.7	23.5	21.1	17.5
Irreg.-Flooded Marsh	3290.7	3277.8	3250.9	2310.5	30.9	12.2
Ocean Beach	19.6	19.6	14.5	9.7	6.1	3.9
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	5.1	9.8	13.5	17.1
Regularly-Flooded Marsh	213.1	235.0	271.9	1328.2	2947.4	1559.4
Riverine Tidal	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3515.5	3512.8	3471.9	3121.6	2008.3	901.6
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	0.0	20.3	18.7	46.1	1257.4	3588.0
Tidal Swamp	17.1	17.0	17.0	17.0	12.7	2.3
Tidal-Fresh Marsh	3.9	3.9	3.9	3.9	3.9	1.1
Trans. Salt Marsh	263.0	237.7	270.7	573.2	1512.4	2055.7
Undeveloped Dry Land	4553.4	4552.3	4539.6	4439.5	4030.4	3055.4

Table H4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Reeds Beach under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017). It should be noted that Reeds is not fully independent of Dennis (9,850 total acres overlap); the two sites were modeled separately as per PDE's convention to view them as different units for monitoring and management.

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100
Developed Dry Land	257.6	257.6	257.6	257.6	257.6	257.6	257.6	257.6	257.6	257.6	257.1	253.3	239.6	223.7	211.7
Estuarine Beach	5.0	3.5	1.8	1.2	0.8	5.0	3.5	2.0	1.4	0.8	5.0	3.5	1.8	1.3	0.8
Estuarine Open Water	2660.1	2686.7	2701.5	2728.4	2759.9	2660.1	2676.0	2696.8	2725.2	2758.7	2660.1	2686.8	2702.0	2729.8	2763.1
Flooded Developed Dry Land	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	13.3	17.1	30.8	46.7	58.7
Inland Open Water	70.1	59.1	53.6	47.0	46.5	70.1	59.1	53.6	47.0	46.5	70.1	59.1	53.6	47.0	46.5
Inland Shore	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Inland-Fresh Marsh	33.9	32.1	26.8	22.5	21.2	33.9	32.1	26.8	22.5	21.2	33.9	32.1	26.8	22.5	21.2
Irreg.-Flooded Marsh	3277.8	3260.9	3113.3	1840.0	152.1	3277.8	3264.0	3115.3	1841.9	152.5	3277.8	3260.9	3113.3	1840.0	152.1
Ocean Beach	19.6	14.5	9.8	6.2	3.9	19.6	14.5	9.8	6.2	7.1	19.6	14.5	9.8	6.2	7.1
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	5.0	9.8	13.4	15.7	0.0	5.0	9.8	13.4	15.7	0.0	5.0	9.8	13.4	15.7
Regularly-Flooded Marsh	235.0	255.0	464.4	1847.9	3843.5	235.0	262.4	467.0	1861.9	3961.4	235.0	255.0	464.5	1860.0	3958.2
Riverine Tidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3512.8	3481.7	3316.4	2957.0	2348.8	3512.8	3481.7	3316.4	2957.0	2348.8	3512.8	3481.7	3316.4	2957.0	2348.8
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	20.3	17.4	20.5	35.7	89.7	20.3	17.4	20.8	36.1	90.3	20.3	17.4	20.5	35.7	89.7
Tidal Swamp	17.0	17.0	17.0	17.0	15.0	17.0	17.0	17.0	17.0	15.0	17.0	17.0	17.0	17.0	15.0
Tidal-Fresh Marsh	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9	3.9
Trans. Salt Marsh	236.6	255.1	353.2	571.9	791.0	237.7	266.8	413.0	729.7	1073.7	237.7	266.5	412.7	729.5	1073.7
Undeveloped Dry Land	4553.4	4553.4	4553.4	4553.4	4553.4	4552.3	4541.9	4493.3	4382.3	4149.6	4552.3	4541.9	4493.3	4382.3	4149.6

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix I

Results – Dividing (NJ)

At time zero (2014), 28% of the Dividing marsh area is composed of saltmarsh (7% regularly-flooded marsh, 20% irregularly-flooded marsh and 1% transitional salt marsh). under the intermediate SLR scenario (Sweet et al. 2017), from 2014 to 2100, the SLAMM model projects the following changes (Table I1, Figure I1):

Regularly-flooded marsh: projected to experience steady gains from 2014 to 2100 (increasing from 1708 to 5533 acres by 2100) due primarily to inundation/conversion of irregularly-flooded marsh. While these gains are occurring, by late century, areas of regularly-flooded marsh are concurrently being lost (mostly in the southeast portion of the marsh) due to conversion to tidal flat and estuarine open water.

Irregularly-flooded marsh: by 2075, over half (70%) of the irregularly-flooded marsh is projected to be lost due to inundation (converting to regularly-flooded marsh). Losses in acreage occur across each time period (from 4701 acres in 2014 to 675 acres in 2100). The rate of loss is projected to start slowly (-5% by 2025) but then increases steadily.

Transitional salt marsh: projected to increase across each time period (increasing from 326 acres in 2014 to 990 acres in 2100) due to inundation/conversion of undeveloped dry land and swamp. While net gains are occurring, small areas of transitional salt marsh are lost over time due to conversion to regularly-flooded marsh.

Tables I2 and I3 contain results for the low and high SLR scenarios, and Table I4 has results for three model protection scenarios.

Table I1. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Dividing. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The percentage change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes).

SLAMM category	Acres					% Change			
	2014	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**4700.6**	**4482.2**	**3254.9**	**1390.6**	**674.9**	**-4.6**	**-30.8**	**-70.4**	**-85.6**
Trans. Salt Marsh	**326.0**	**403.2**	**565.9**	**802.7**	**990.4**	**23.7**	**73.6**	**146.2**	**203.8**
Regularly-Flooded Marsh	**1707.7**	**1893.5**	**3121.5**	**4914.9**	**5533.0**	**10.9**	**82.8**	**187.8**	**224.0**
Tidal Flat	449.1	424.5	409.8	671.6	1419.0	-5.5	-8.8	49.5	215.9
Estuarine Open Water	2968.7	3046.3	3353.8	3665.8	4005.3	2.6	13.0	23.5	34.9
Undeveloped Dry Land	5848.8	5780.8	5588.0	5284.6	4942.8	-1.2	-4.5	-9.6	-15.5
Swamp	4594.7	4566.4	4473.5	4257.1	3857.5	-0.6	-2.6	-7.3	-16.0
Tidal Swamp	1082.6	1082.5	1082.0	1018.1	658.0	0.0	-0.1	-6.0	-39.2
Inland Open Water	739.2	738.0	570.4	428.8	391.5	-0.2	-22.8	-42.0	-47.0
Tidal-Fresh Marsh	54.1	54.1	54.1	51.6	31.3	0.0	0.0	-4.7	-42.2
Inland-Fresh Marsh	316.3	316.2	314.4	304.0	290.1	0.0	-0.6	-3.9	-8.3
Estuarine Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-100.0
Riverine Tidal	7.2	7.2	6.9	5.5	3.1	-0.4	-4.8	-23.8	-56.7
Inland Shore	100.6	100.6	100.6	100.4	98.7	0.0	0.0	-0.2	-1.9
Ocean Beach	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Open Ocean	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Developed Dry Land	128.6	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	8.1	--	--	--	--	--	--	--	--

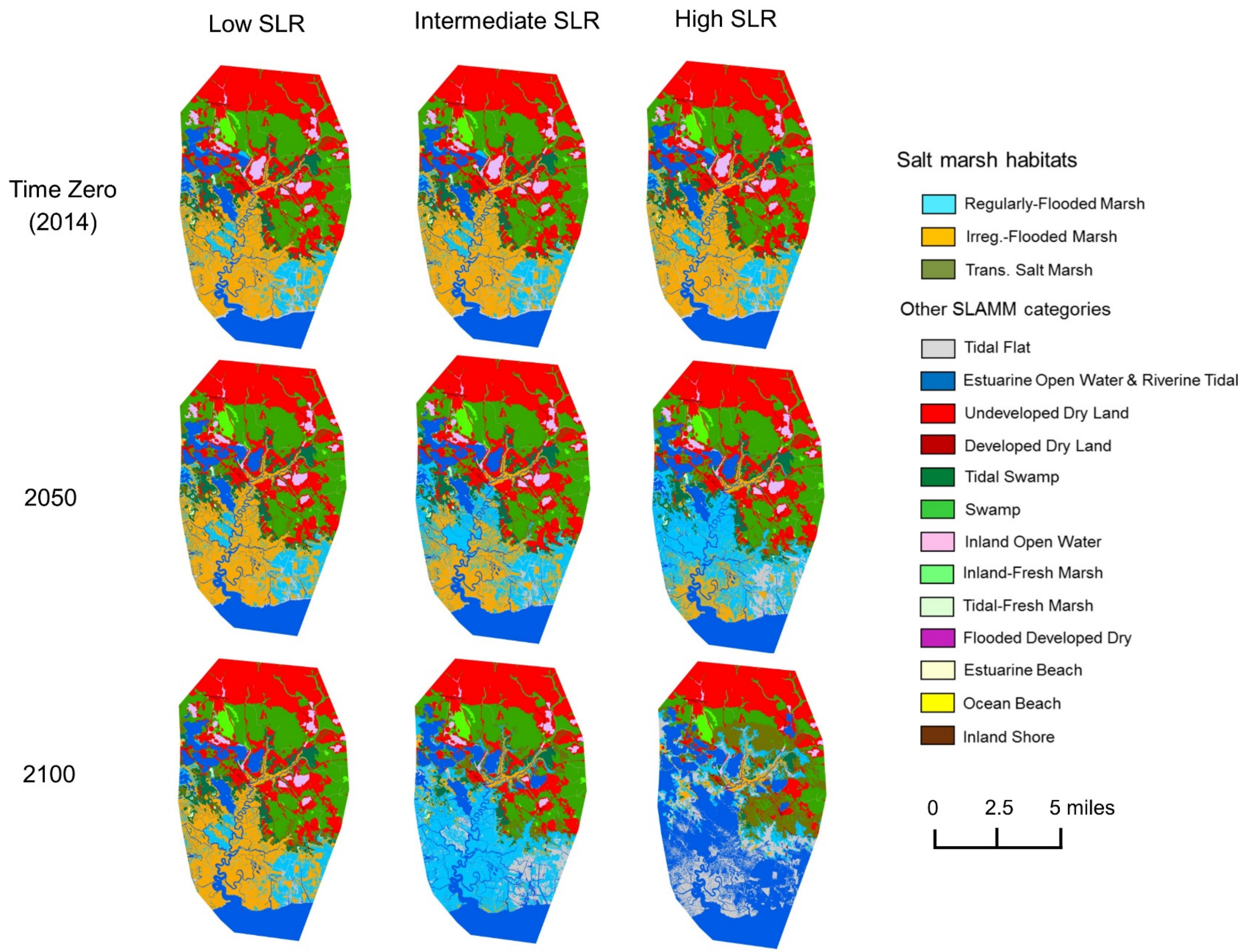


Figure I1. SLAMM land use categories from early to late century for the Dividing under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the “protect dry developed land” modeling scenario.

Table I2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dividing under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	128.6	128.6	128.6	128.6	128.6	128.6
Estuarine Beach	0.0	0.0	0.0	0.0	0.0	0.0
Estuarine Open Water	2827.7	2968.7	3040.5	3272.0	3346.7	3427.3
Flooded Developed Dry Land	8.1	8.1	8.1	8.1	8.1	8.1
Inland Open Water	880.2	739.2	738.6	583.6	579.8	567.9
Inland Shore	100.6	100.6	100.6	100.6	100.6	100.6
Inland-Fresh Marsh	316.4	316.3	316.2	315.4	314.5	314.4
Irreg.-Flooded Marsh	4788.7	4700.6	4690.0	4606.4	4576.1	4559.8
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1977.7	1707.7	1677.3	1764.0	1797.6	1795.0
Riverine Tidal	7.2	7.2	7.2	7.1	6.9	6.7
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4599.5	4594.7	4586.5	4537.9	4503.6	4468.6
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	4.4	449.1	424.3	357.8	315.2	277.1
Tidal Swamp	1082.6	1082.6	1082.6	1082.5	1082.2	1081.6
Tidal-Fresh Marsh	54.1	54.1	54.1	54.1	54.1	54.1
Trans. Salt Marsh	399.3	326.0	353.4	507.1	609.3	712.7
Undeveloped Dry Land	5857.3	5848.8	5824.5	5707.2	5609.1	5529.7

Table I3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dividing under the high SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	128.6	128.6	128.6	128.6	128.6	128.6
Estuarine Beach	0.0	0.0	0.0	0.0	0.0	0.0
Estuarine Open Water	2827.7	2968.7	3059.7	3437.6	4101.6	8110.1
Flooded Developed Dry Land	8.1	8.1	8.1	8.1	8.1	8.1
Inland Open Water	880.2	739.2	729.1	563.9	390.5	161.6
Inland Shore	100.6	100.6	100.6	100.5	98.4	94.2
Inland-Fresh Marsh	316.4	316.3	316.2	305.3	289.5	238.6
Irreg.-Flooded Marsh	4788.7	4700.6	4339.4	1632.6	735.0	560.1
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1977.7	1707.7	2016.2	4400.2	2295.6	1739.8
Riverine Tidal	7.2	7.2	7.2	6.5	2.7	1.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4599.5	4594.7	4561.3	4351.8	3690.5	1980.5
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	4.4	449.1	450.4	852.6	4596.4	3155.3
Tidal Swamp	1082.6	1082.6	1082.5	1067.8	575.8	262.3
Tidal-Fresh Marsh	54.1	54.1	54.1	53.0	21.2	4.7
Trans. Salt Marsh	399.3	326.0	410.6	679.6	1237.8	2582.1
Undeveloped Dry Land	5857.3	5848.8	5768.4	5444.2	4860.7	4005.5

Table I4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Dividing under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017).

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100
Developed Dry Land	128.6	128.6	128.6	128.6	128.6	128.6	128.6	128.6	128.6	128.6	128.5	125.2	120.0	111.8	98.4
Estuarine Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Estuarine Open Water	2968.7	3046.0	3336.5	3641.1	3970.6	2968.7	3046.3	3353.8	3665.8	4005.3	2968.7	3046.3	3353.8	3665.8	4005.3
Flooded Developed Dry Land	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.1	8.2	11.5	16.7	24.9	38.3
Inland Open Water	739.2	738.0	570.4	428.8	391.5	739.2	738.0	570.4	428.8	391.5	739.2	738.0	570.4	428.8	391.5
Inland Shore	100.6	100.6	100.6	100.4	98.7	100.6	100.6	100.6	100.4	98.7	100.6	100.6	100.6	100.4	98.7
Inland-Fresh Marsh	316.3	316.2	314.4	304.0	290.1	316.3	316.2	314.4	304.0	290.1	316.3	316.2	314.4	304.0	290.1
Irreg.-Flooded Marsh	4700.6	4482.2	3259.2	1393.9	675.4	4700.6	4482.2	3254.9	1390.6	674.9	4700.6	4482.2	3254.9	1390.6	674.9
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1707.7	1893.3	3119.2	4834.4	5124.2	1707.7	1893.5	3121.5	4914.9	5533.0	1707.7	1893.5	3121.5	4914.9	5533.0
Riverine Tidal	7.2	7.2	6.9	5.5	3.1	7.2	7.2	6.9	5.5	3.1	7.2	7.2	6.9	5.5	3.1
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	4594.7	4566.4	4473.5	4257.1	3857.5	4594.7	4566.4	4473.5	4257.1	3857.5	4594.7	4566.4	4473.5	4257.1	3857.5
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	449.1	424.5	409.8	671.9	1415.7	449.1	424.5	409.8	671.6	1419.0	449.1	424.5	409.8	671.6	1419.0
Tidal Swamp	1082.6	1082.5	1082.0	1018.1	658.0	1082.6	1082.5	1082.0	1018.1	658.0	1082.6	1082.5	1082.0	1018.1	658.0
Tidal-Fresh Marsh	54.1	54.1	54.1	51.6	31.3	54.1	54.1	54.1	51.6	31.3	54.1	54.1	54.1	51.6	31.3
Trans. Salt Marsh	317.6	327.4	311.9	331.5	522.3	326.0	403.2	565.9	802.7	990.4	326.0	403.2	565.9	802.7	990.4
Undeveloped Dry Land	5857.3	5857.3	5857.3	5857.3	5857.3	5848.8	5780.8	5588.0	5284.6	4942.8	5848.8	5780.8	5588.0	5284.6	4942.8

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix J

Results – Lower Maurice (NJ)

At time zero (2014), 27% of the Lower Maurice marsh area is composed of saltmarsh (5% regularly-flooded marsh, 20% irregularly-flooded marsh and 2% transitional salt marsh). Under the intermediate SLR scenario (Sweet et al. 2017), from 2014 to 2100, the SLAMM model projects the following changes (Table J1, Figure J1):

Regularly-flooded marsh: projected to experience steady gains from 2014 to 2100 (increasing from 1300 to 5639 acres by 2100) due primarily to inundation/conversion of irregularly-flooded marsh. The rate of conversion starts slowly (with limited change by 2025) but increases sharply from 2050 onward. While these gains are occurring, by late century, some areas of regularly-flooded marsh are concurrently being lost (mostly in the southwest portion of the marsh) due to conversion to tidal flat and estuarine open water.

Irregularly-flooded marsh: by 2075, almost half (45%) of the irregularly-flooded marsh is projected to be lost due to inundation (converting to regularly-flooded marsh). Losses in acreage occur across each time period (from 4804 acres in 2014 to 390 acres in 2100). The rate of loss is projected to start slowly (-2% by 2025) but then increases steadily from 2050 onward.

Transitional salt marsh: projected to increase across each time period (increasing from 421 acres in 2014 to 851 acres in 2100) due to inundation/conversion of undeveloped dry land and swamp. While net gains are occurring, small areas of transitional salt marsh are lost over time due to conversion to regularly-flooded marsh.

Tables J2 and J3 contain results for the low and high SLR scenarios, and Table J4 has results for three model protection scenarios.

Table J2. Projected changes in acreage of SLAMM land use categories from time zero to 2100 at Lower Maurice. Saltmarsh habitats are in bold print because they are the focus of our case study. Percent change calculations are based on change in acreage relative to time zero. The % change cells are color-coded based on direction of change (loss in light red; gains in green). Results are based on the intermediate SLR scenario (Sweet et al. 2017) and "protect dry developed land" modeling scenario (which prevents the developed dry land categories from changing thus the hashes).

SLAMM category	Acres					% Change			
	2014	2025	2050	2075	2100	2025	2050	2075	2100
Irreg.-Flooded Marsh	**4804.3**	**4717.7**	**4208.4**	**2626.5**	**390.2**	**-1.8**	**-12.4**	**-45.3**	**-91.9**
Trans. Salt Marsh	**421.1**	**480.8**	**718.2**	**849.7**	**850.8**	**14.2**	**70.6**	**101.8**	**102.1**
Regularly-Flooded Marsh	**1299.5**	**1379.6**	**1899.9**	**3467.2**	**5638.5**	**6.2**	**46.2**	**166.8**	**333.9**
Tidal Flat	376.3	329.7	336.3	575.9	1047.4	-12.4	-10.6	53.0	178.3
Estuarine Open Water	7544.4	7620.4	7712.7	7848.2	8139.0	1.0	2.2	4.0	7.9
Undeveloped Dry Land	5422.3	5402.1	5302.0	5145.3	4909.4	-0.4	-2.2	-5.1	-9.5
Swamp	3269.5	3225.8	3011.4	2697.5	2314.2	-1.3	-7.9	-17.5	-29.2
Tidal Swamp	584.6	584.6	584.2	576.5	508.0	0.0	-0.1	-1.4	-13.1
Inland Open Water	31.7	31.4	29.3	27.9	26.3	-1.1	-7.6	-12.1	-17.0
Tidal-Fresh Marsh	17.6	17.6	17.6	17.6	16.7	0.0	0.0	-0.2	-5.1
Inland-Fresh Marsh	63.4	49.5	26.9	22.8	20.6	-21.9	-57.7	-64.0	-67.6
Estuarine Beach	25.4	21.4	15.0	8.2	3.7	-15.8	-41.0	-67.6	-85.3
Riverine Tidal	5.7	5.3	4.0	2.7	1.0	-6.3	-30.4	-53.4	-83.1
Inland Shore	3.8	3.8	3.8	3.8	3.8	0.0	0.0	0.0	0.0
Ocean Beach	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Open Ocean	0.0	0.0	0.0	0.0	0.0	--	--	--	--
Developed Dry Land	394.8	--	--	--	--	--	--	--	--
Flooded Developed Dry Land	35.9	--	--	--	--	--	--	--	--

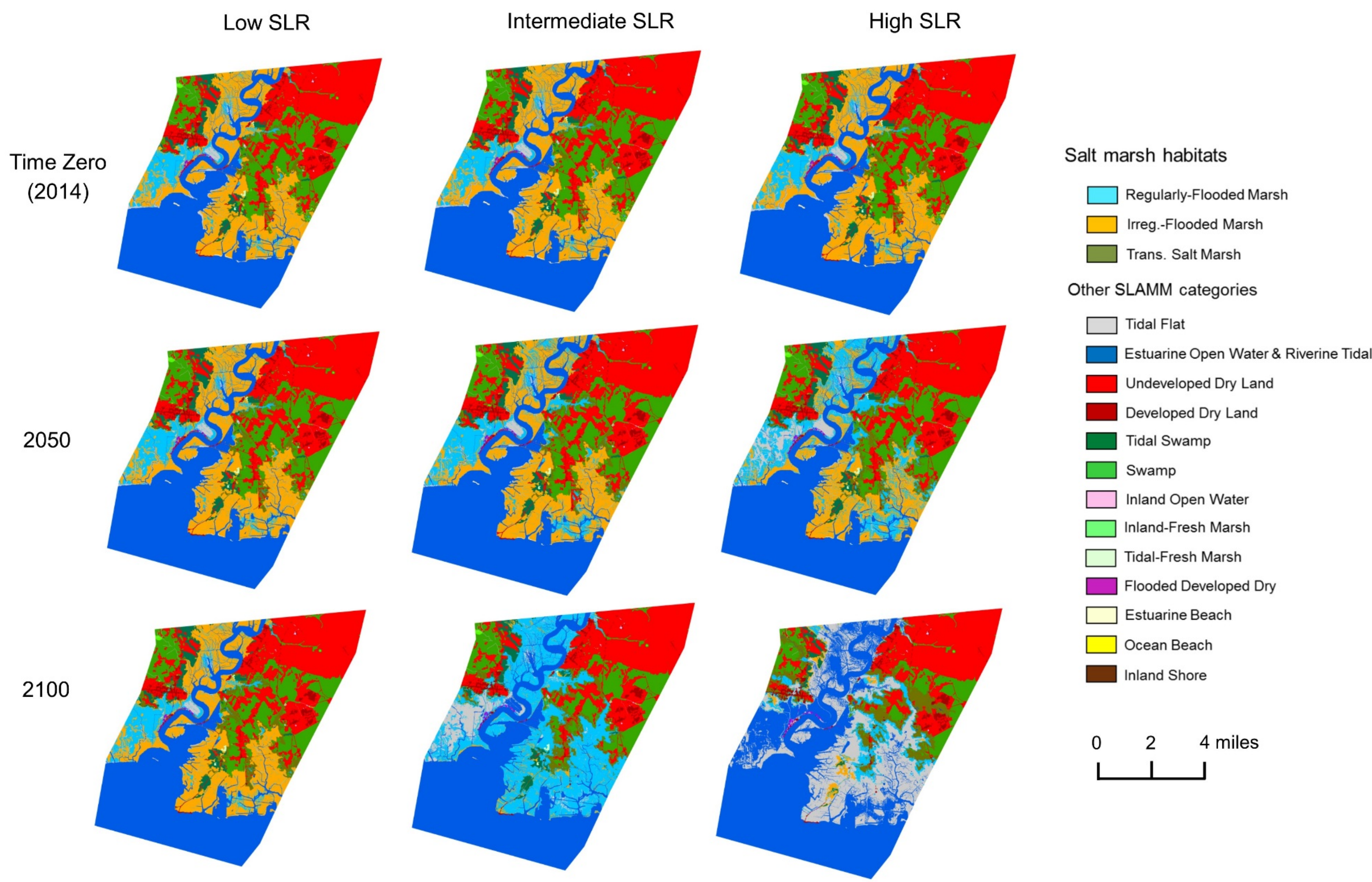


Figure J1. SLAMM land use categories from early to late century for lower Maurice under the low, intermediate and high SLR scenarios (based on Sweet et al. 2017) and the “protect dry developed land” modeling scenario.

Table J2. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower Maurice under the low SLR scenario (Sweet et al. 2017) and the "protect dry developed land" modeling scenario.

SLAMM category	Projected change in acreage (low SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	394.8	394.8	394.8	394.8	394.8	394.8
Estuarine Beach	25.4	25.4	21.5	15.6	11.6	8.2
Estuarine Open Water	7543.7	7544.4	7617.4	7674.1	7732.3	7787.8
Flooded Developed Dry Land	35.9	35.9	35.9	35.9	35.9	35.9
Inland Open Water	32.2	31.7	31.5	30.7	29.5	28.9
Inland Shore	3.8	3.8	3.8	3.8	3.8	3.8
Inland-Fresh Marsh	80.3	63.4	55.4	37.3	28.9	26.0
Irreg.-Flooded Marsh	4854.1	4804.3	4789.2	4743.6	4704.7	4680.5
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1550.8	1299.5	1297.9	1347.8	1371.7	1378.1
Riverine Tidal	6.0	5.7	5.5	4.8	4.1	3.6
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3288.0	3269.5	3247.2	3171.6	3074.1	3001.5
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	11.5	376.3	328.4	288.2	262.1	240.6
Tidal Swamp	584.6	584.6	584.6	584.5	584.4	584.1
Tidal-Fresh Marsh	17.6	17.6	17.6	17.6	17.6	17.6
Trans. Salt Marsh	440.2	421.1	458.6	580.5	729.6	844.6
Undeveloped Dry Land	5431.5	5422.3	5411.1	5369.7	5315.3	5264.3

Table J3. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower Maurice under the high SLR scenario (Sweet et al. 2017) and the “protect dry developed land” modeling scenario.

SLAMM category	Projected change in acreage (high SLR scenario)					
	Time zero (2014)	2007	2025	2050	2075	2100
Developed Dry Land	394.8	394.8	394.8	394.8	394.8	394.8
Estuarine Beach	25.4	25.4	21.3	13.4	6.3	2.1
Estuarine Open Water	7543.7	7544.4	7622.8	7758.8	8174.2	10397.6
Flooded Developed Dry Land	35.9	35.9	35.9	35.9	35.9	35.9
Inland Open Water	32.2	31.7	31.3	28.7	24.8	9.6
Inland Shore	3.8	3.8	3.8	3.8	3.8	3.8
Inland-Fresh Marsh	80.3	63.4	44.8	24.0	19.9	2.7
Irreg.-Flooded Marsh	4854.1	4804.3	4665.0	3056.1	170.9	283.6
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1550.8	1299.5	1424.9	2789.9	4017.2	1141.6
Riverine Tidal	6.0	5.7	5.2	3.1	0.7	0.3
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3288.0	3269.5	3206.7	2824.0	2199.5	1457.0
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	11.5	376.3	344.5	769.1	2940.3	4792.1
Tidal Swamp	584.6	584.6	584.6	582.1	465.7	176.9
Tidal-Fresh Marsh	17.6	17.6	17.6	17.6	14.3	0.1
Trans. Salt Marsh	440.2	421.1	500.6	782.1	974.2	1484.0
Undeveloped Dry Land	5431.5	5422.3	5396.5	5217.1	4857.8	4118.4

Table J4. Projected changes in acreage of SLAMM land use categories from time zero (2007) to 2100 at Lower Maurice under three different model protection scenarios, based on the intermediate SLR scenario (Sweet et al. 2017).

SLAMM category	Protect All Dry					Protect Dry Developed					Protect None				
	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100	2014	2025	2050	2075	2100
Developed Dry Land	394.8	394.8	394.8	394.8	394.8	394.8	394.8	394.8	394.8	394.8	394.4	390.8	372.5	354.5	336.1
Estuarine Beach	25.4	21.4	15.0	8.2	3.7	25.4	21.4	15.0	8.2	3.7	25.4	21.4	15.0	8.2	3.7
Estuarine Open Water	7544.4	7620.4	7696.6	7830.5	8118.8	7544.4	7620.4	7712.7	7848.2	8139.0	7544.4	7620.4	7712.7	7848.2	8139.0
Flooded Developed Dry Land	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	36.3	39.9	58.1	76.2	94.6
Inland Open Water	31.7	31.4	29.3	27.9	26.3	31.7	31.4	29.3	27.9	26.3	31.7	31.4	29.3	27.9	26.3
Inland Shore	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8	3.8
Inland-Fresh Marsh	63.4	49.5	26.9	22.8	20.6	63.4	49.5	26.9	22.8	20.6	63.4	49.5	26.9	22.8	20.6
Irreg.-Flooded Marsh	4804.3	4717.7	4216.8	2633.6	392.2	4804.3	4717.7	4208.4	2626.5	390.2	4804.3	4717.7	4208.4	2626.5	390.2
Ocean Beach	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ocean Flat	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open Ocean	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Regularly-Flooded Marsh	1299.5	1379.6	1904.3	3437.6	5436.4	1299.5	1379.6	1899.9	3467.2	5638.5	1299.5	1379.6	1899.9	3467.2	5638.5
Riverine Tidal	5.7	5.3	4.0	2.7	1.0	5.7	5.3	4.0	2.7	1.0	5.7	5.3	4.0	2.7	1.0
Rocky Intertidal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Swamp	3269.5	3225.8	3011.4	2697.5	2314.2	3269.5	3225.8	3011.4	2697.5	2314.2	3269.5	3225.8	3011.4	2697.5	2314.2
Tidal Creek	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tidal Flat	376.3	329.7	336.3	576.4	1048.3	376.3	329.7	336.3	575.9	1047.4	376.3	329.7	336.3	575.9	1047.4
Tidal Swamp	584.6	584.6	584.2	576.5	508.0	584.6	584.6	584.2	576.5	508.0	584.6	584.6	584.2	576.5	508.0
Tidal-Fresh Marsh	17.6	17.6	17.6	17.6	16.7	17.6	17.6	17.6	17.6	16.7	17.6	17.6	17.6	17.6	16.7
Trans. Salt Marsh	411.8	451.4	592.0	603.3	548.2	421.1	480.8	718.2	849.7	850.8	421.1	480.8	718.2	849.7	850.8
Undeveloped Dry Land	5431.5	5431.5	5431.5	5431.5	5431.5	5422.3	5402.1	5302.0	5145.3	4909.4	5422.3	5402.1	5302.0	5145.3	4909.4

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html

Appendix K

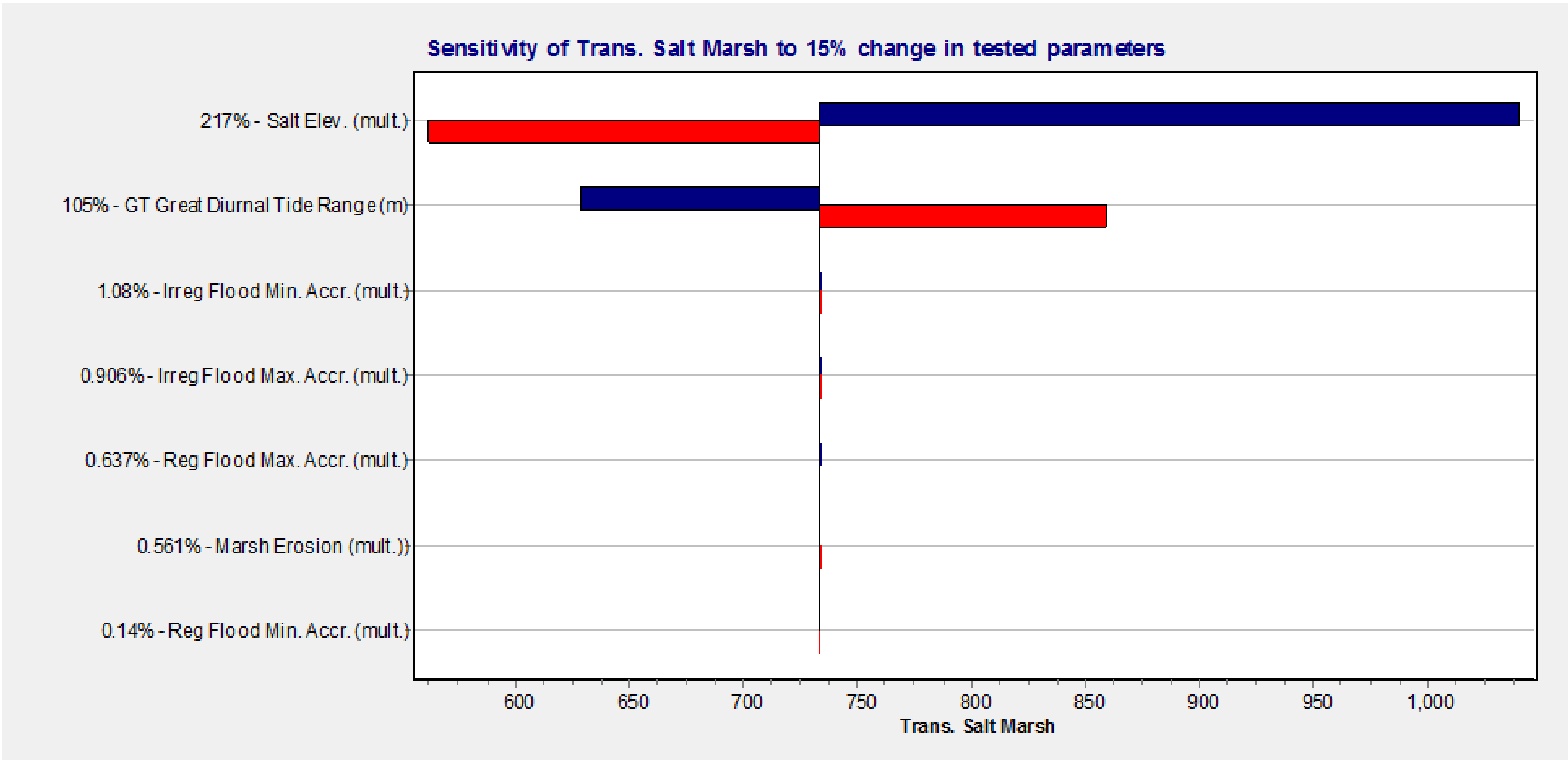
Sensitivity analysis

Table K1. Acreage changes (in percentage) caused by +/-15% change in parameters for three types of marshes.

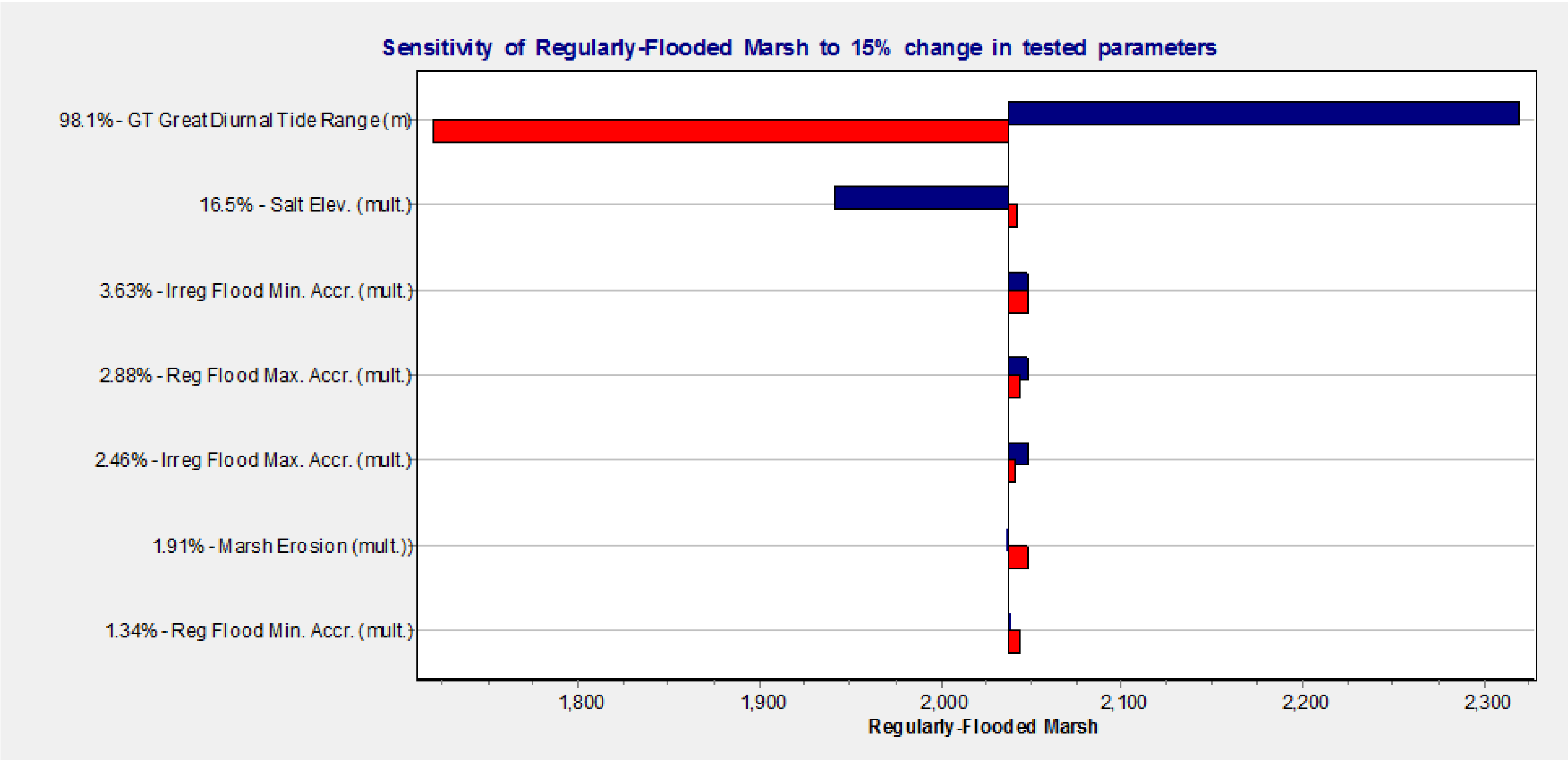
Marsh type	Variable	Percent change						
		Broadkill	Mispillion	Lower St. Jones	Dividing	Lower Maurice	Dennis	Reeds Beach
Irregularly flooded marsh	GT Great Diurnal Tide Range	1.40	4.40	30.20	7.80	50.60	74.25	58.64
	Salt Elevation	0.20	0.70	1.80	0.40	2.20	6.58	8.81
	Marsh Erosion	0.30	0.20	0.70	0.10	0.30	0.15	0.57
	Reg Flood Max. Accr.	0.30	0.30	0.80	0.00	0.60	0.85	0.86
	Reg Flood Min. Accr.	0.10	0.20	0.30	0.00	0.40	0.27	0.31
	Irreg Flood Max. Accr.	0.30	0.20	0.50	0.10	0.50	0.49	0.14
	Irreg Flood Min. Accr.	0.50	0.30	0.40	0.10	0.50	0.48	0.54
Regularly flooded marsh	GT Great Diurnal Tide Range	14.70	5.90	3.20	11.80	9.60	8.85	7.17
	Salt Elevation	2.50	2.20	2.70	1.50	1.20	2.12	1.39
	Marsh Erosion	0.30	0.80	0.90	0.10	0.10	0.17	0.10
	Reg Flood Max. Accr.	0.40	1.30	1.00	0.20	0.20	0.38	0.29
	Reg Flood Min. Accr.	0.20	0.90	0.50	0.20	0.10	0.13	0.10
	Irreg Flood Max. Accr.	0.40	1.10	0.60	0.20	0.20	0.29	0.21
	Irreg Flood Min. Accr.	0.50	1.50	0.50	0.20	0.20	0.28	0.20
Transitional salt marsh	GT Great Diurnal Tide Range	15.80	17.40	12.40	17.00	19.50	22.80	14.12
	Salt Elevation	32.60	25.10	20.00	38.40	37.20	39.63	49.39
	Marsh Erosion	0.10	0.10	0.10	0.10	0.00	0.01	0.03
	Reg Flood Max. Accr.	0.10	0.10	0.10	0.10	0.00	0.01	0.02
	Reg Flood Min. Accr.	0.00	0.10	0.00	0.00	0.00	0.01	0.02
	Irreg Flood Max. Accr.	0.10	0.20	0.10	0.00	0.00	0.00	0.02
	Irreg Flood Min. Accr.	0.20	0.20	0.10	0.00	0.00	0.01	0.02

Tornado plots –
Broadkill

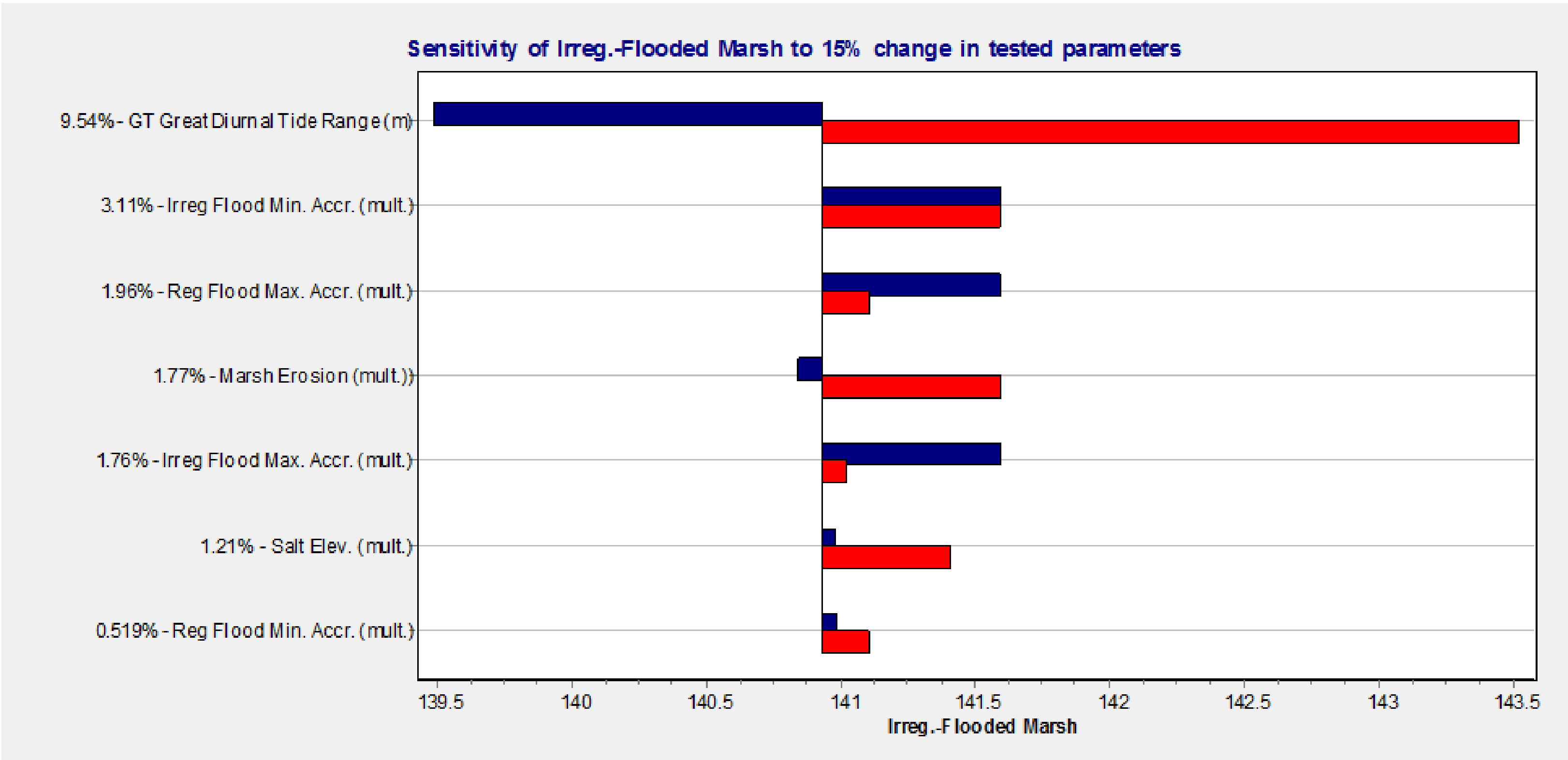
Broadkill – Transitional Salt Marsh



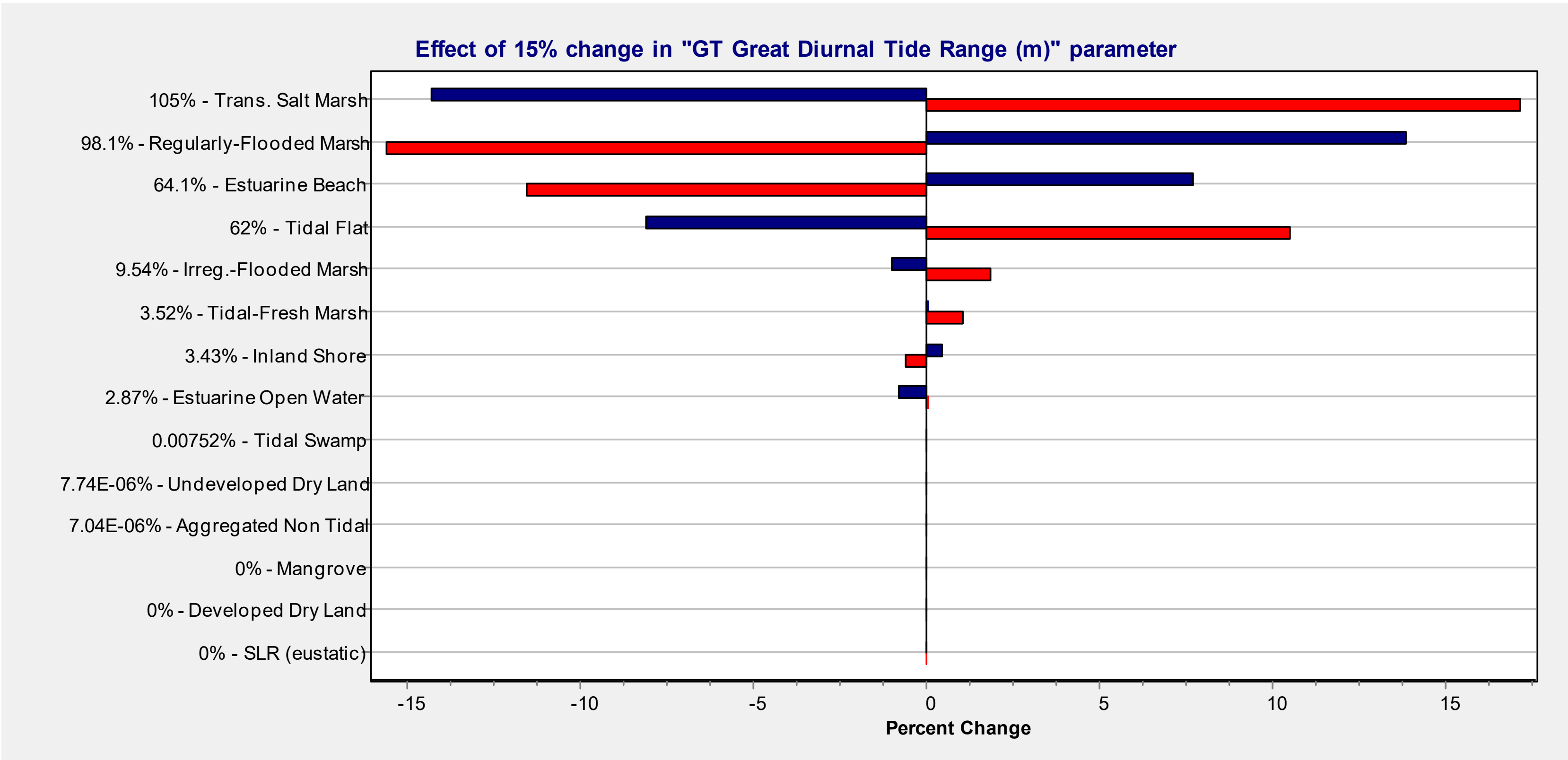
Broadkill – Regularly-Flooded Marsh



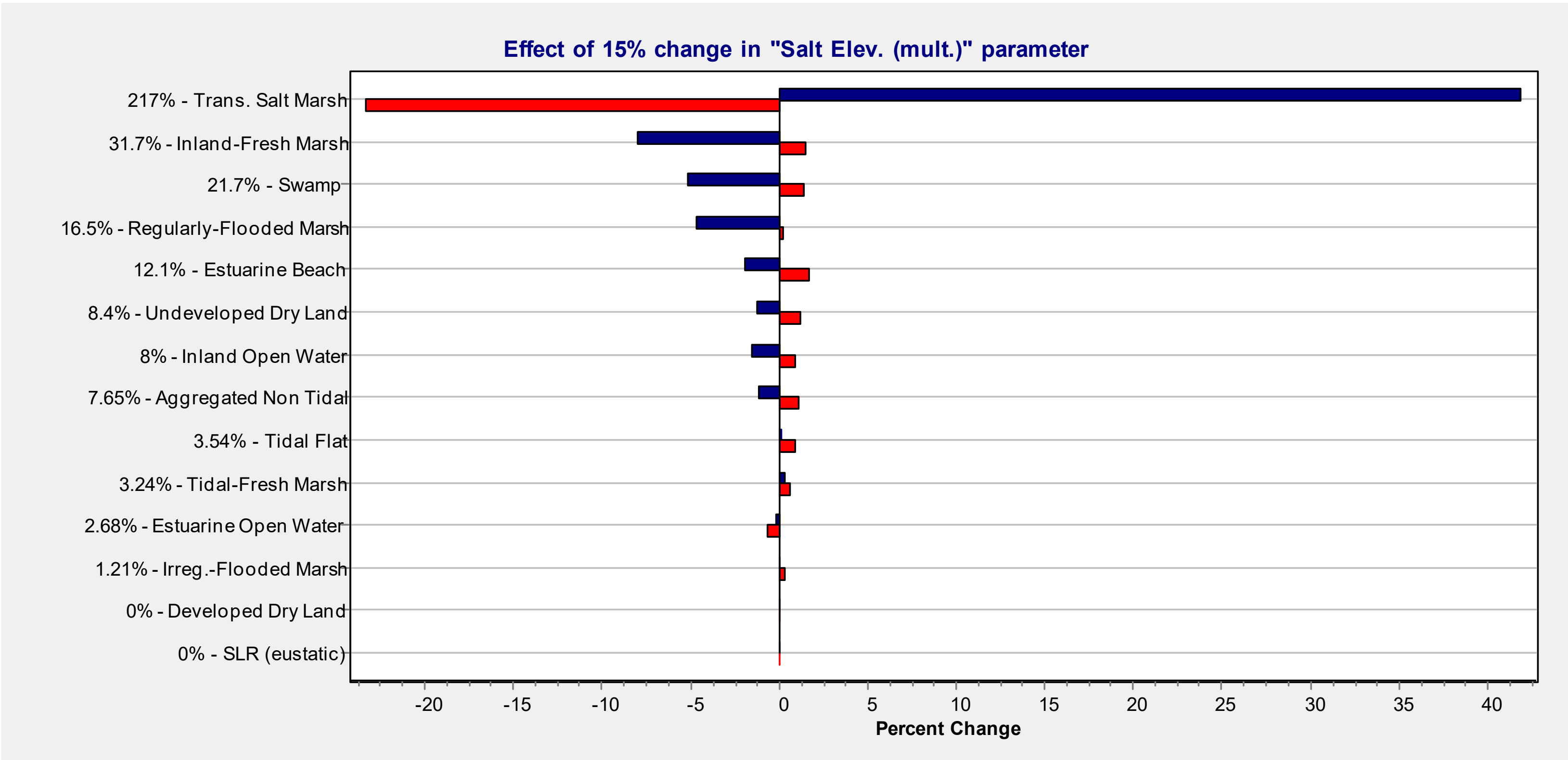
Broadkill – Irregularly-Flooded Marsh



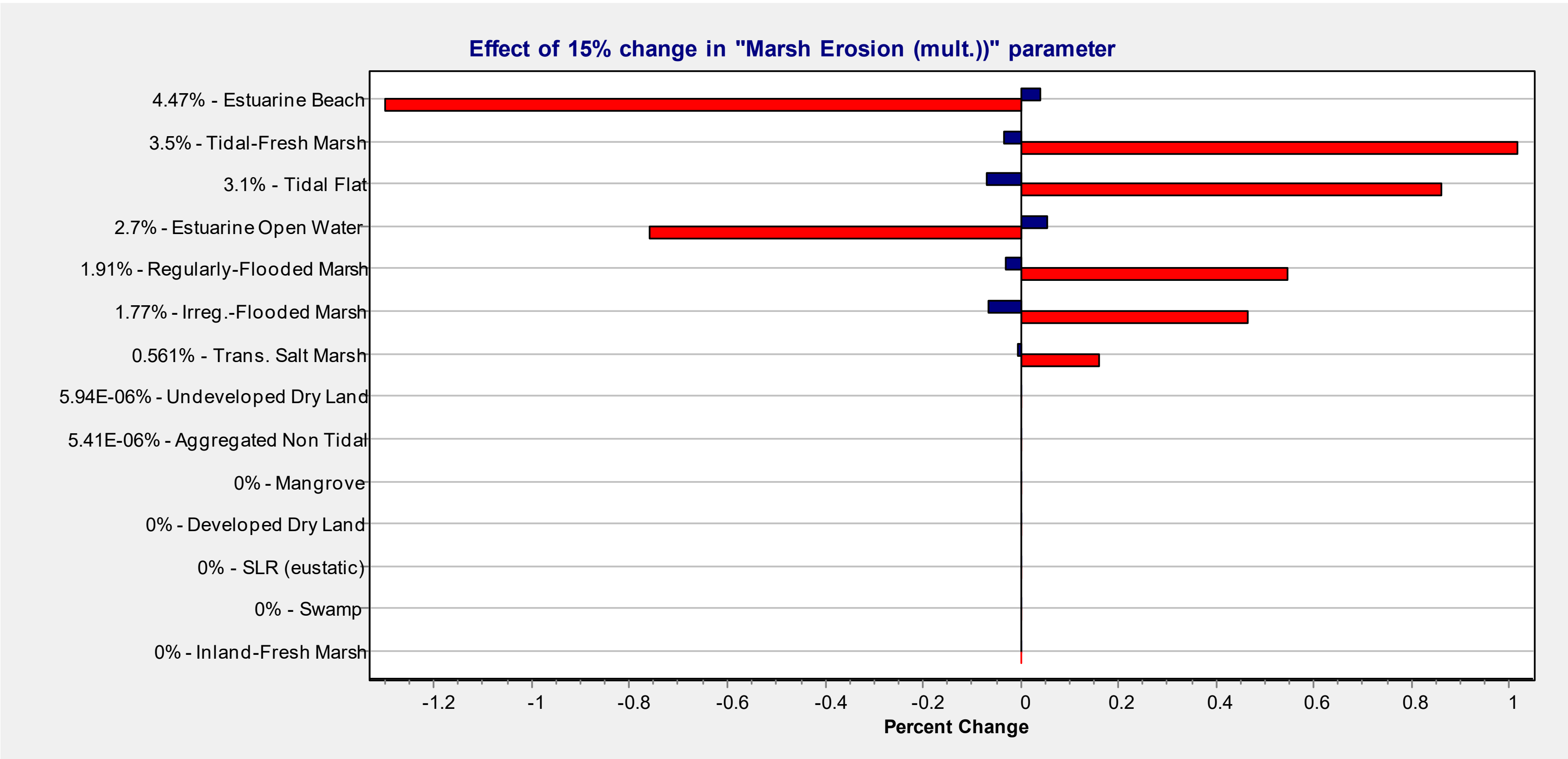
Broadkill effects – GT



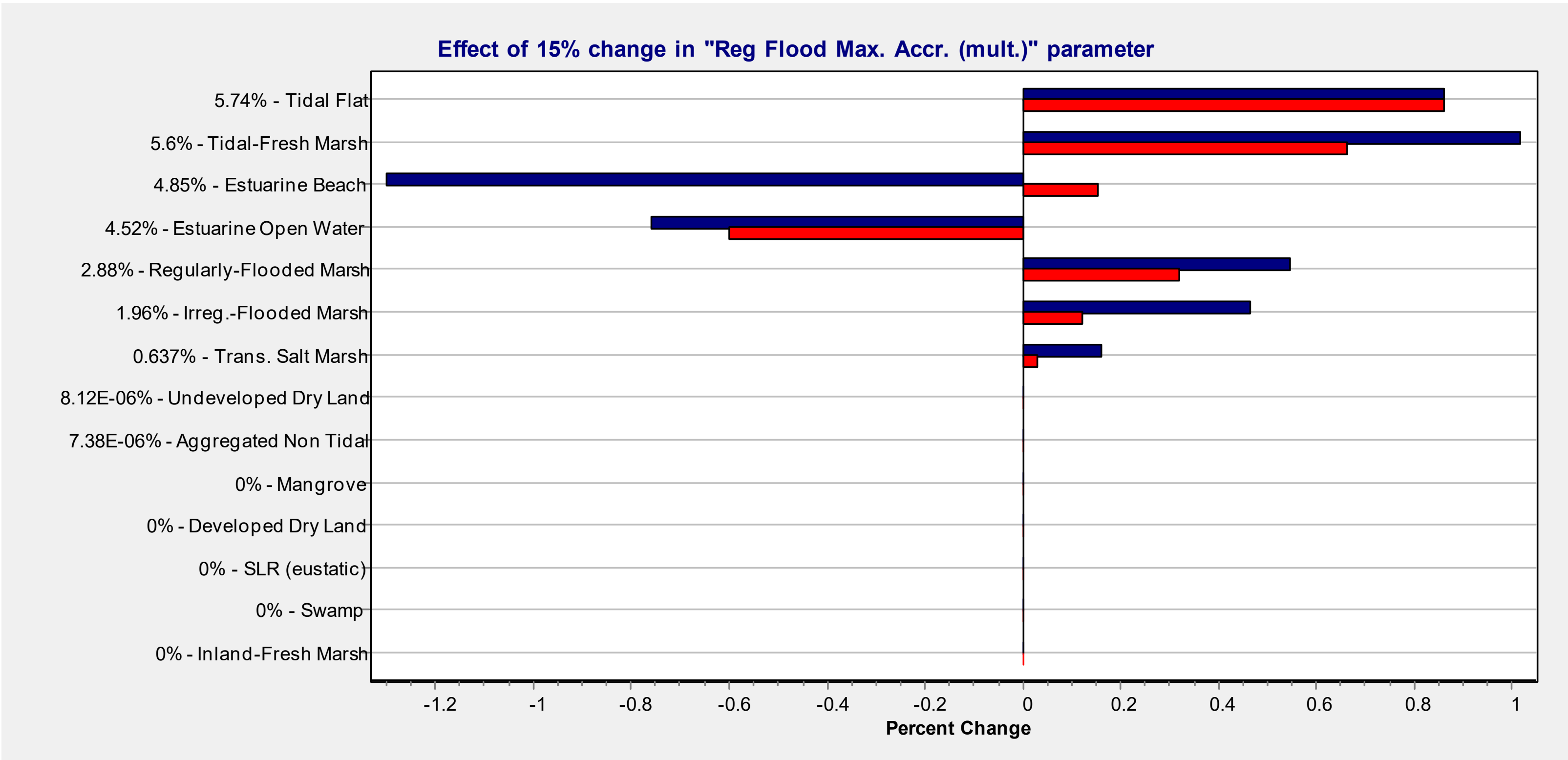
Broadkill effects – Salt elevation



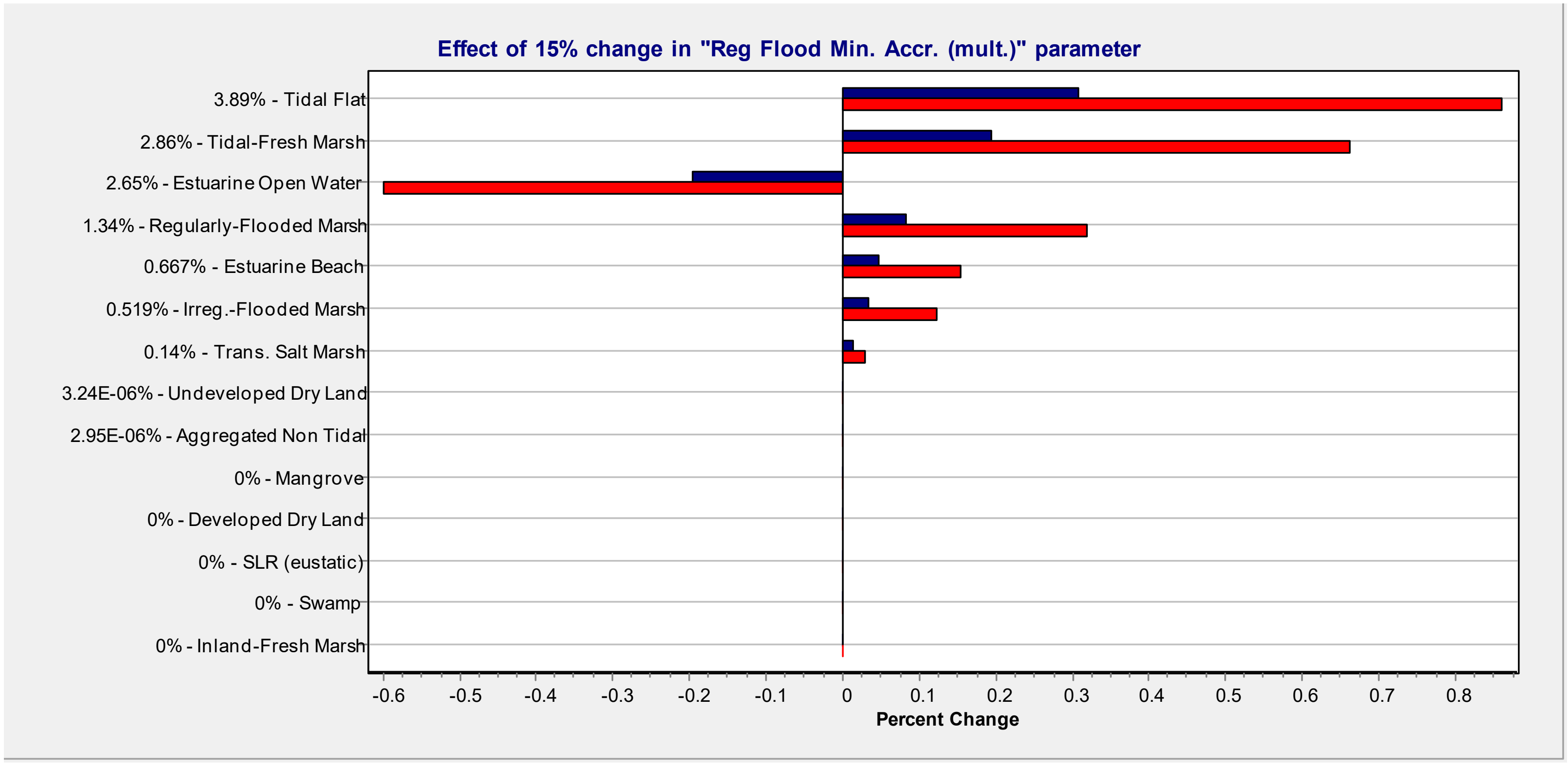
Broadkill effects – Marsh erosion



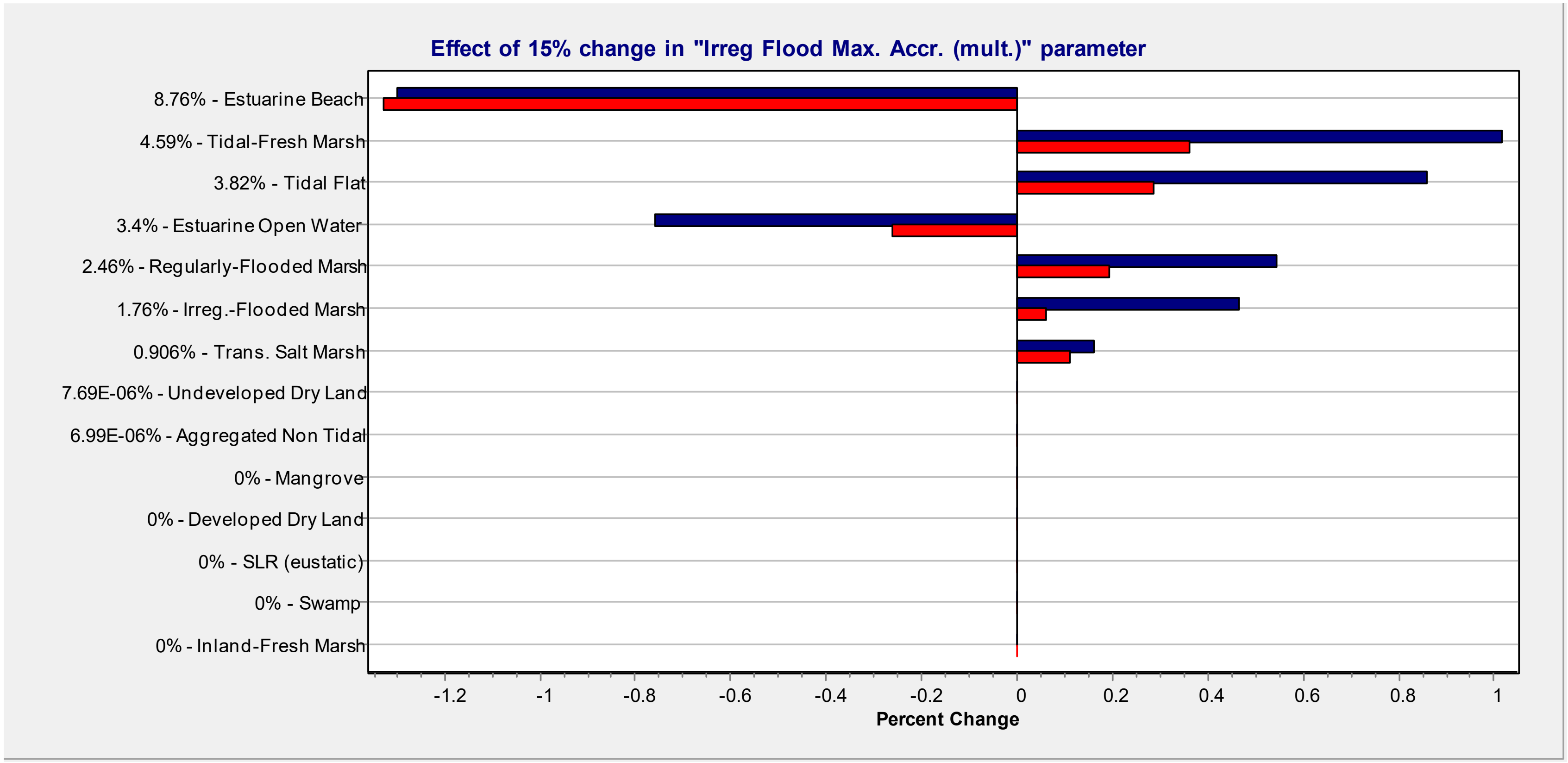
Broadkill effects – Reg Flood Max Accr



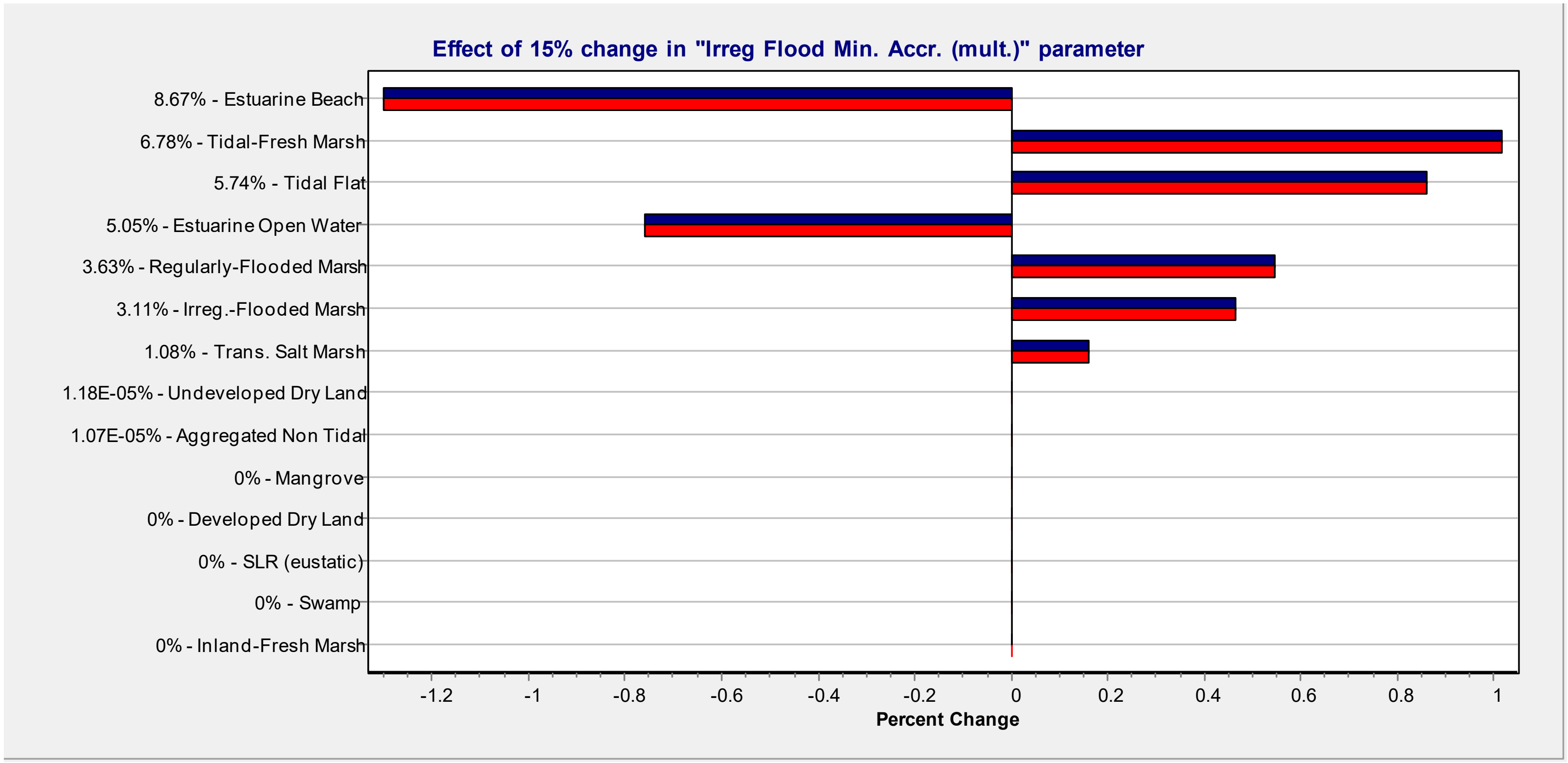
Broadkill effects – Reg Flood Min Accr



Broadkill effects – Irreg Flood Max Accr



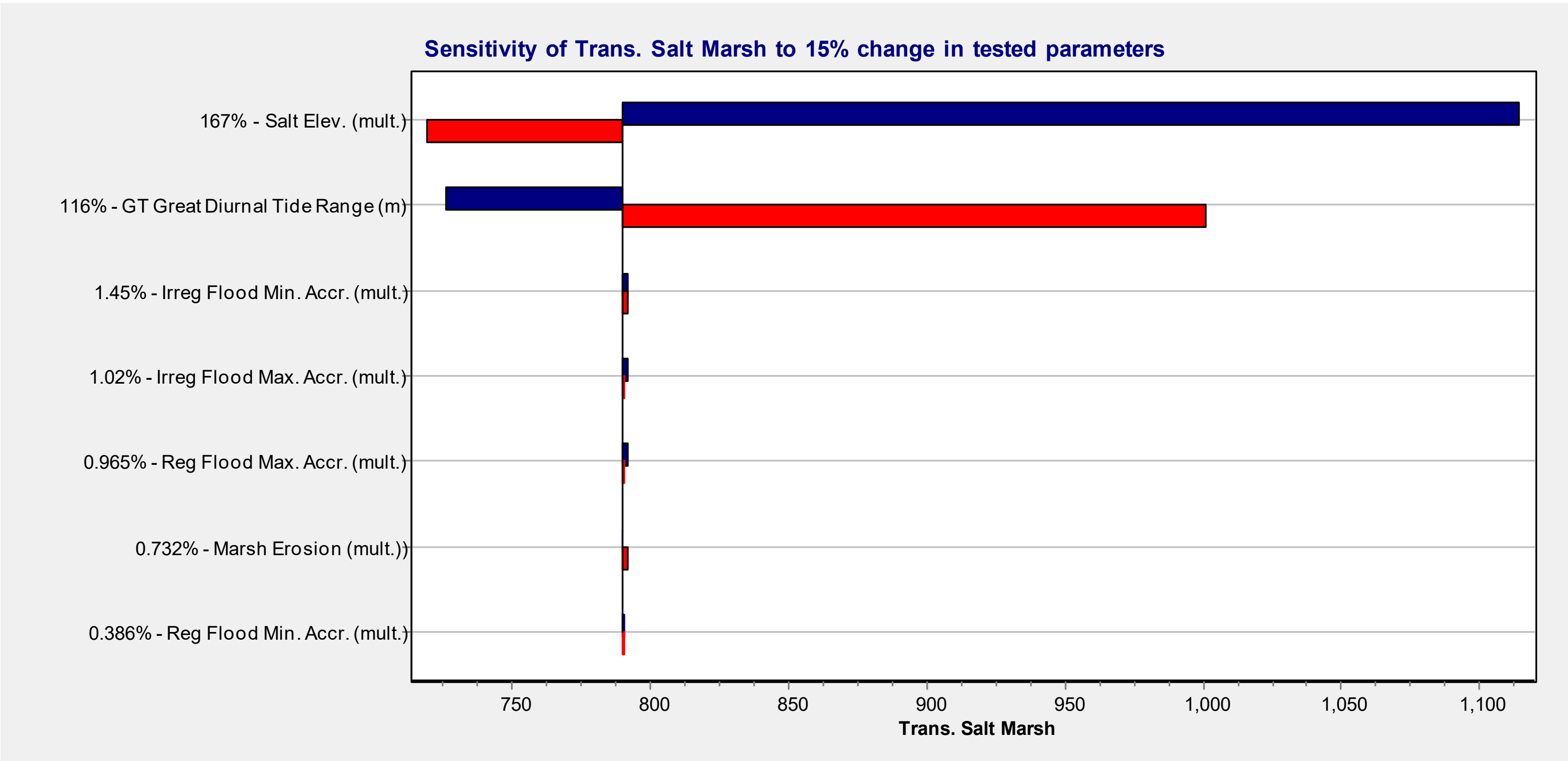
Broadkill effects – Irreg Flood Min Accr



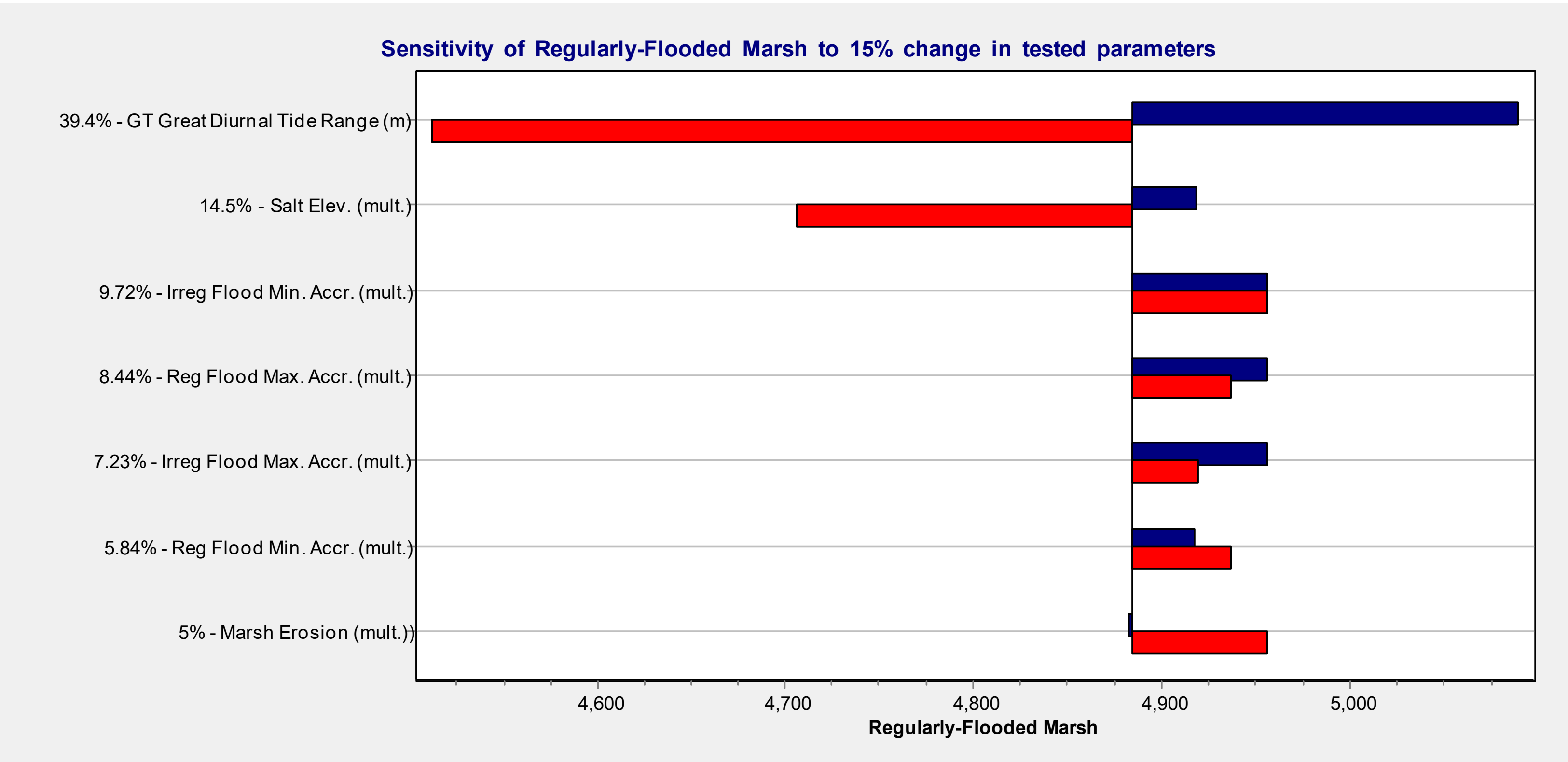
Tornado plots –

Mispillion

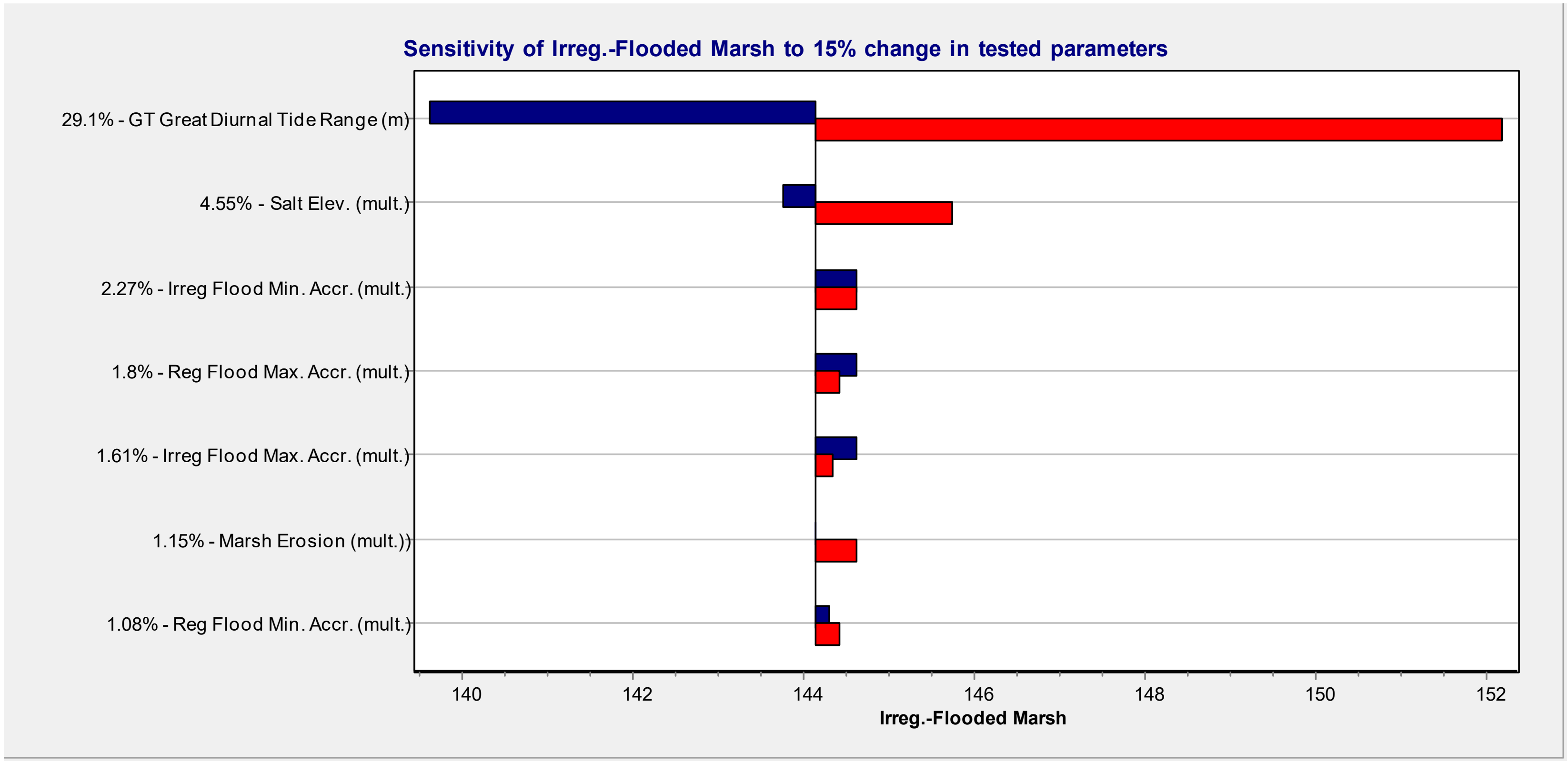
Mispillion - Transitional Salt Marsh



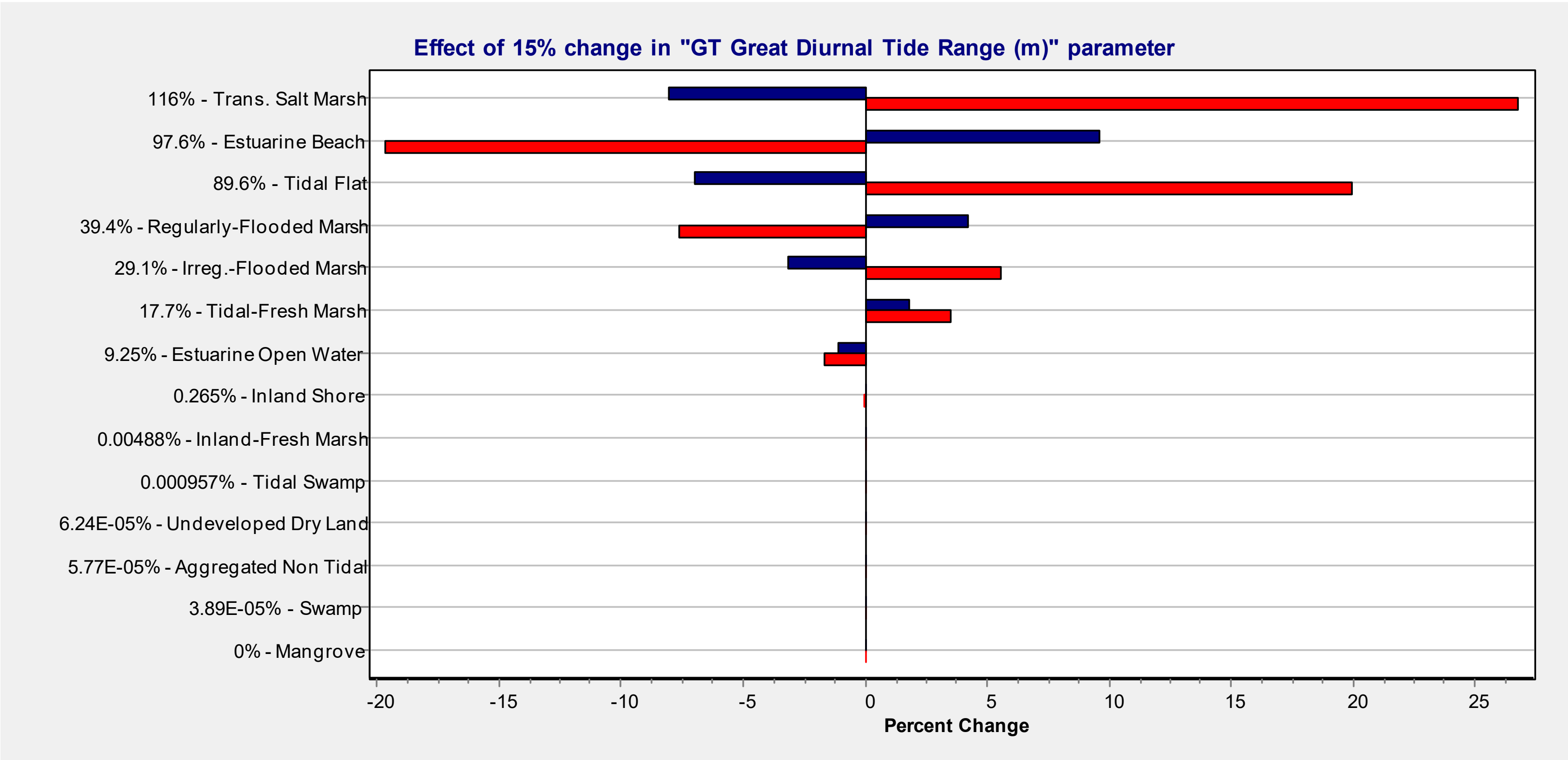
Mispillion - Regularly-Flooded Marsh



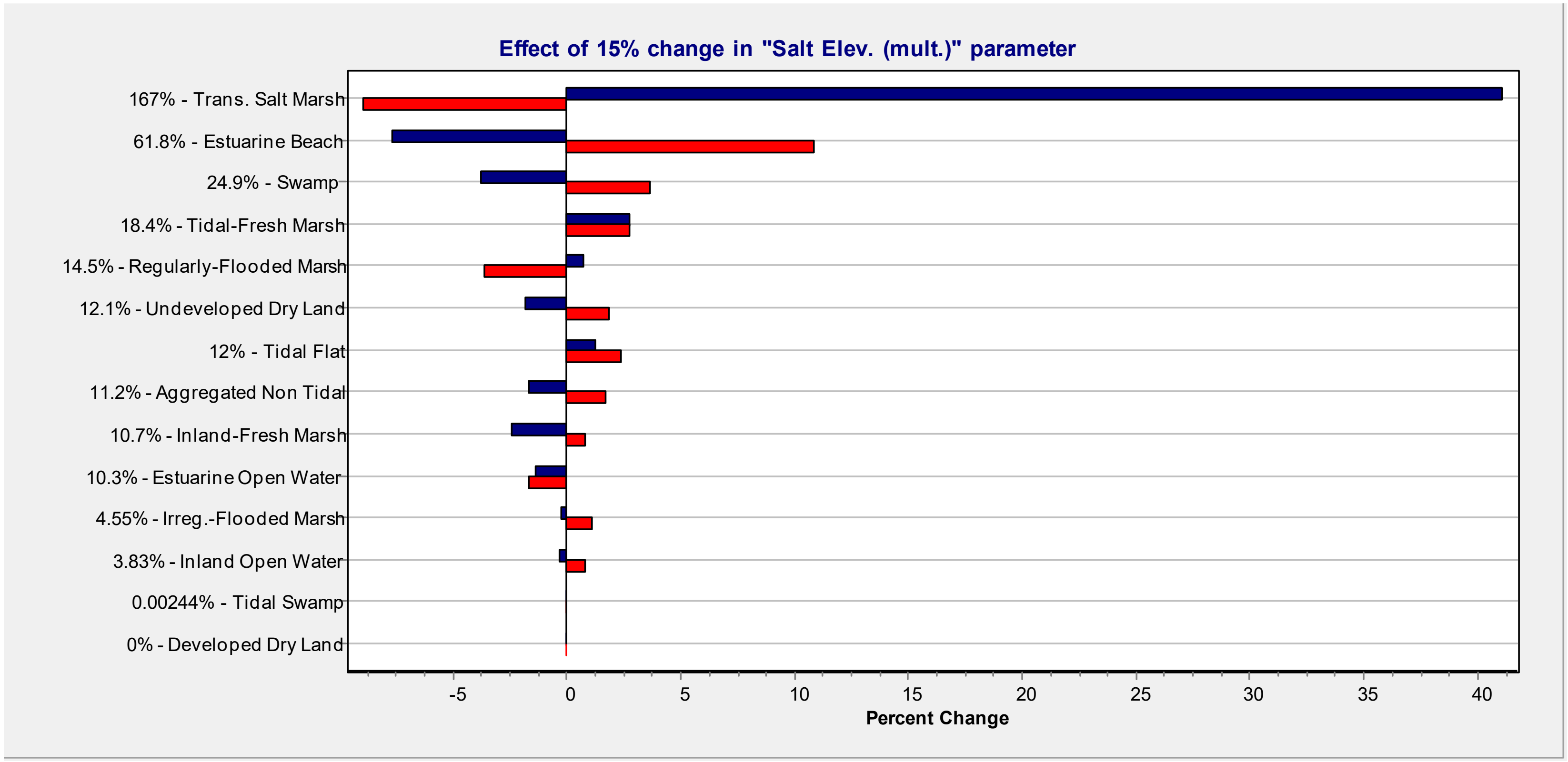
Mispillion - Irregularly-Flooded Marsh



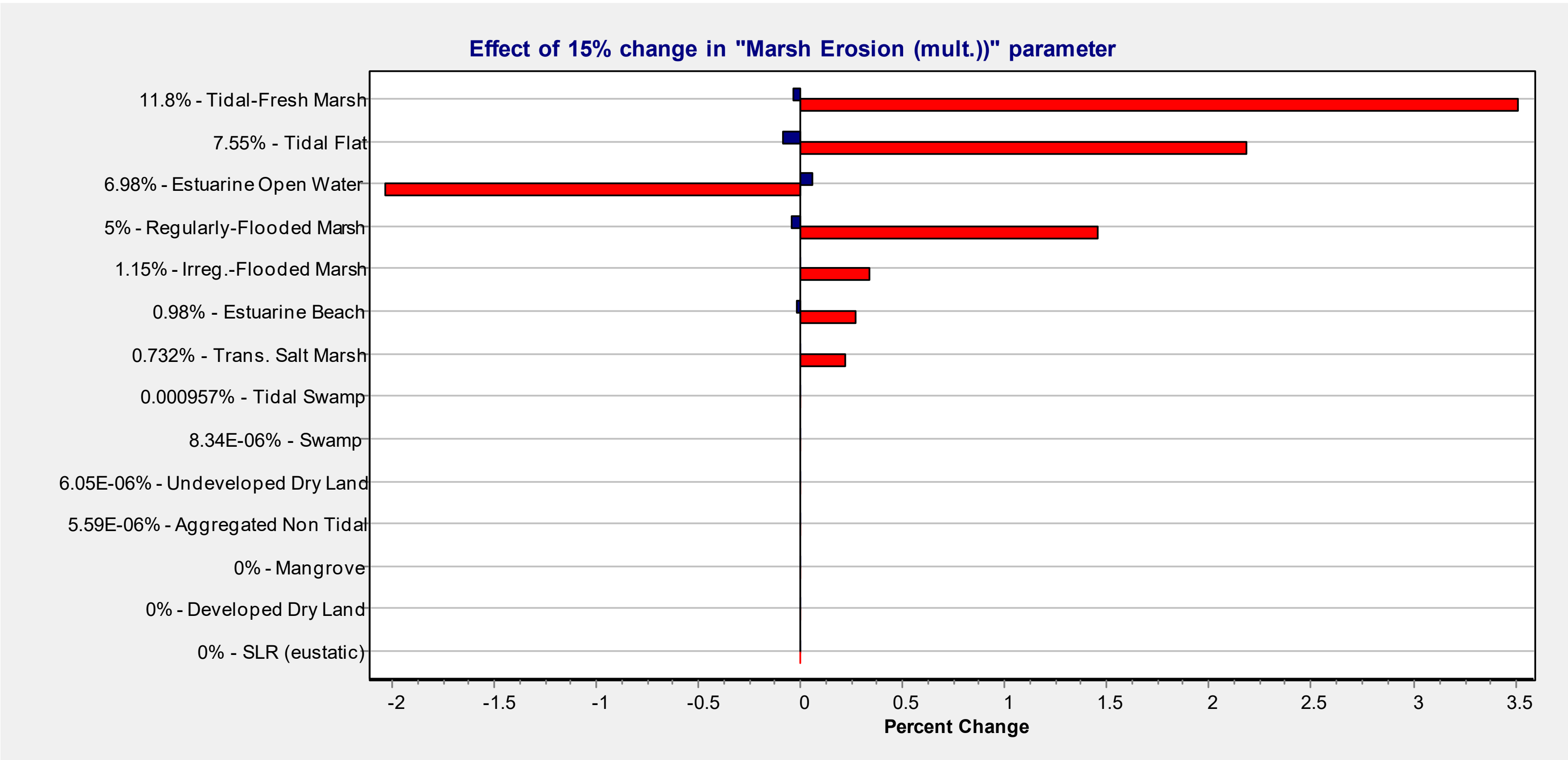
Mispillion - Effects - GT



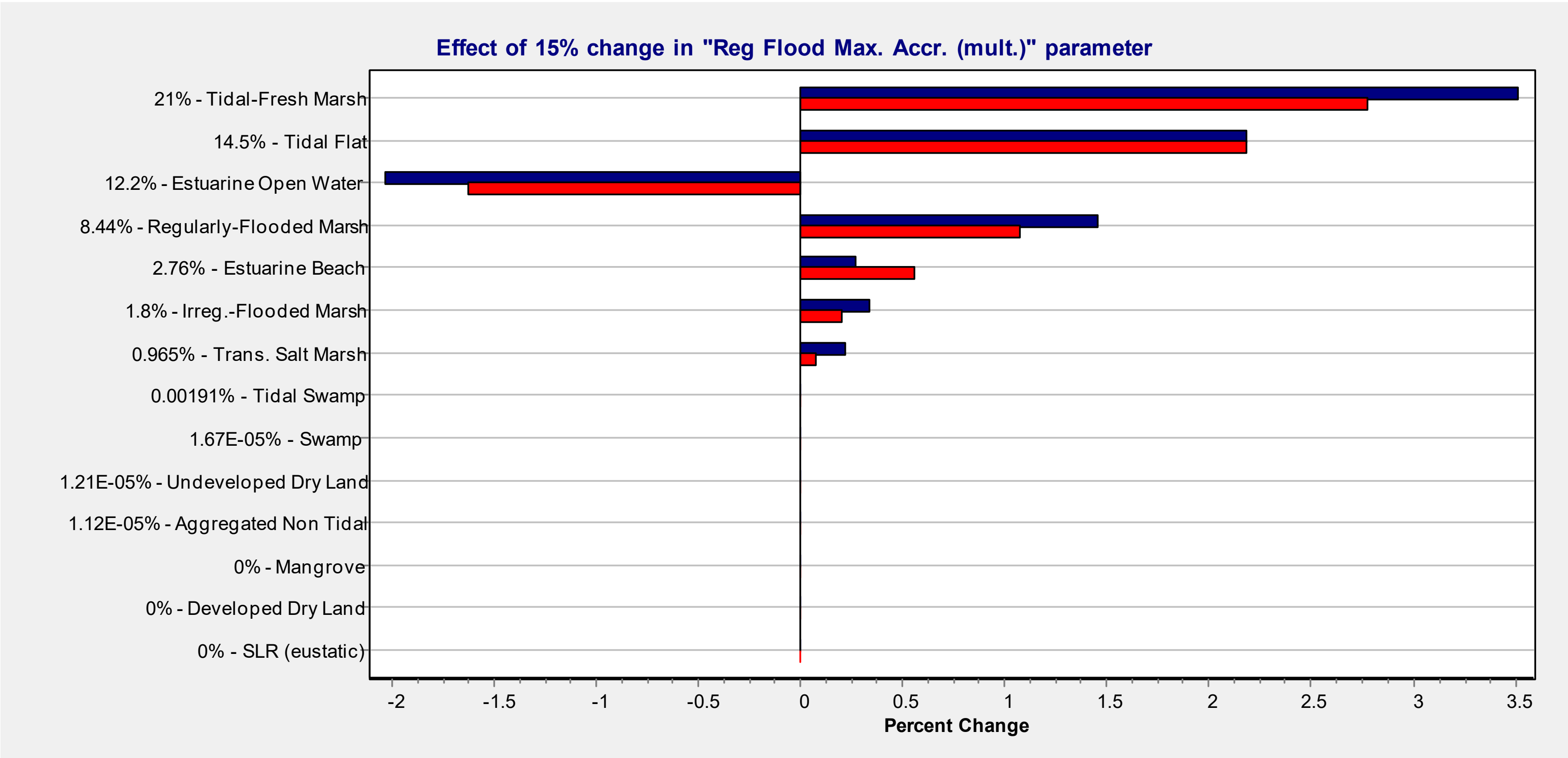
Mispillion - Effects – Salt elevation



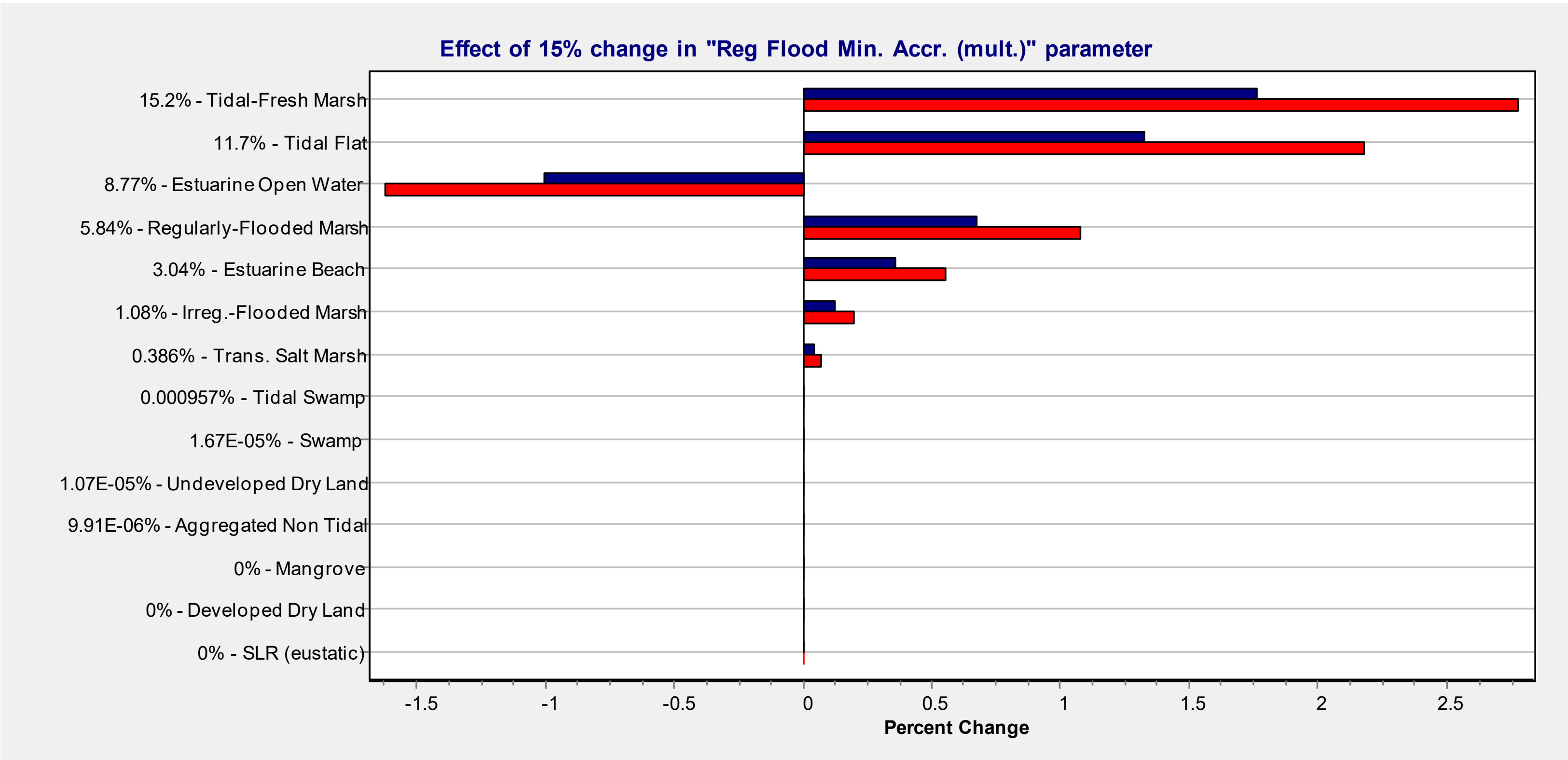
Mispillion - Effects – Marsh erosion



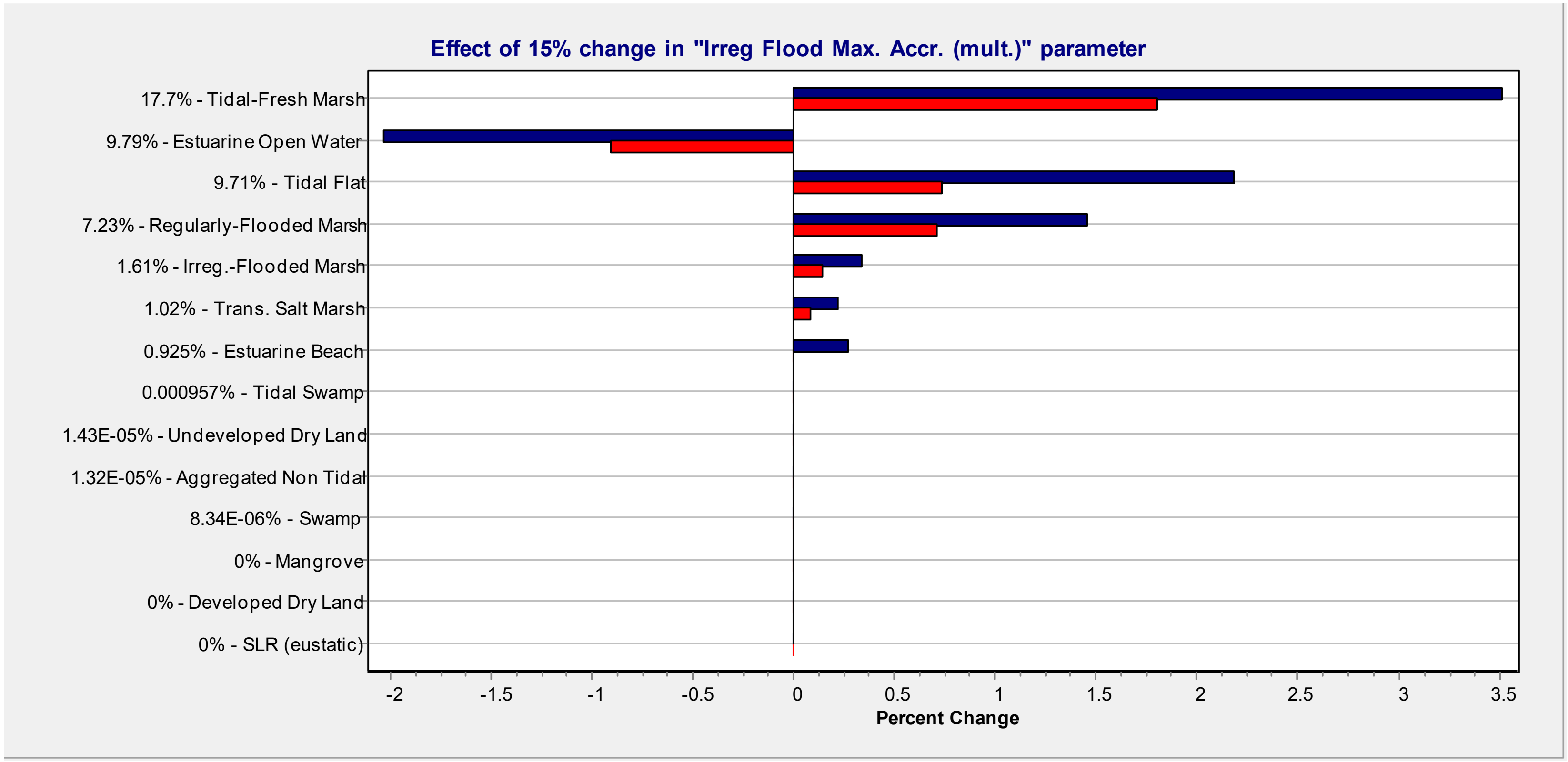
Mispillion - Effects – Reg flood max accr



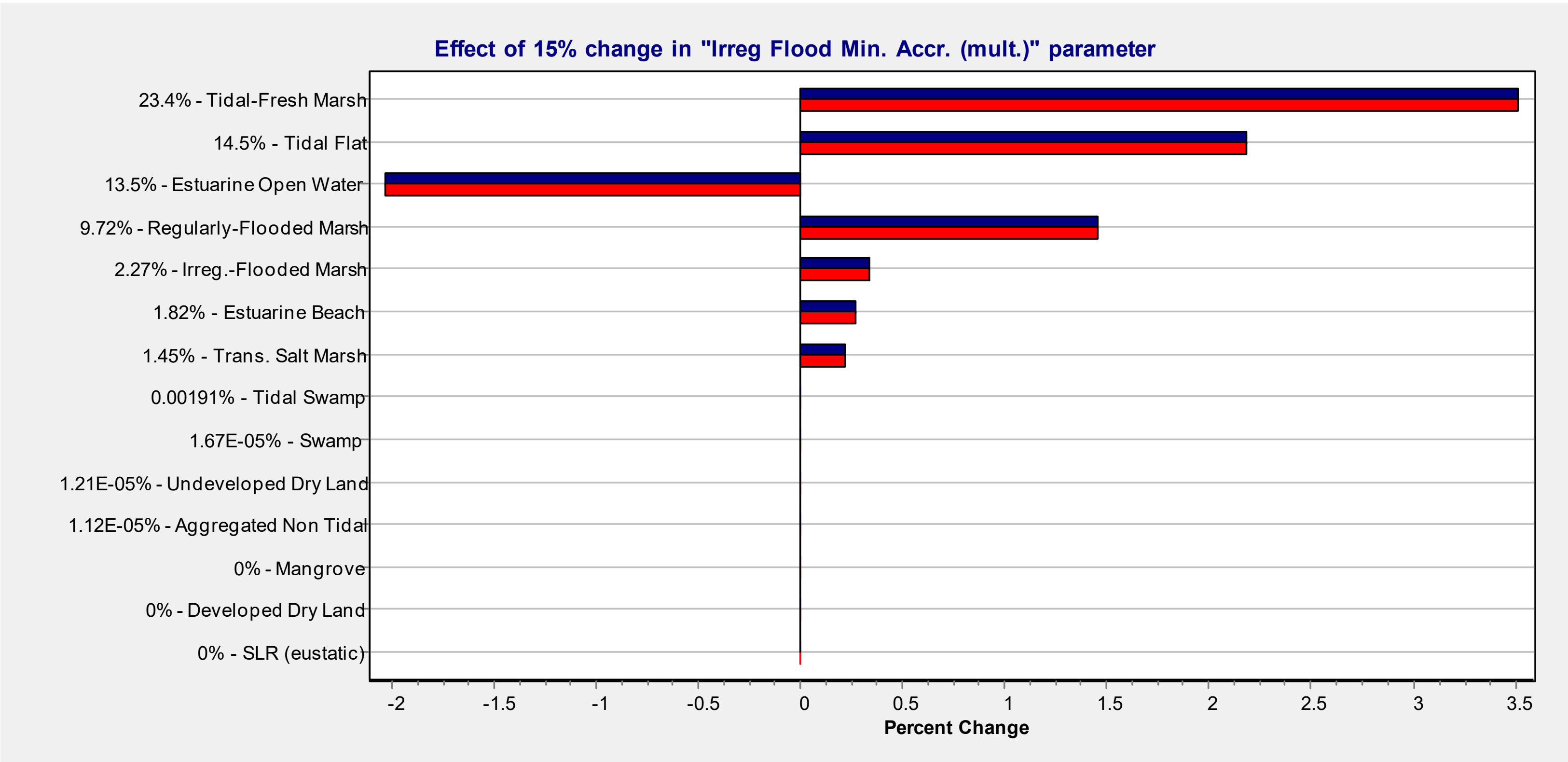
Mispillion - Effects – Reg flood min accr



Mispillion - Effects – Irreg flood max accr



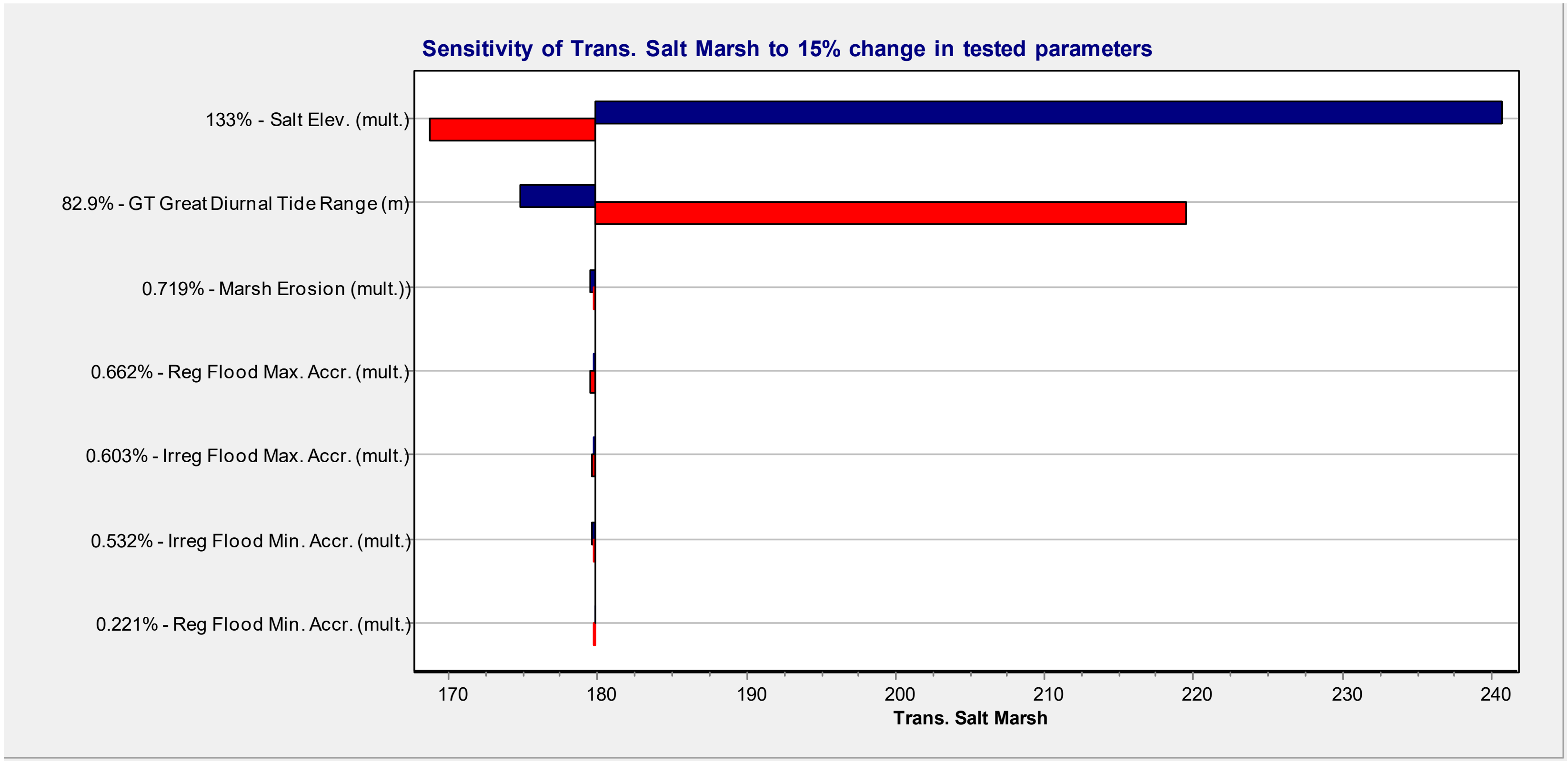
Mispillion - Effects – Irreg flood min accr



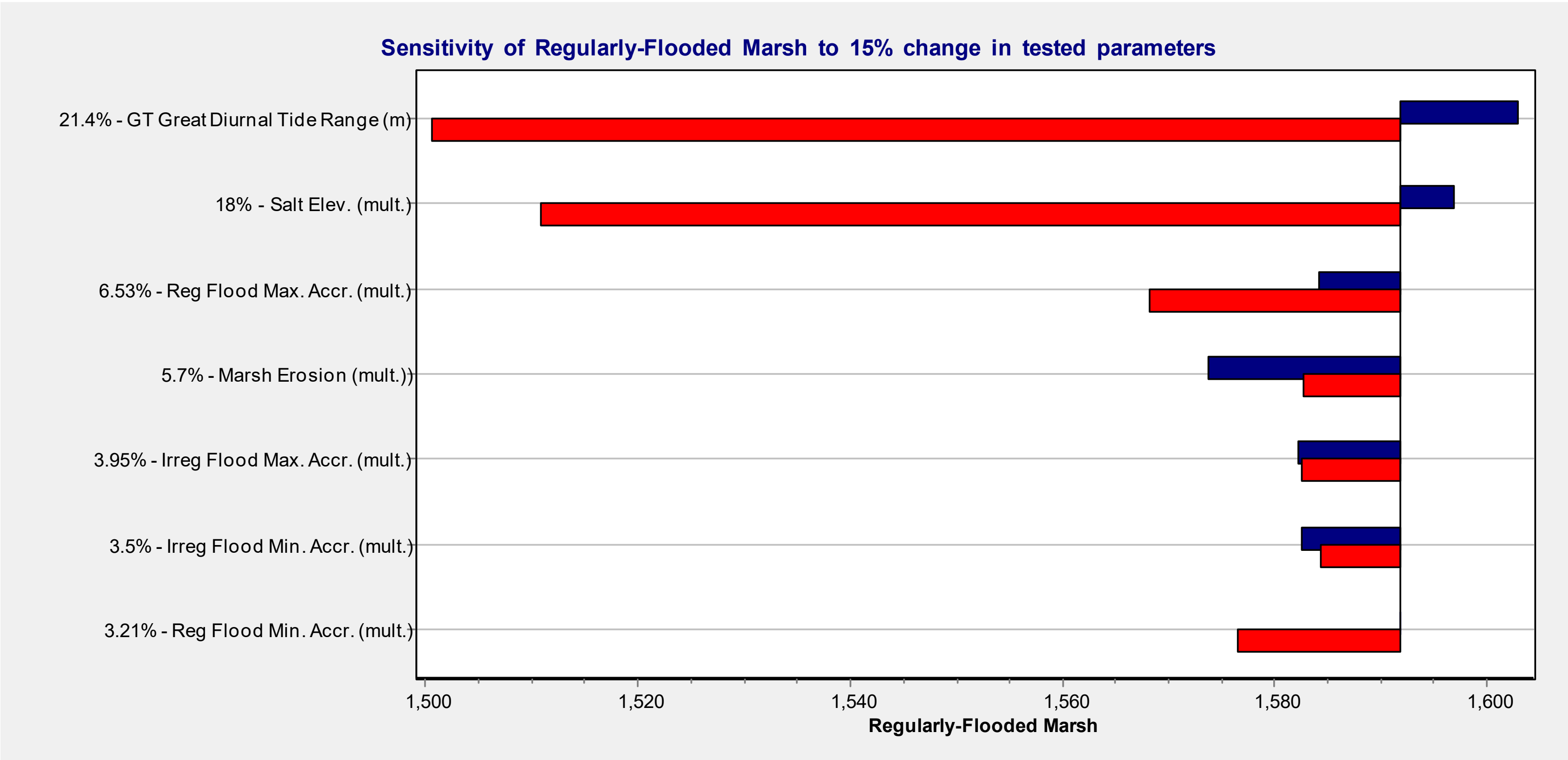
Tornado plots –

Lower St. Jones

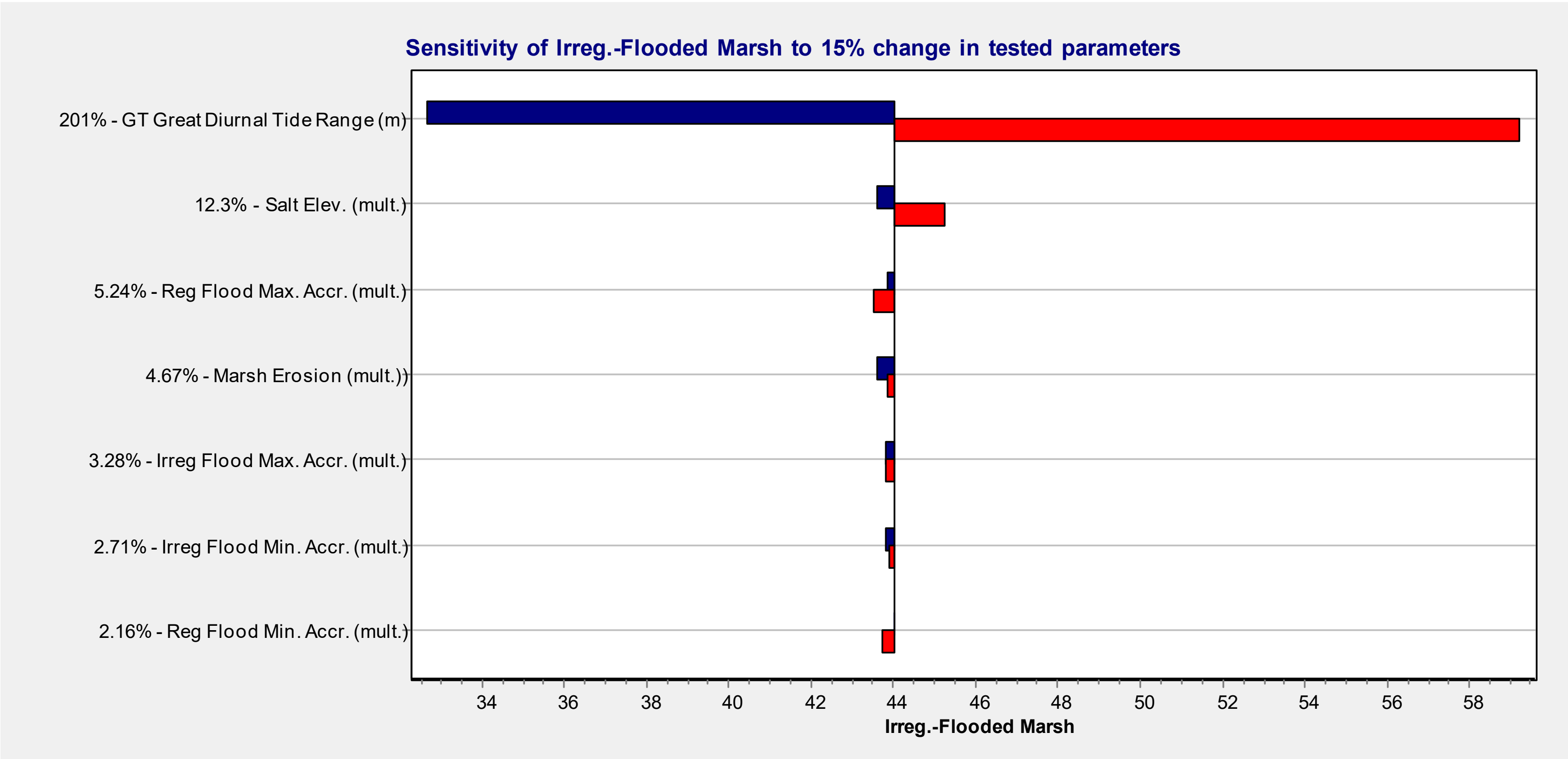
Lower St. Jones - Transitional Salt Marsh



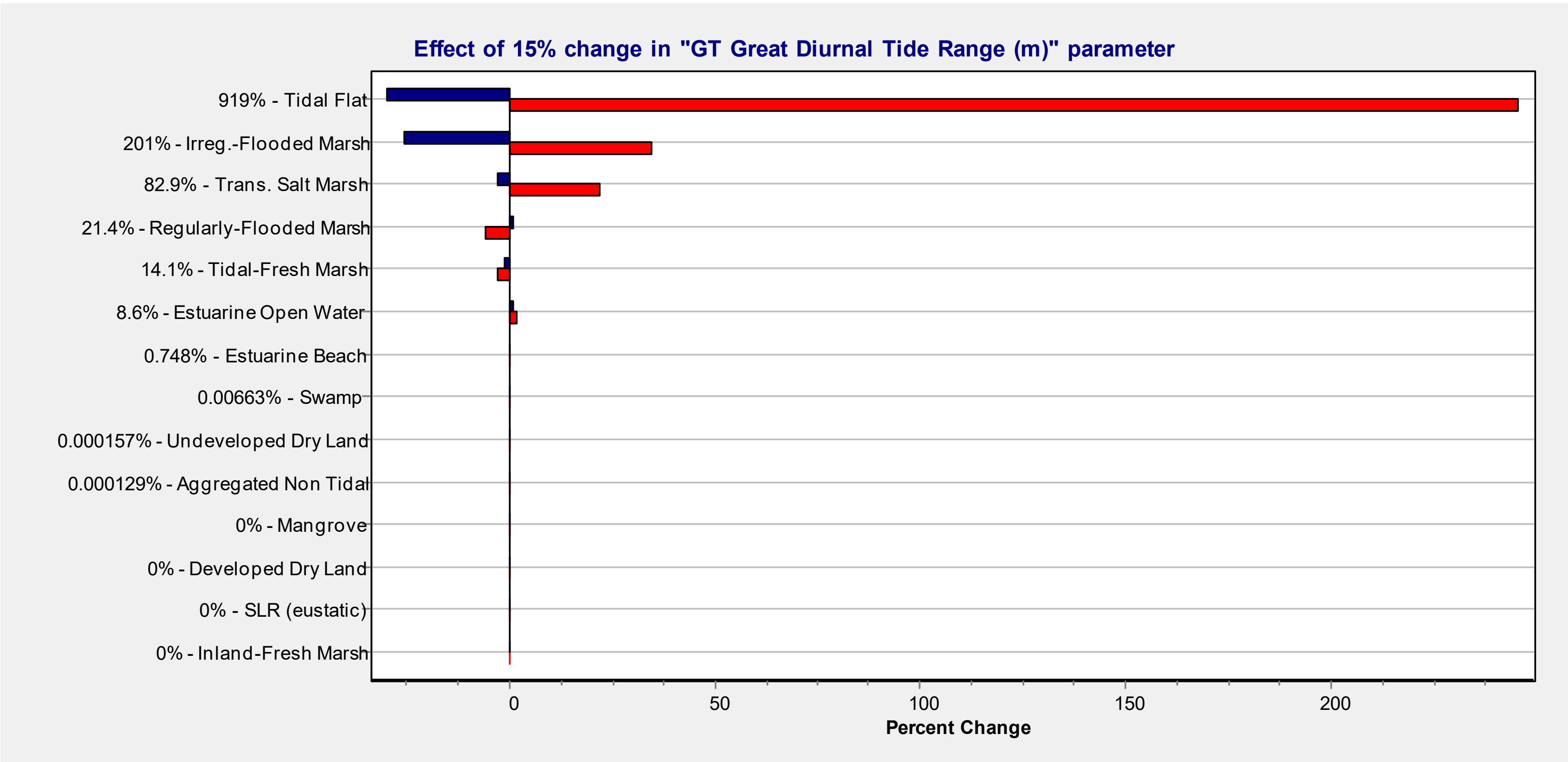
Lower St. Jones - Regularly-Flooded Marsh



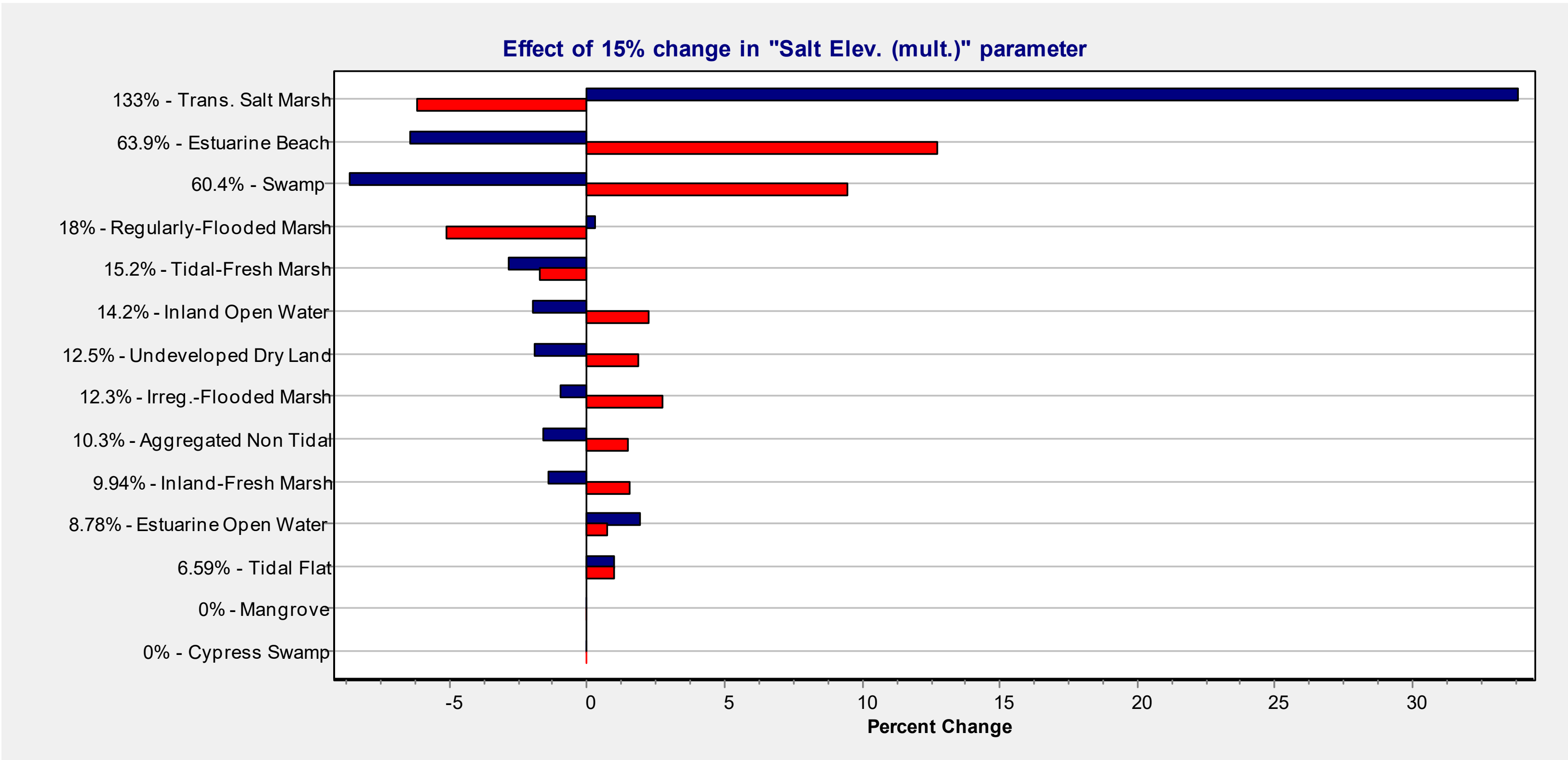
Lower St. Jones - Irregularly-Flooded Marsh



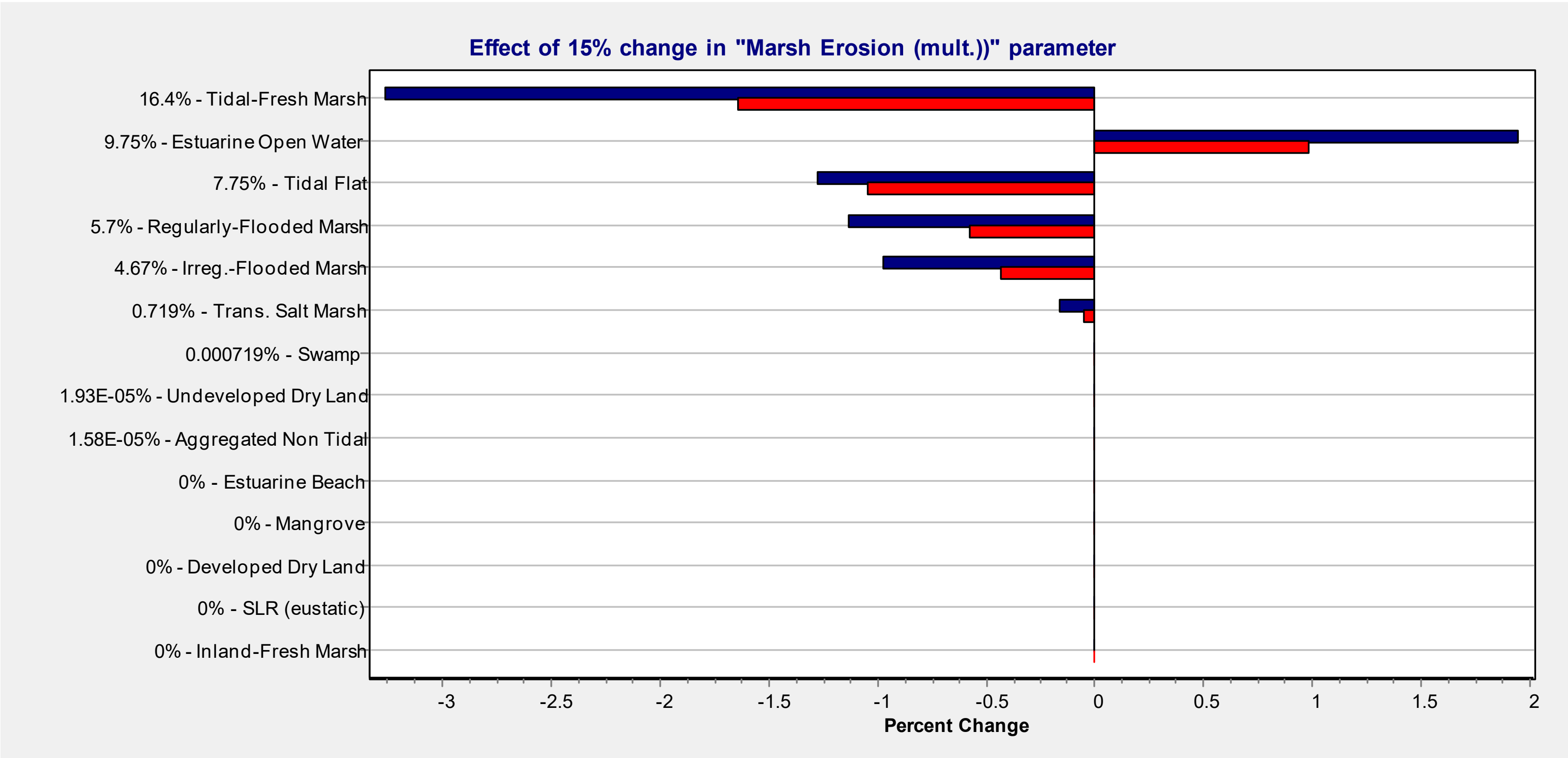
Lower St. Jones - Effects - GT



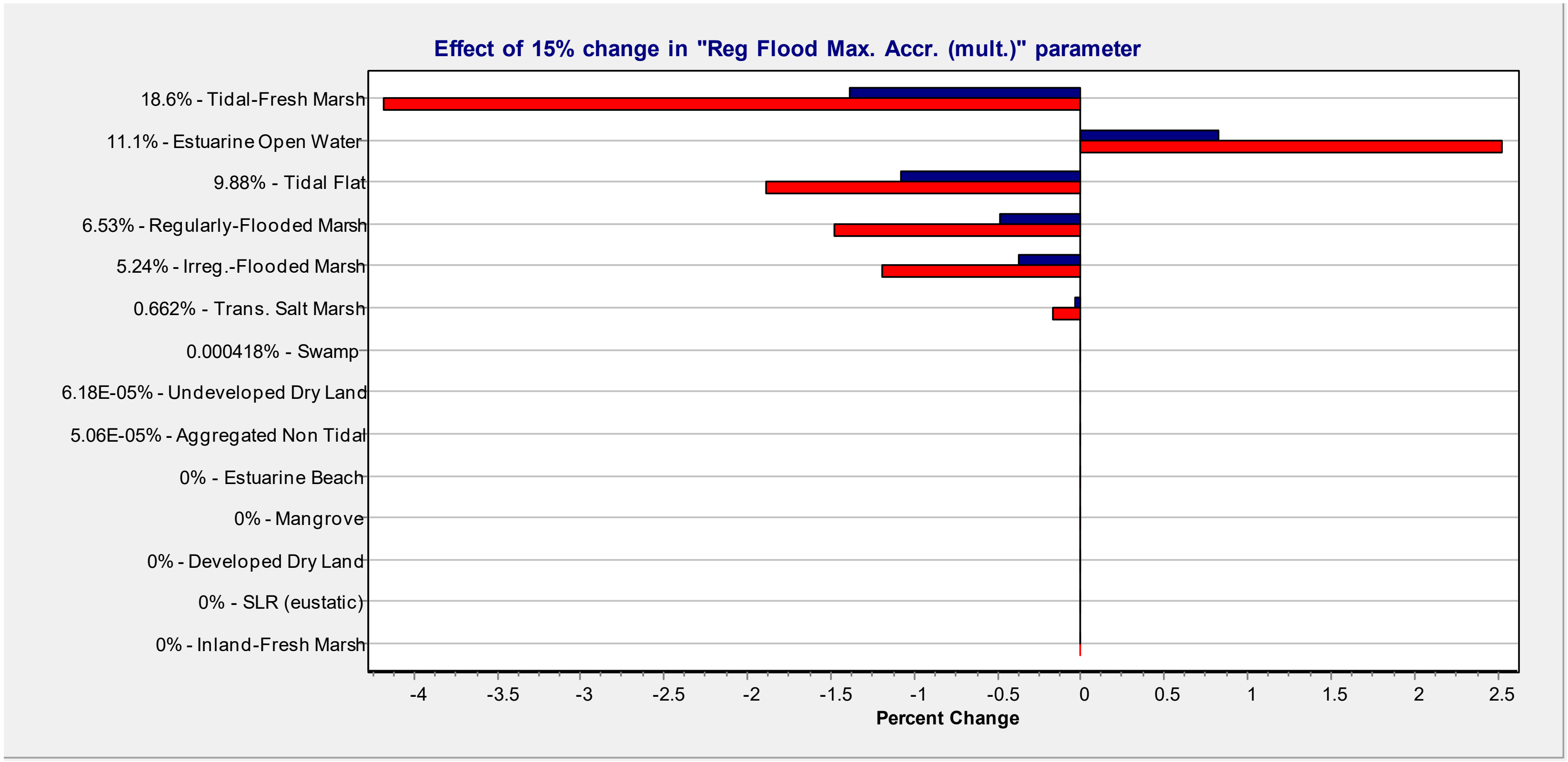
Lower St. Jones - Effects – Salt elevation



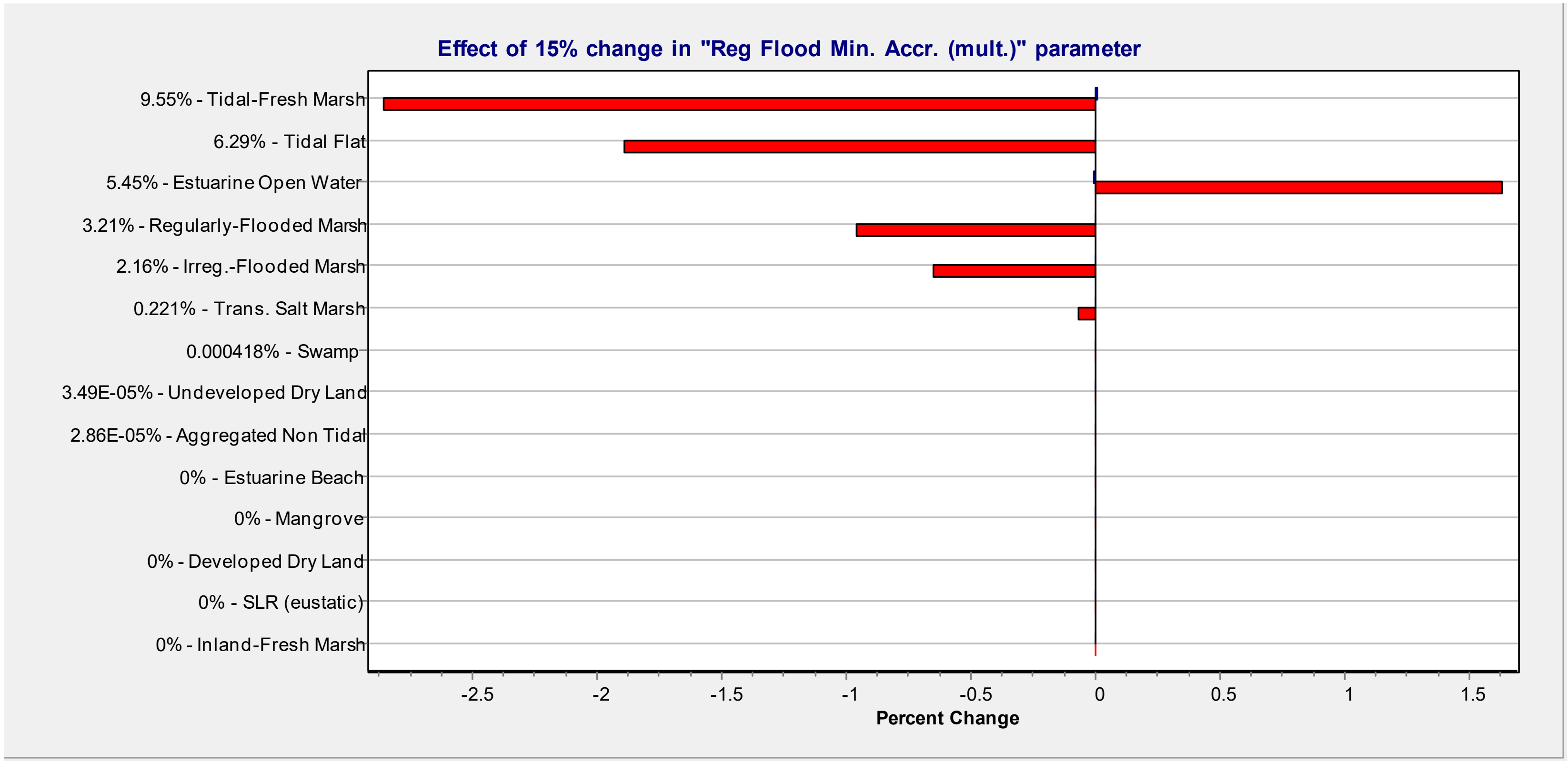
Lower St. Jones - Effects – Marsh erosion



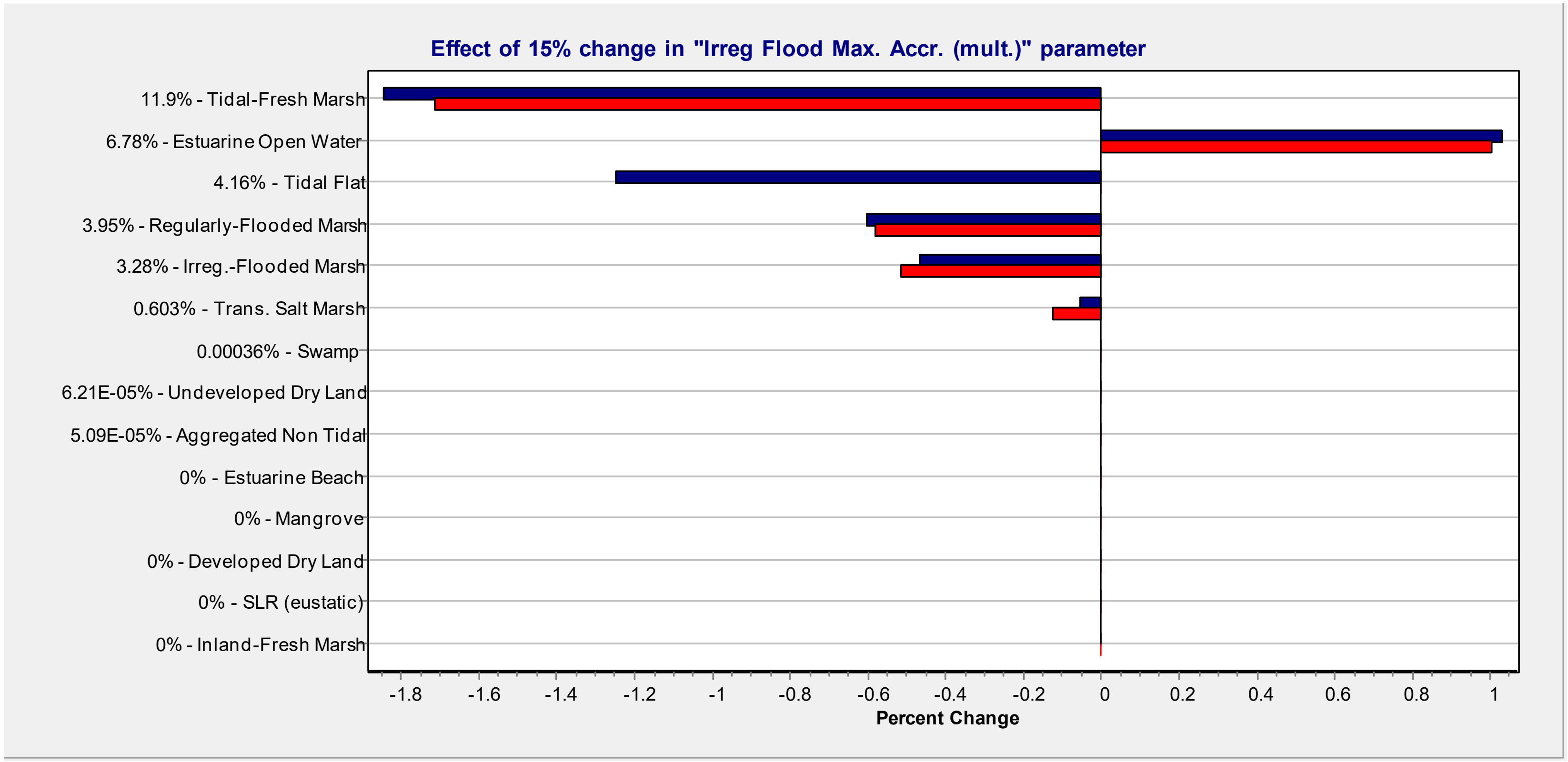
Lower St. Jones - Effects – Reg flood max accr



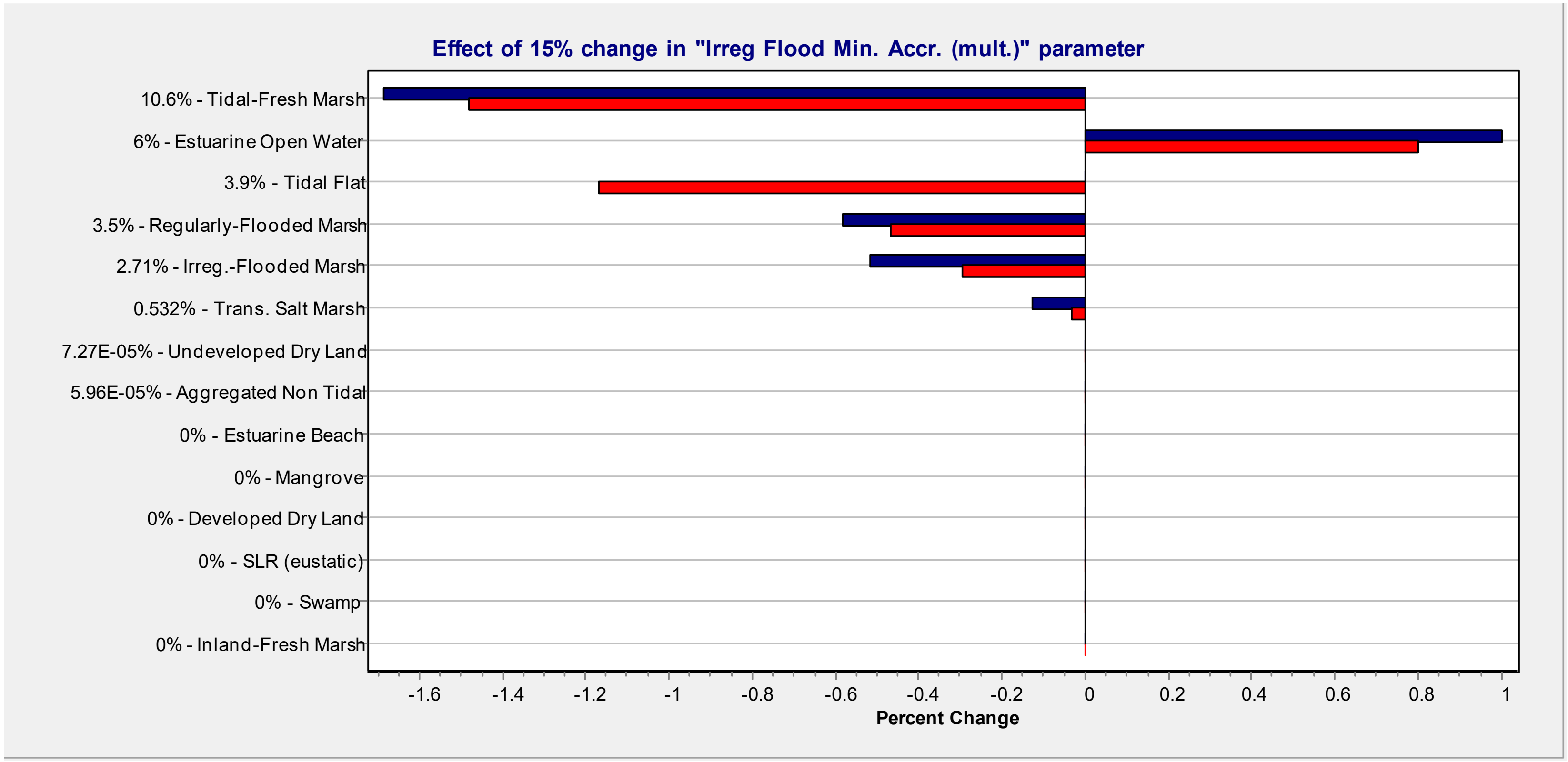
Lower St. Jones - Effects – Reg flood min accr



Lower St. Jones - Effects – Irreg flood max accr



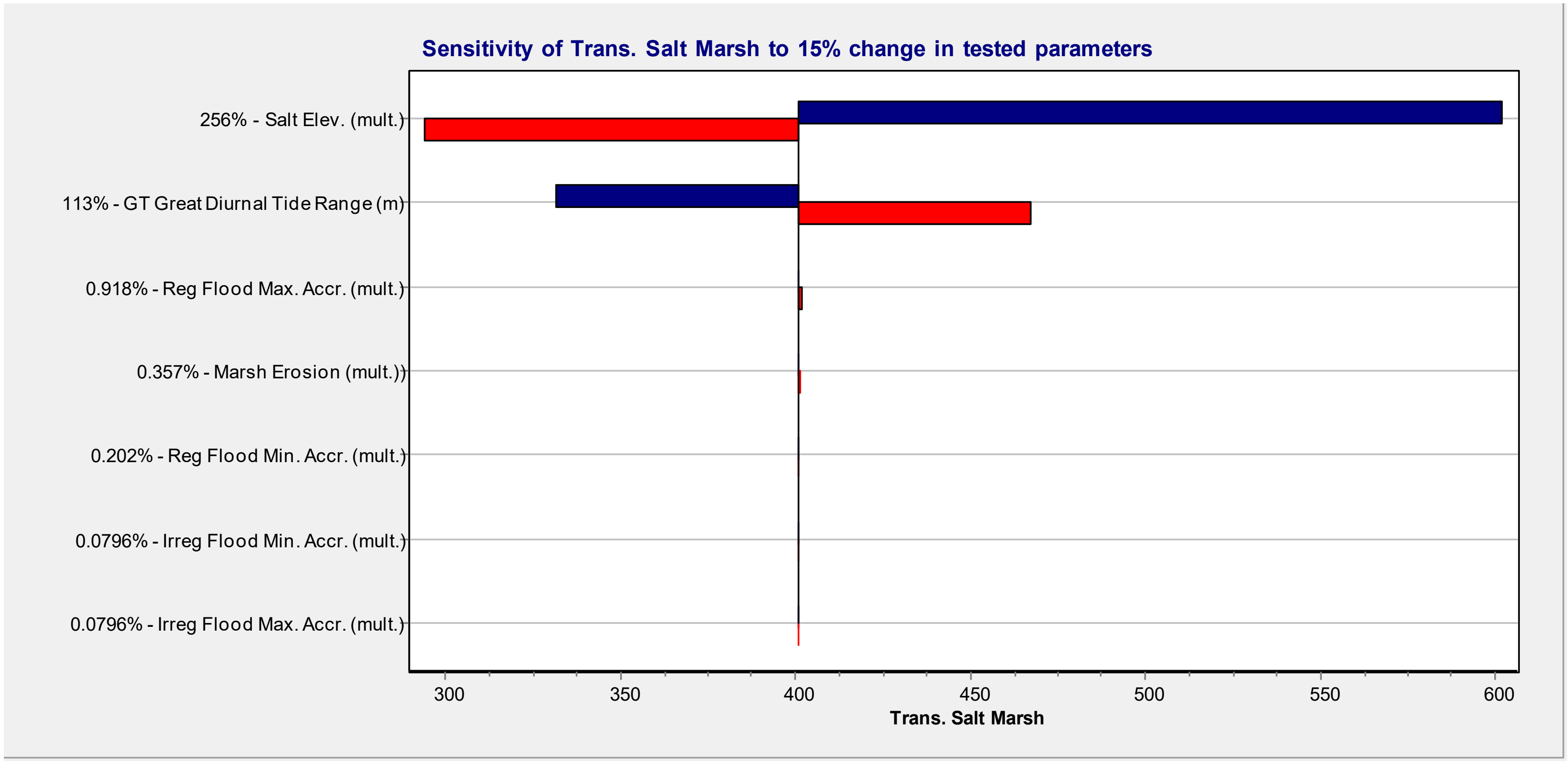
Lower St. Jones - Effects – Irreg flood min accr



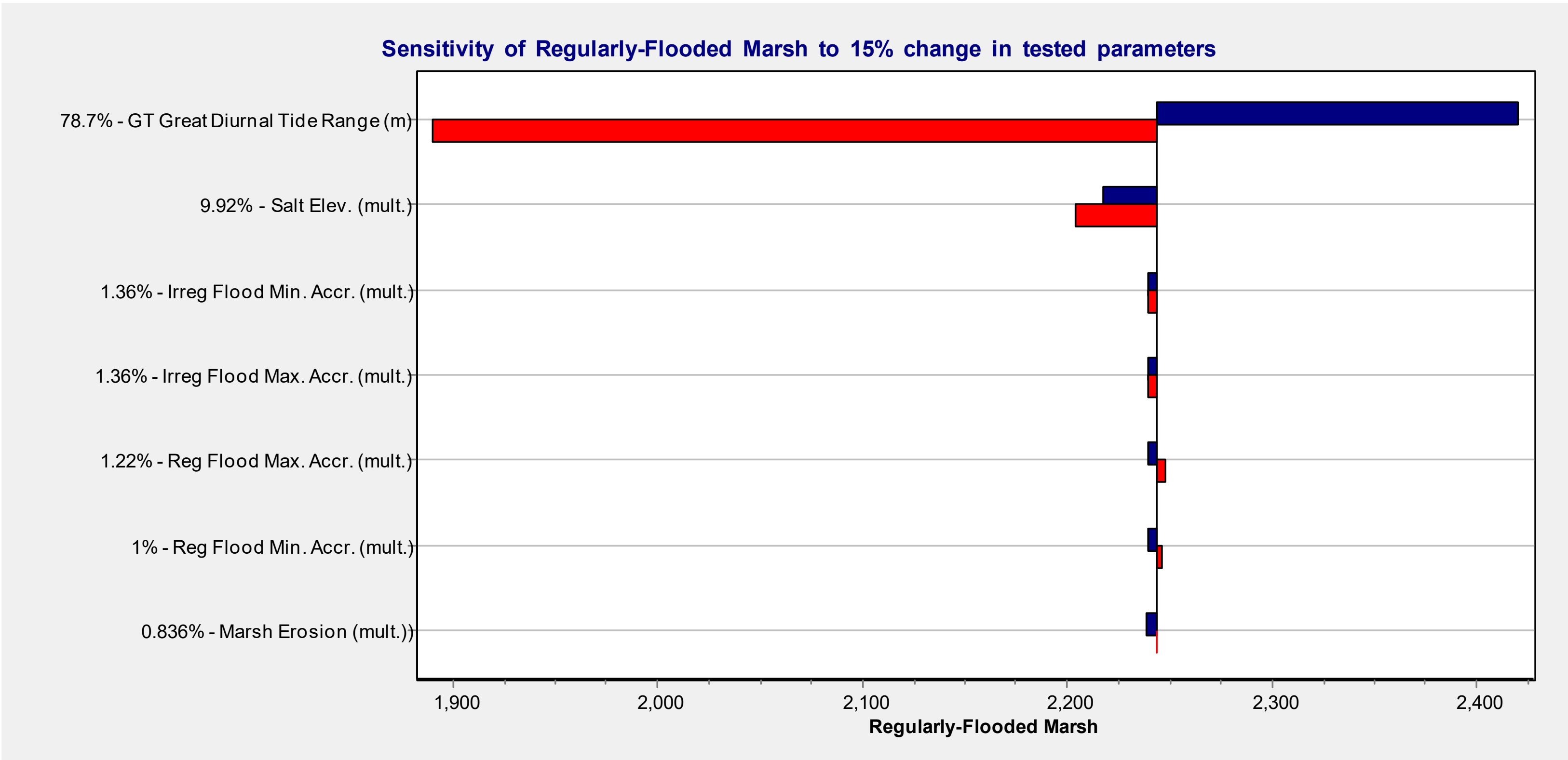
Tornado plots –

Dividing

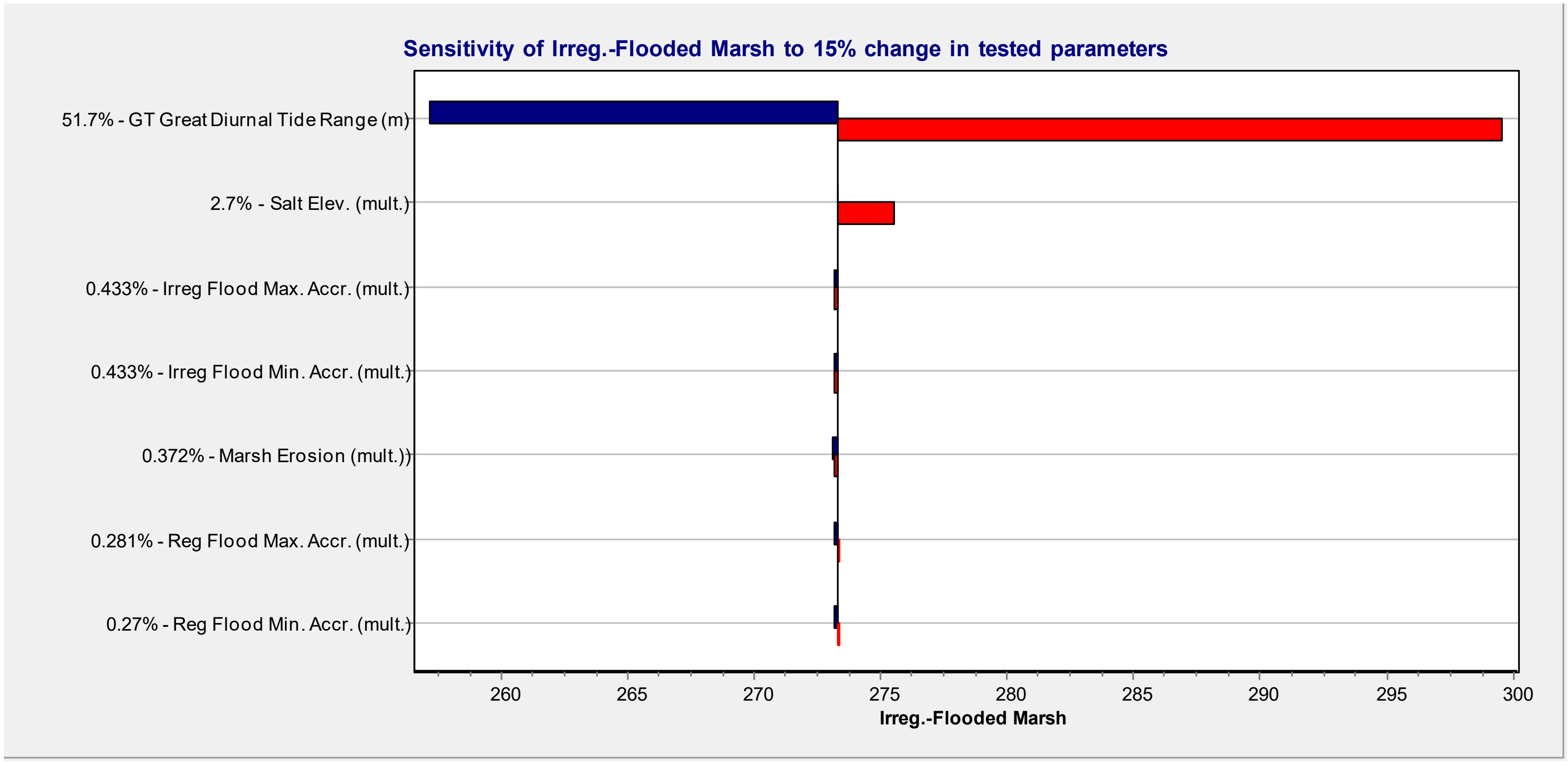
Dividing - Transitional Salt Marsh



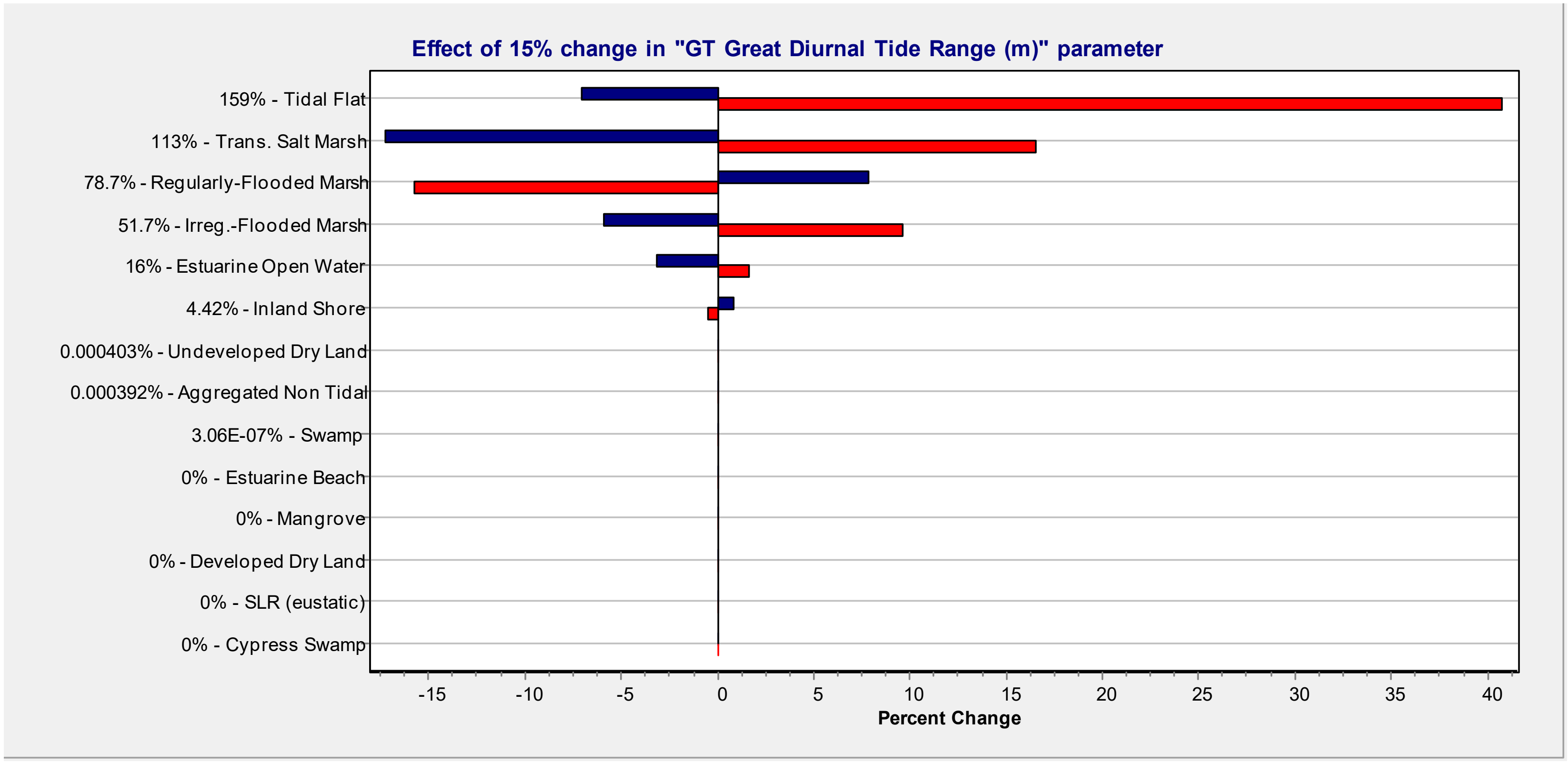
Dividing - Regularly-Flooded Marsh



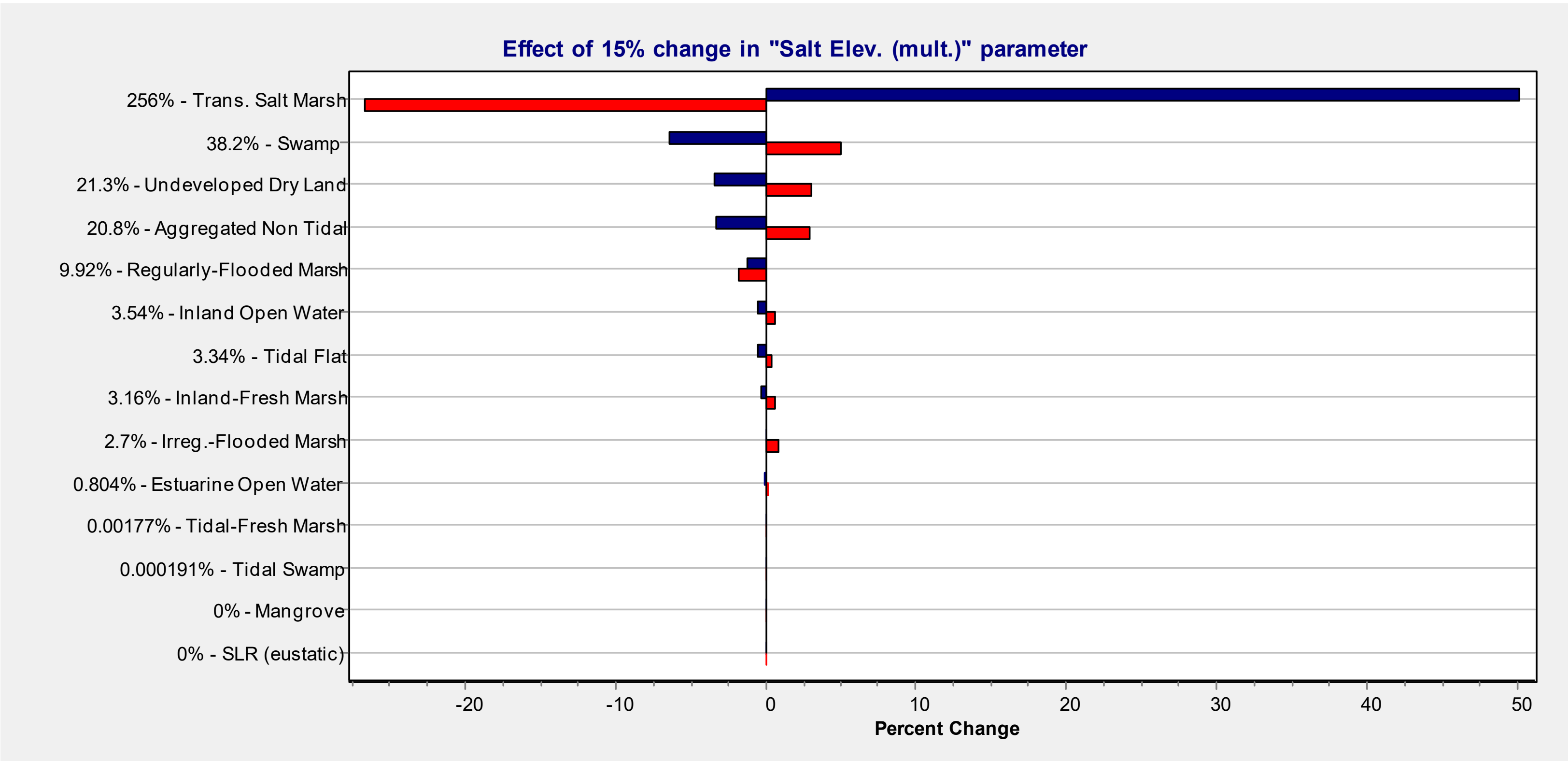
Dividing - Irregularly-Flooded Marsh



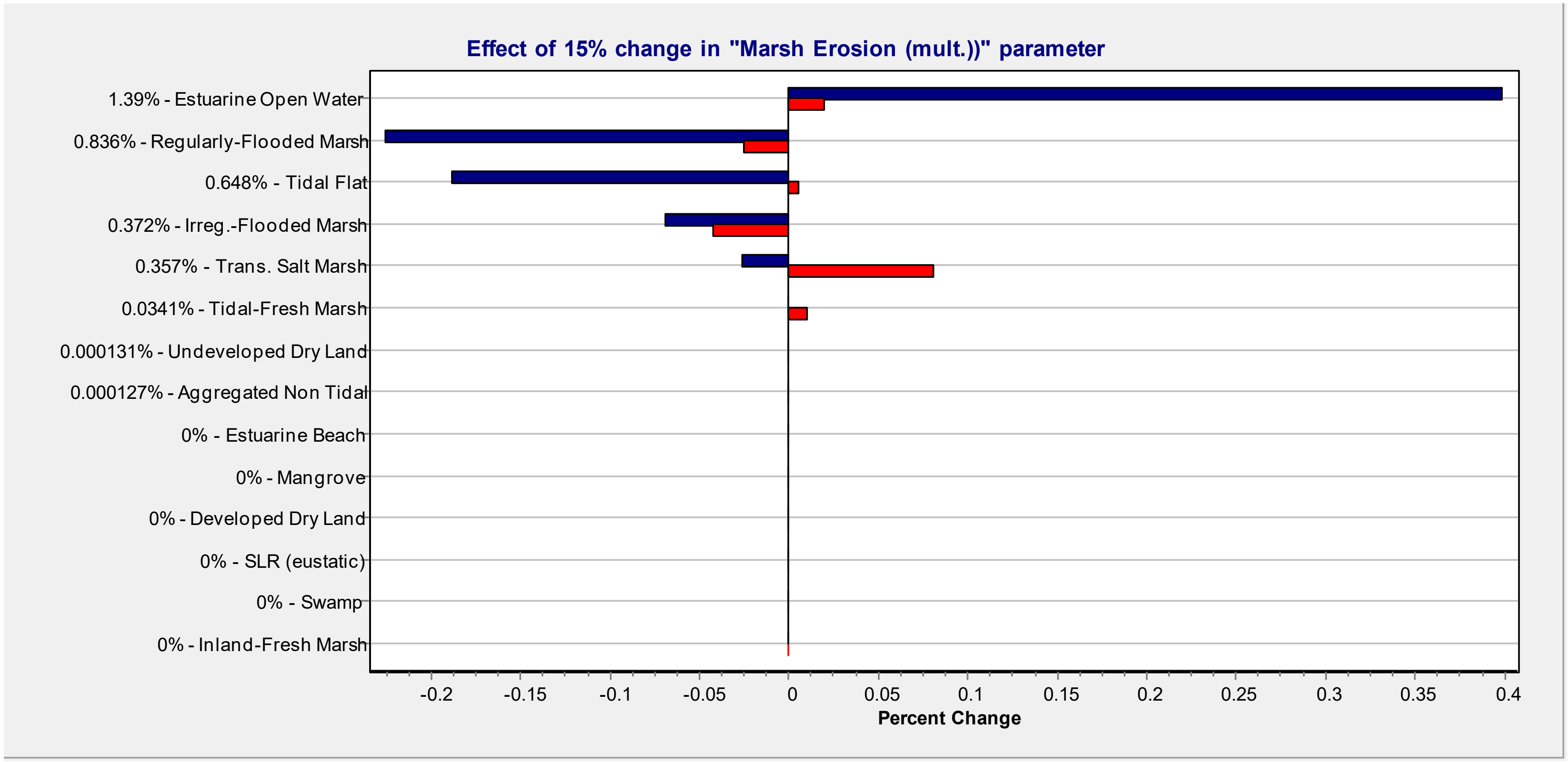
Dividing - Effects - GT



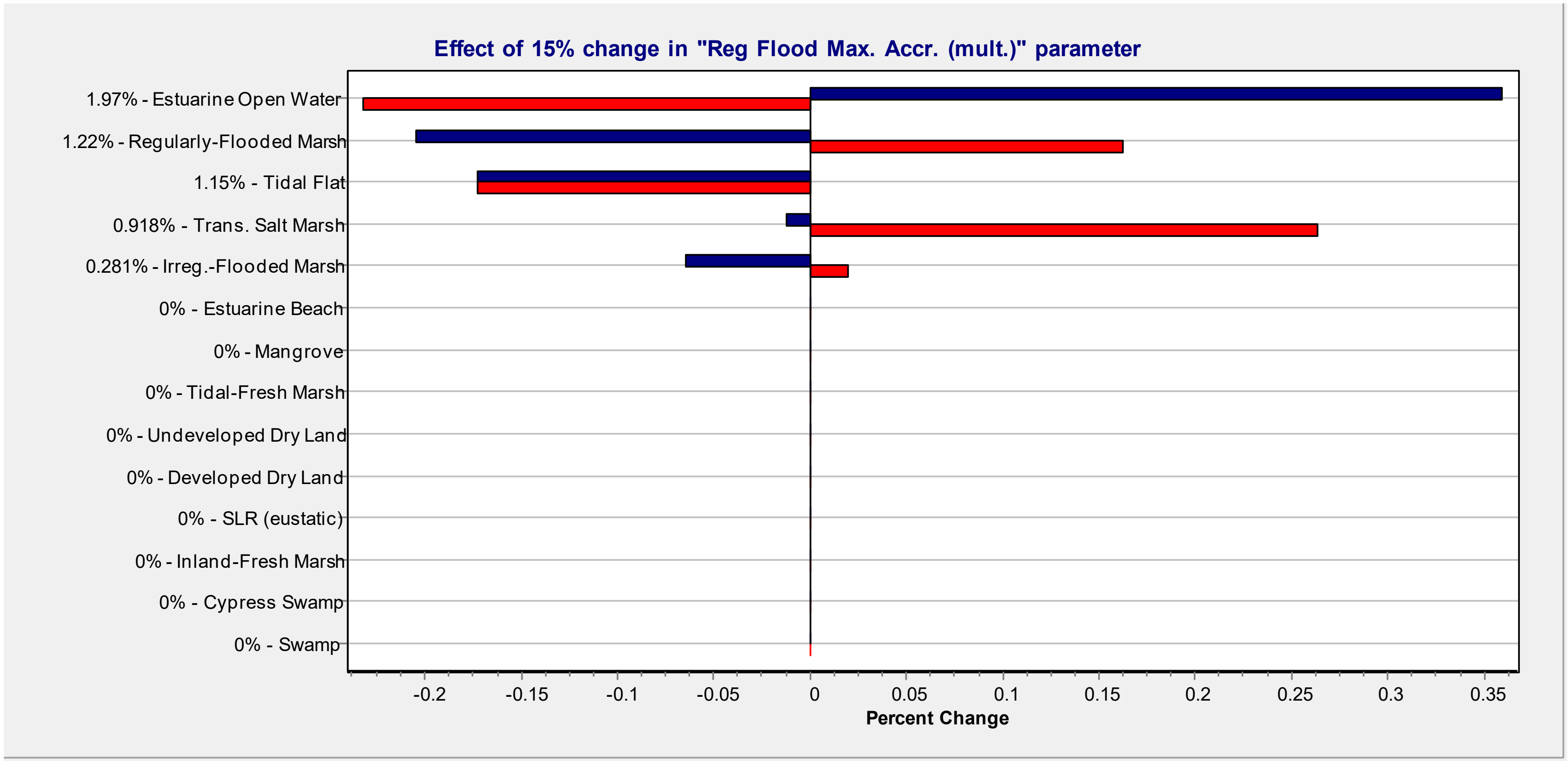
Dividing - Effects – Salt elevation



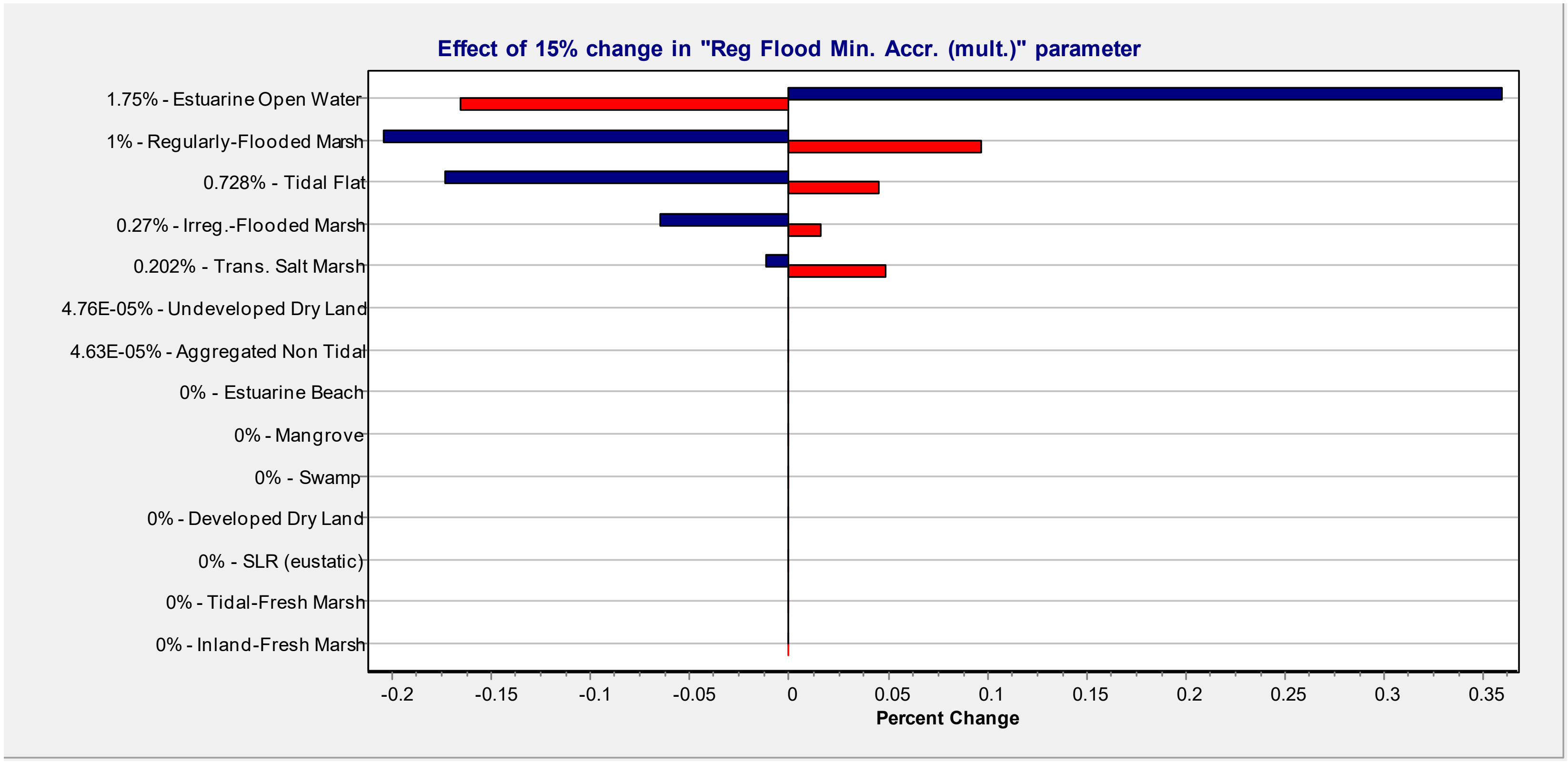
Dividing - Effects – Marsh erosion



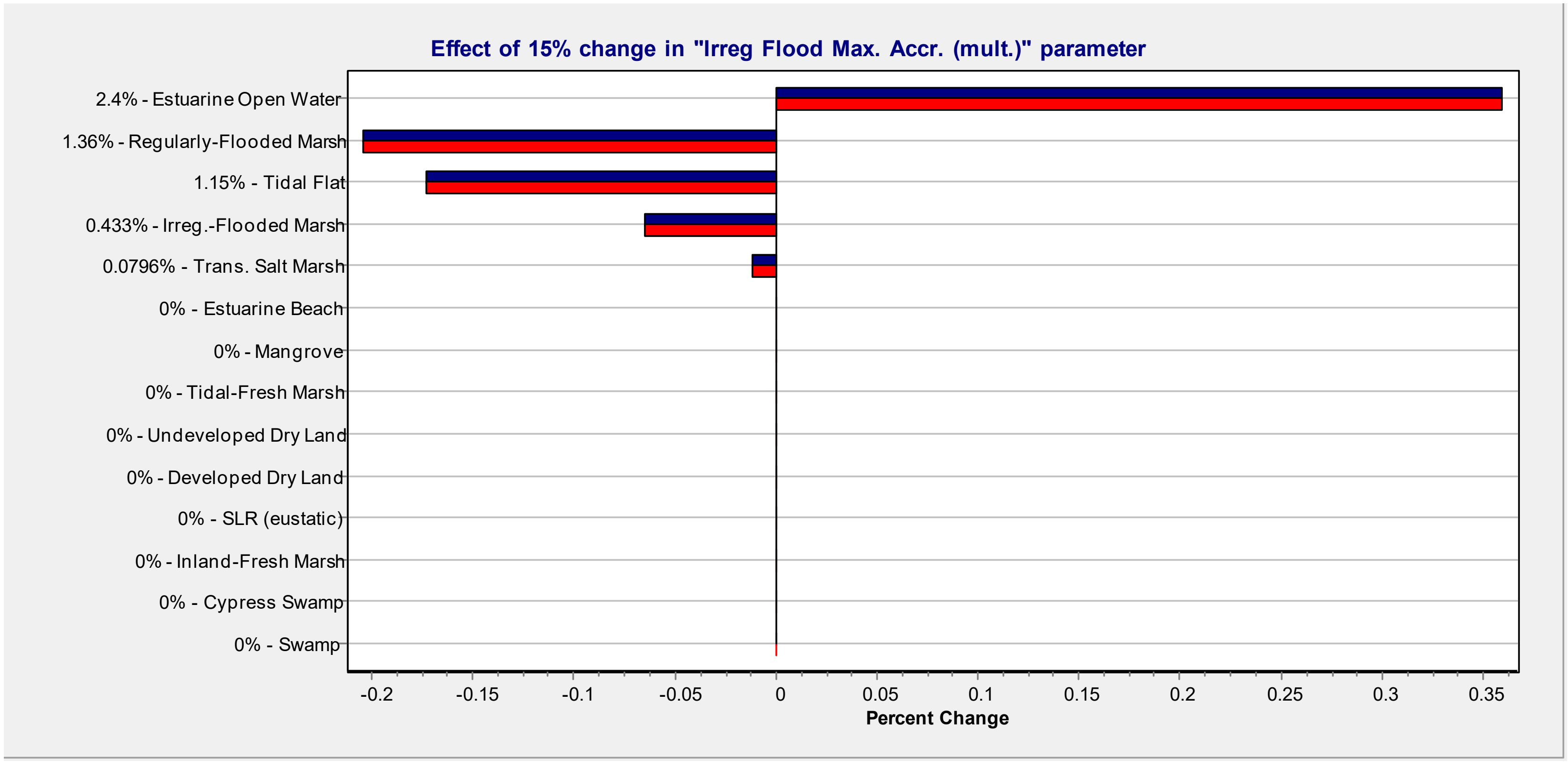
Dividing - Effects – Reg flood max accr



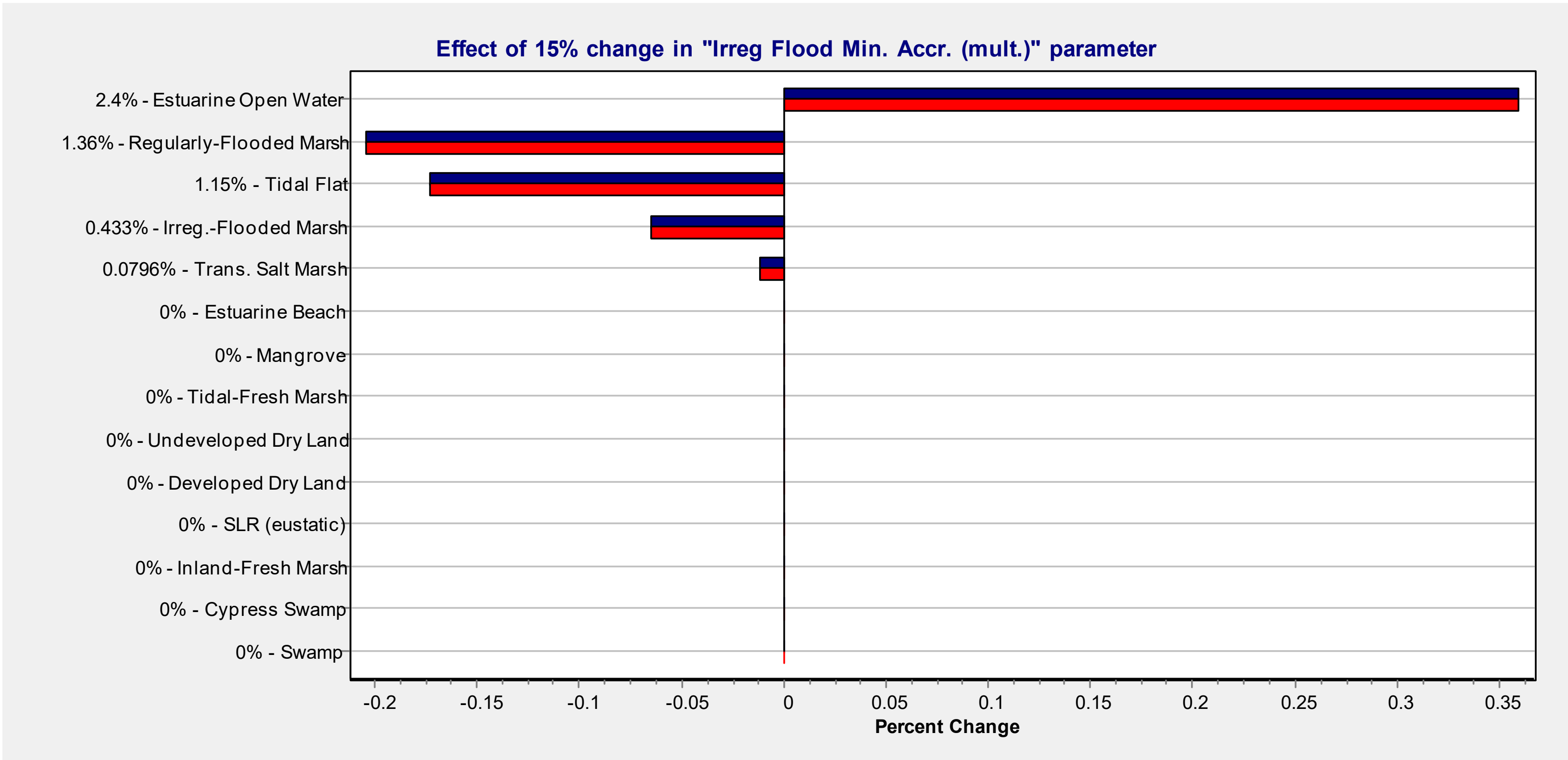
Dividing - Effects – Reg flood min accr



Dividing - Effects – Irreg flood max accr



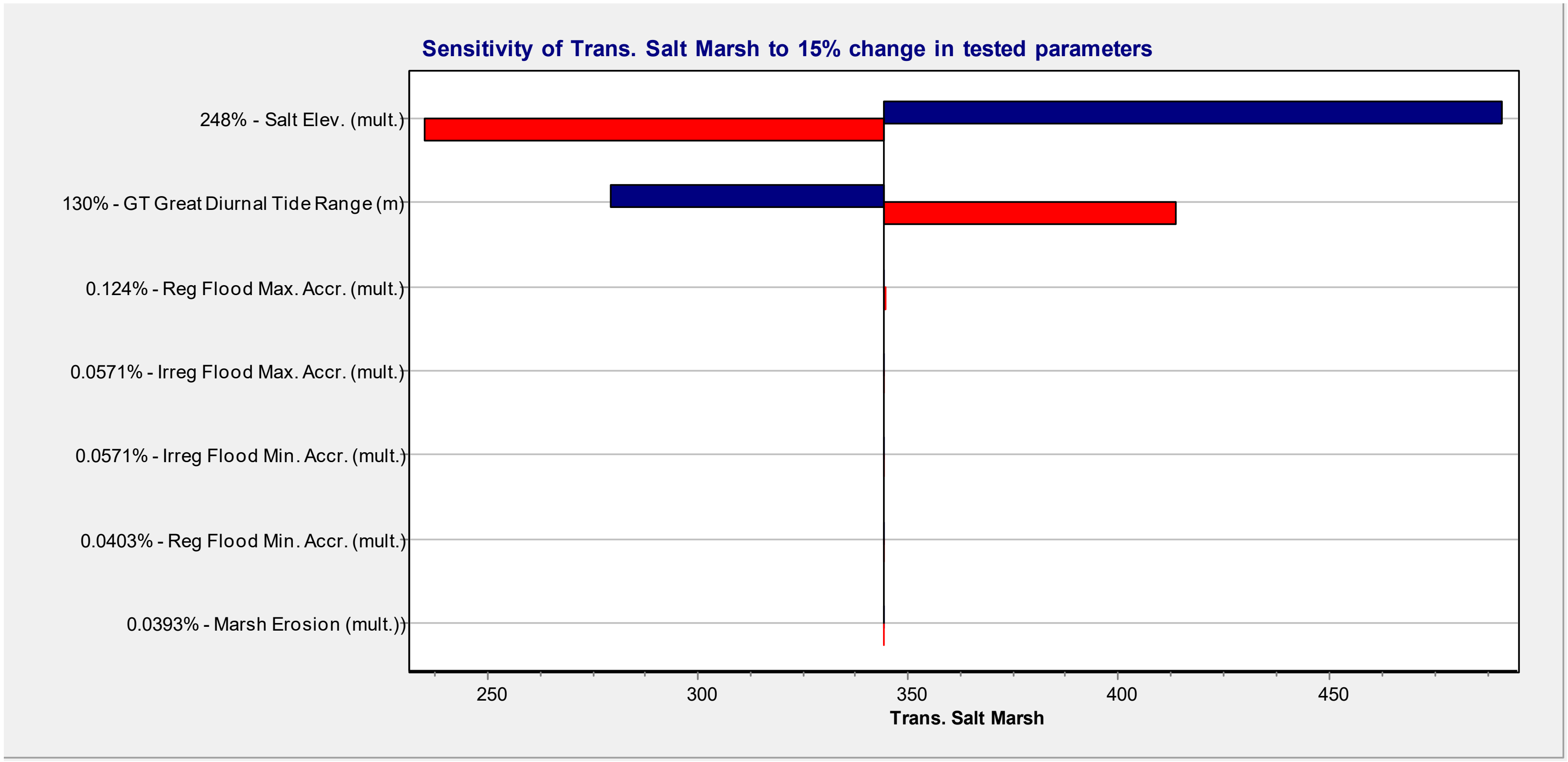
Dividing - Effects – Irreg flood min accr



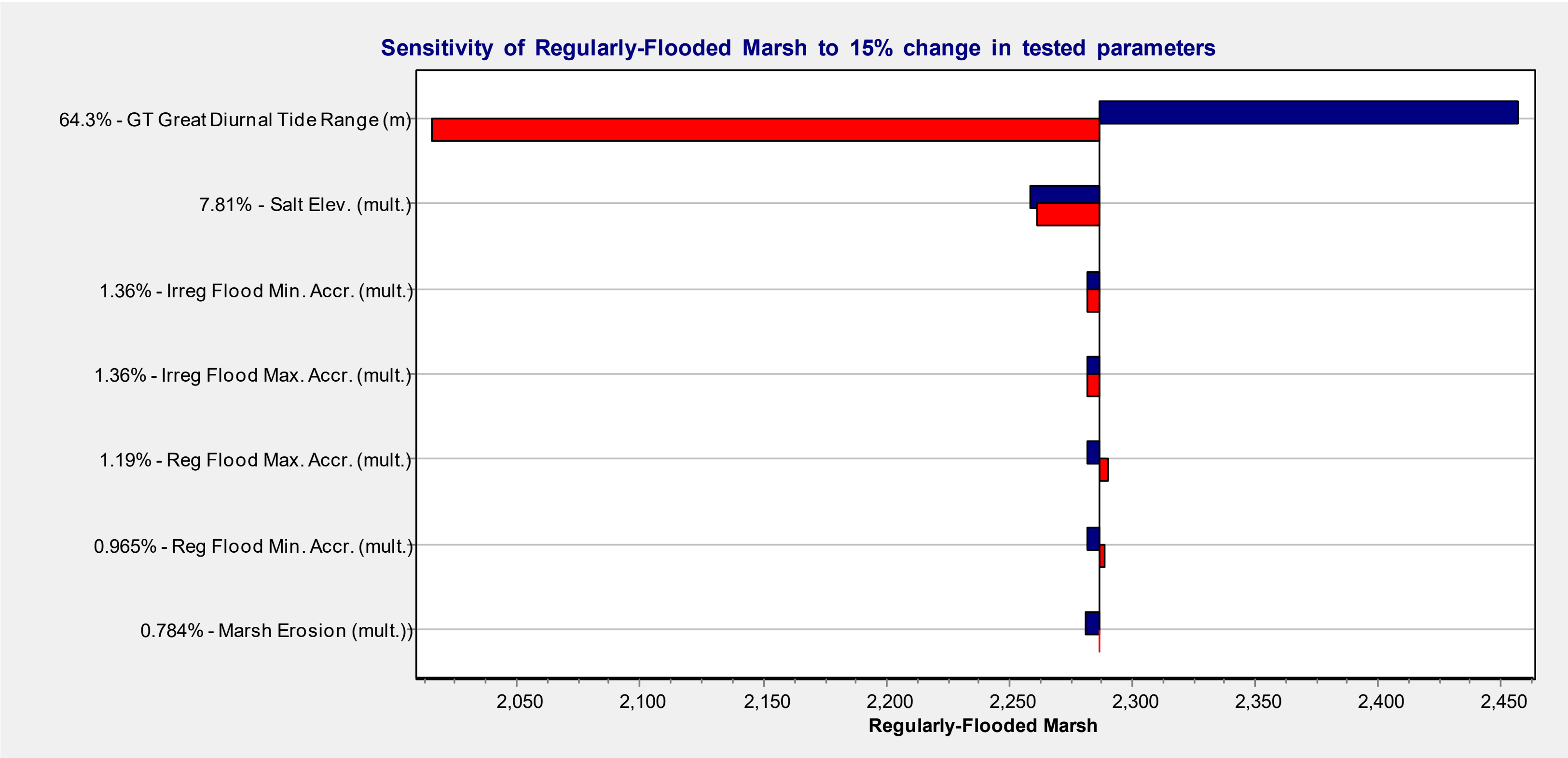
Tornado plots –

Lower Maurice

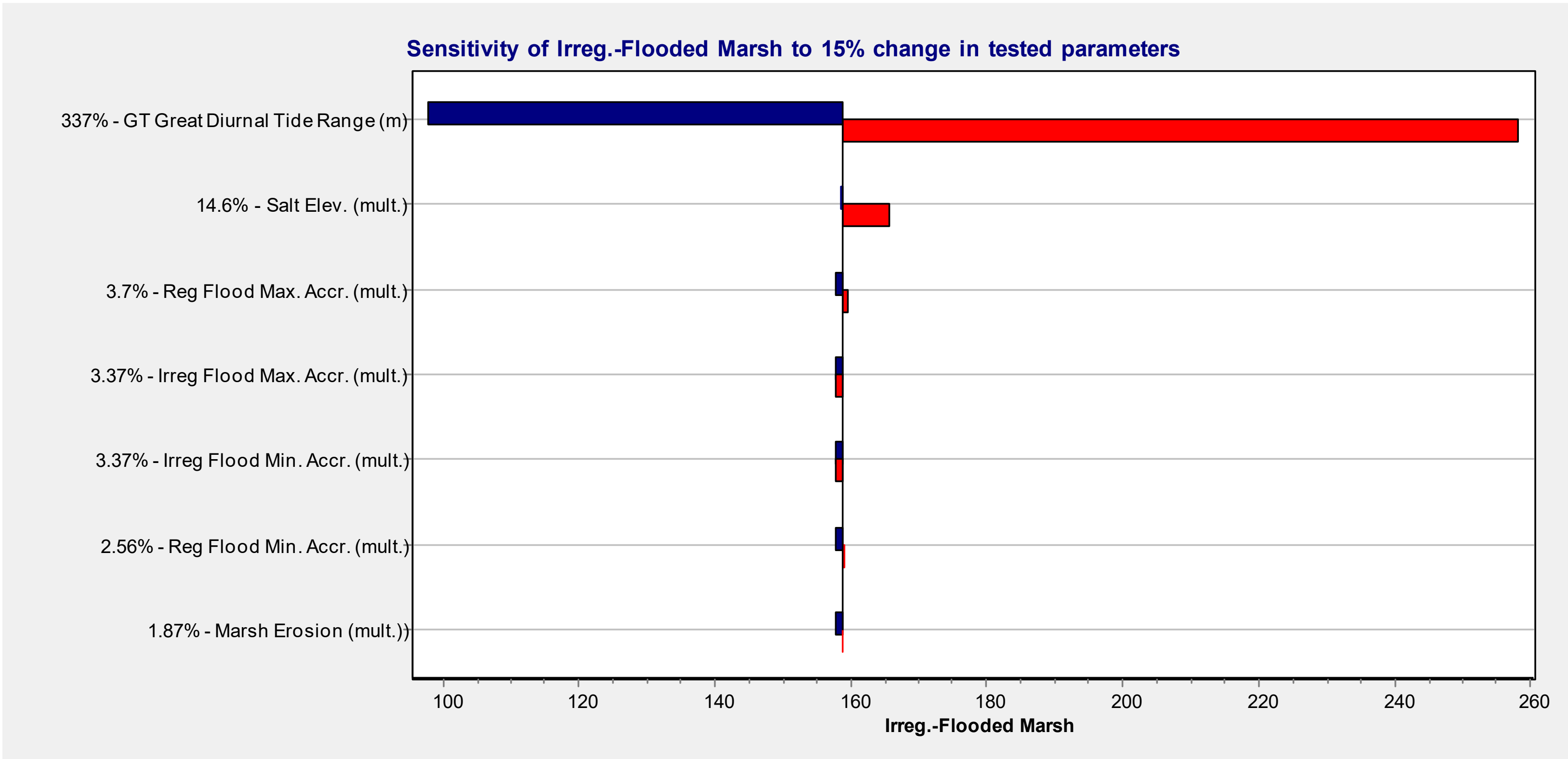
Lower Maurice - Transitional Salt Marsh



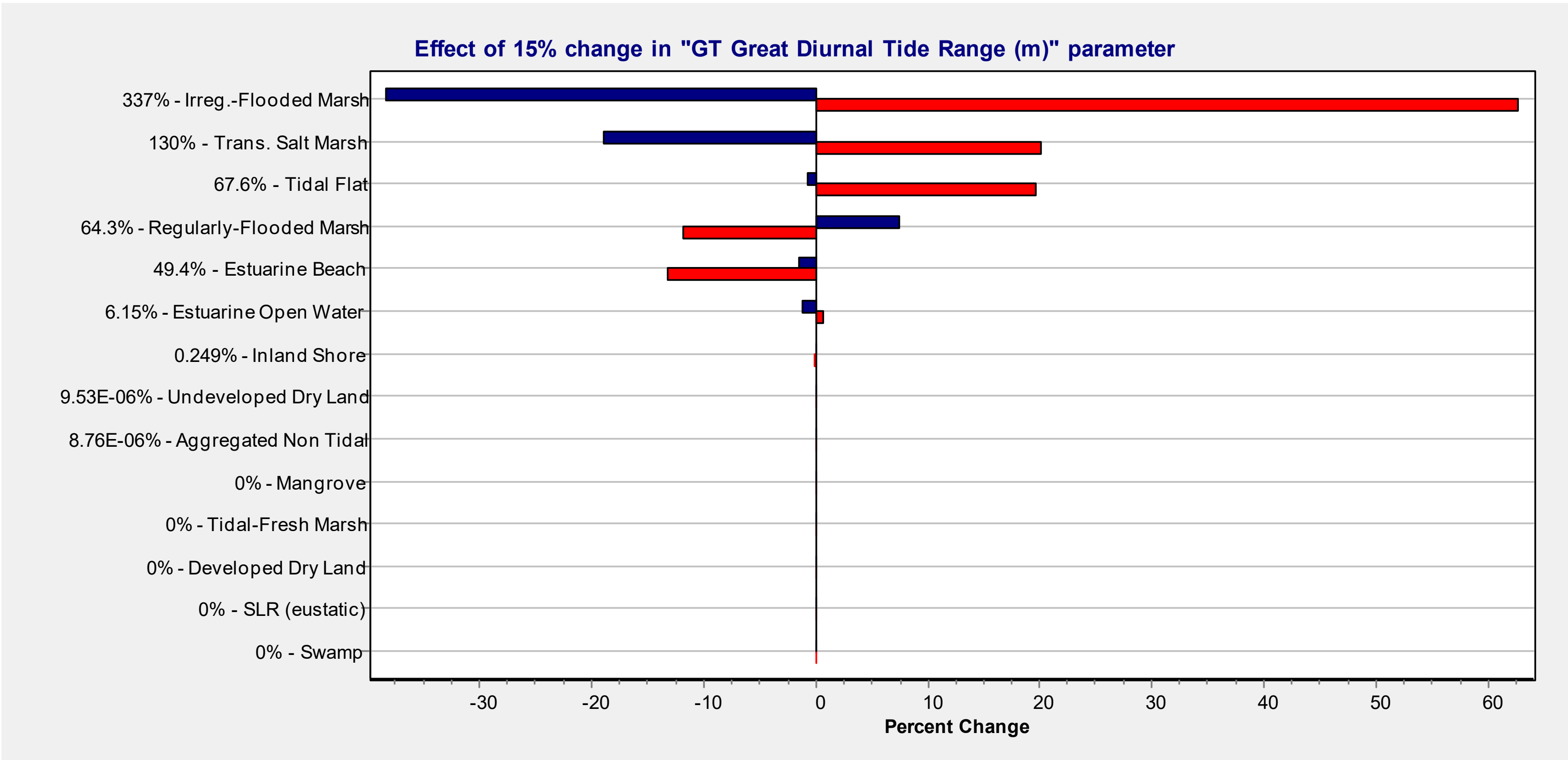
Lower Maurice - Regularly-Flooded Marsh



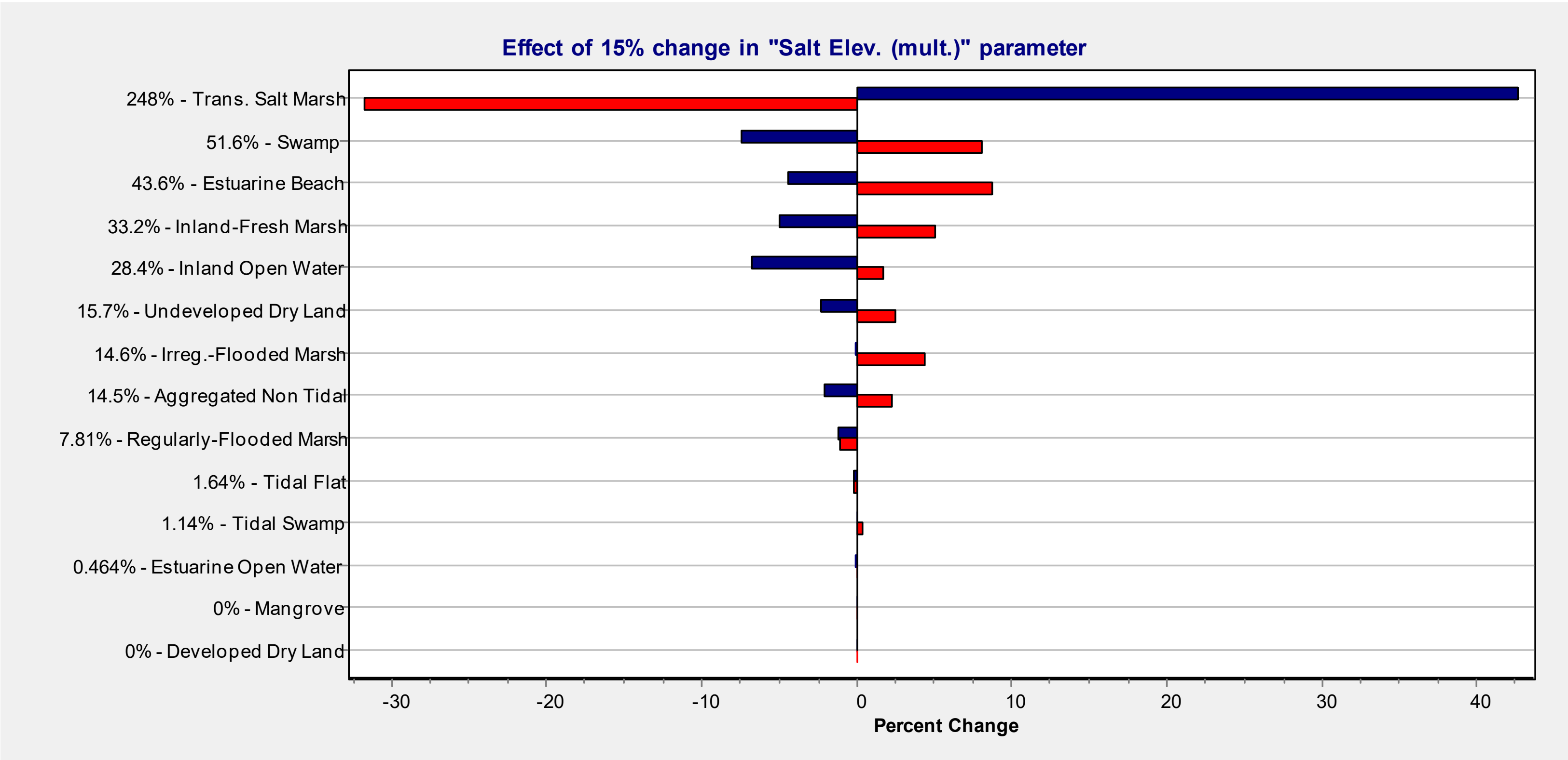
Lower Maurice - Irregularly-Flooded Marsh



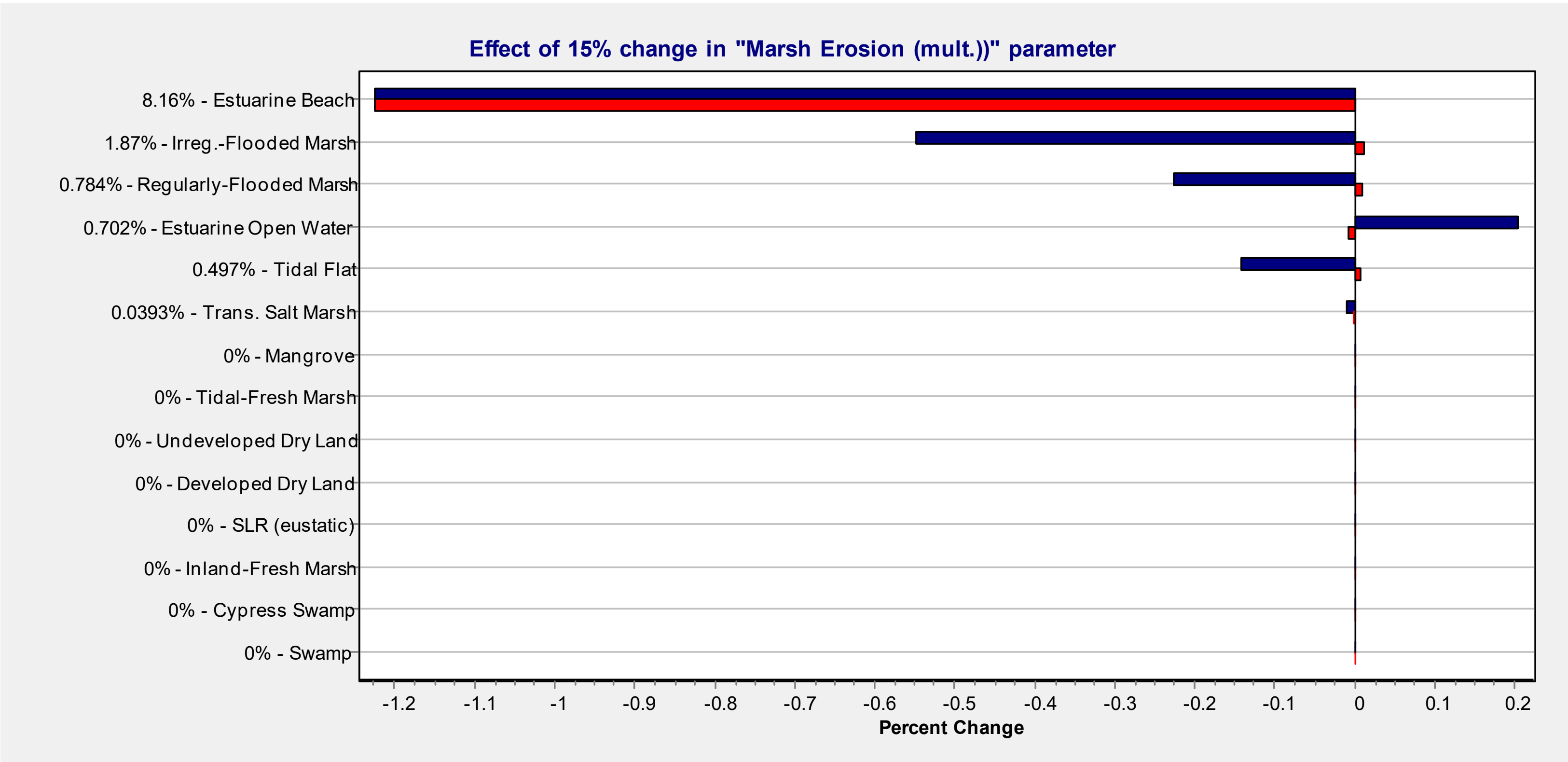
Lower Maurice - Effects - GT



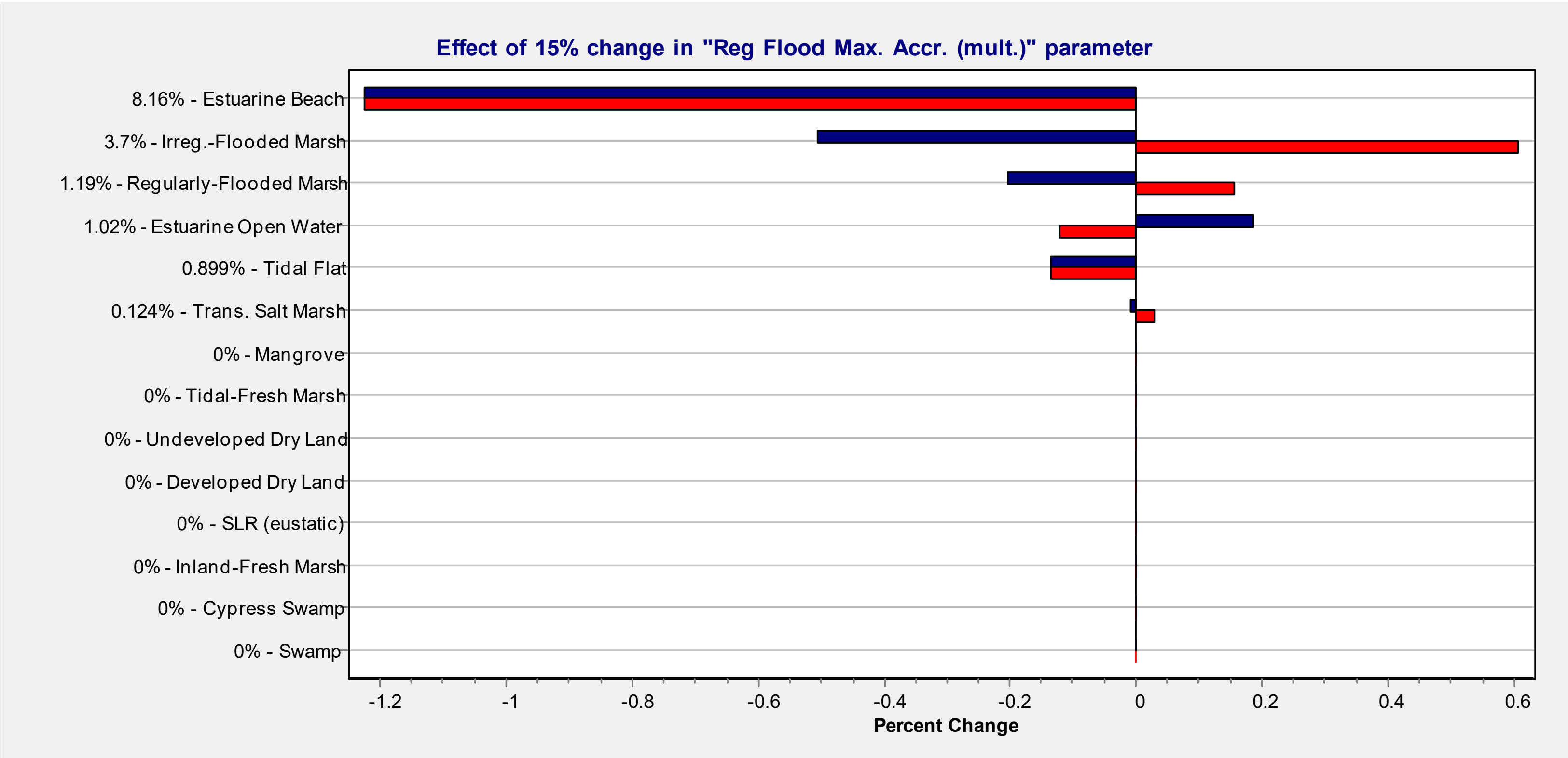
Lower Maurice - Effects – Salt elevation



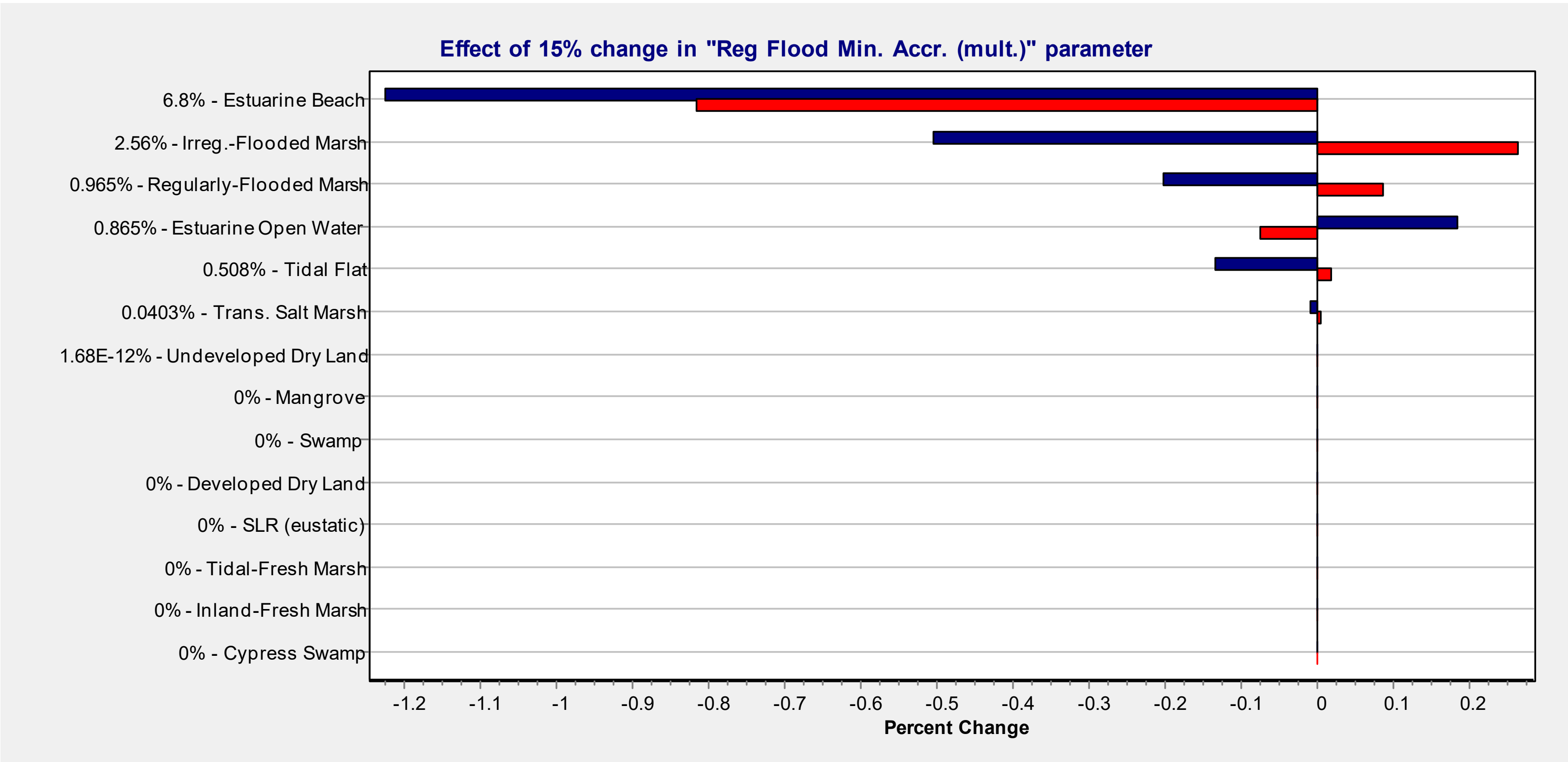
Lower Maurice - Effects – Marsh erosion



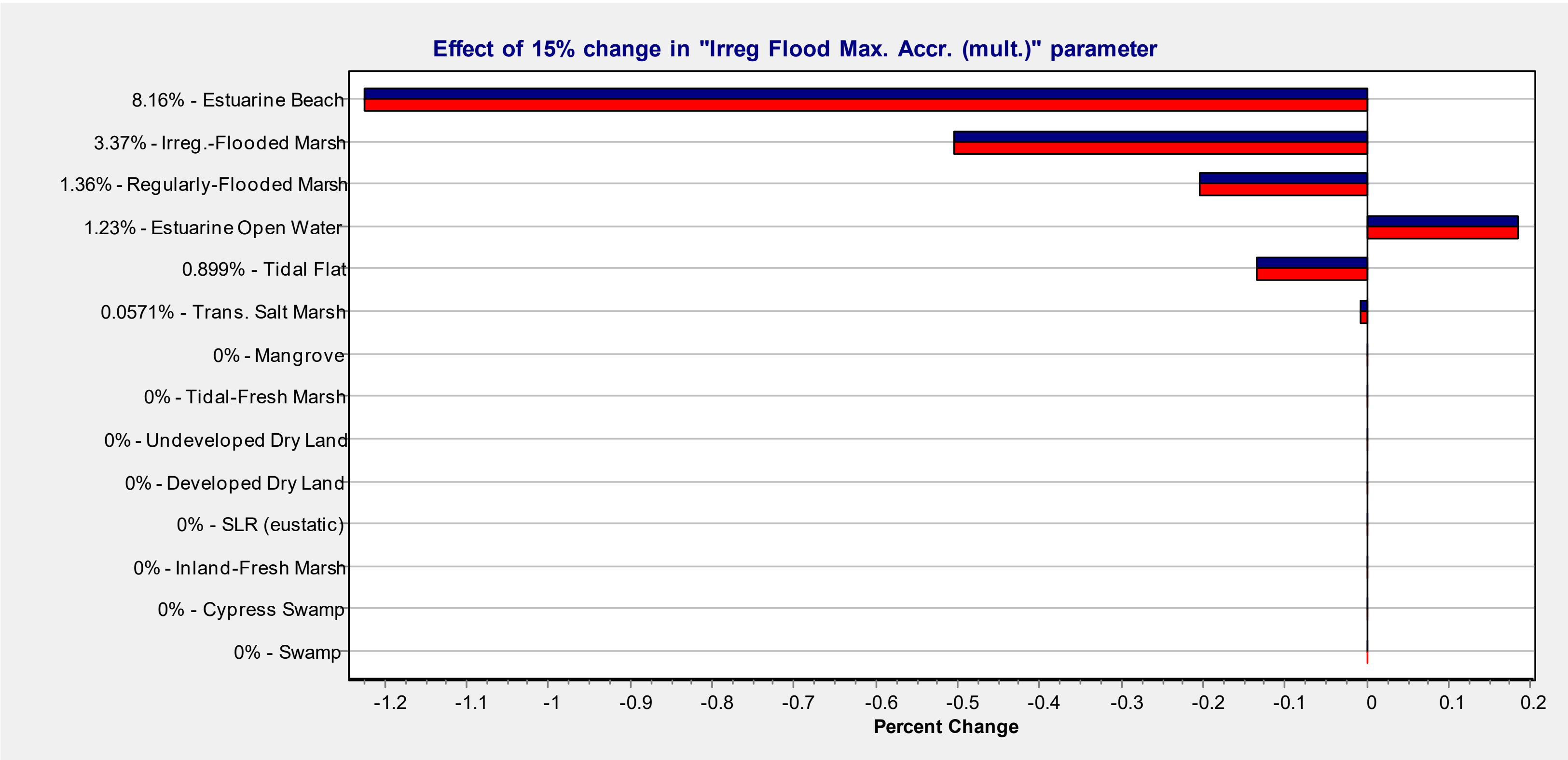
Lower Maurice - Effects – Reg flood max accr



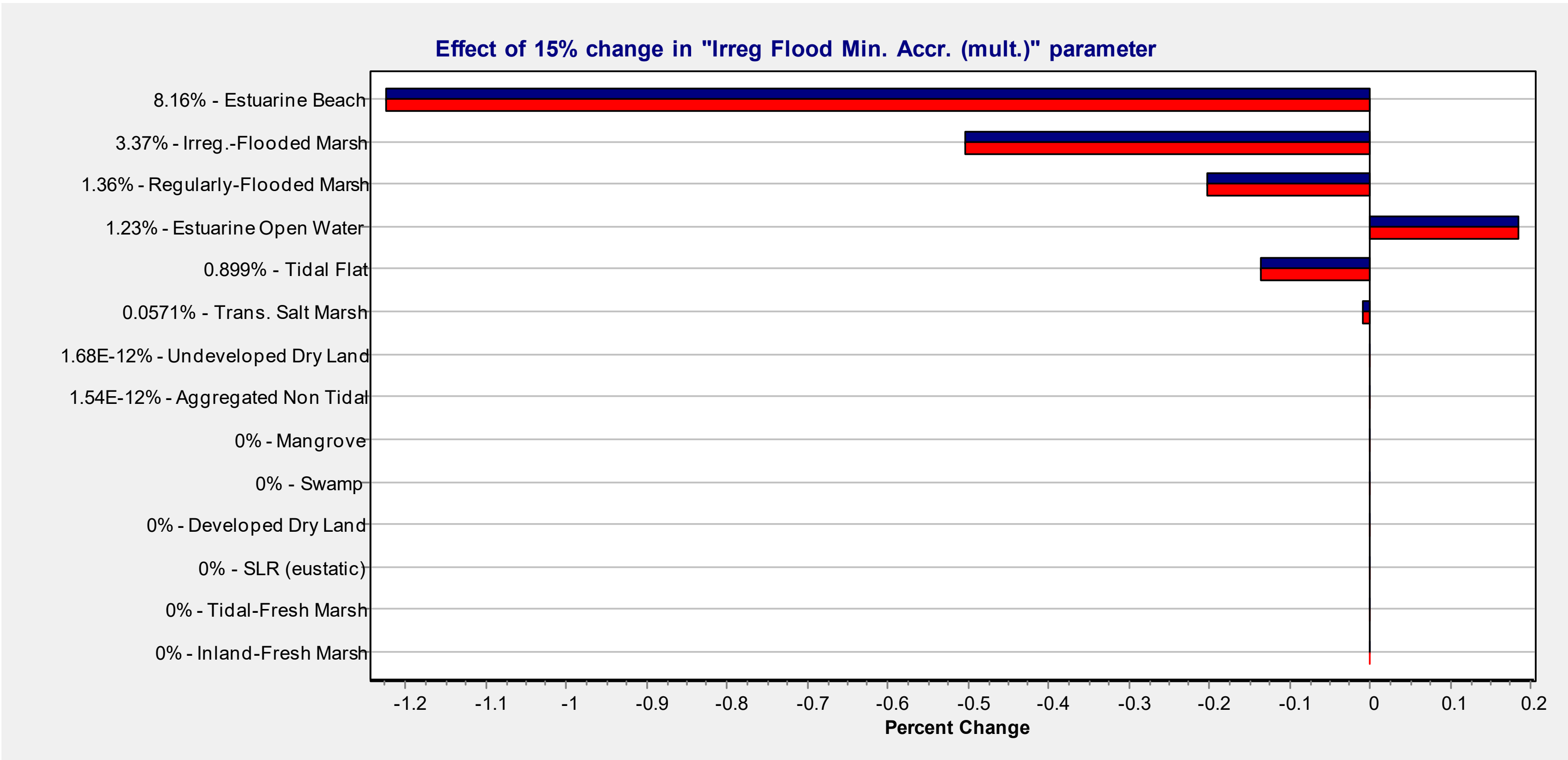
Lower Maurice - Effects – Reg flood min accr



Lower Maurice - Effects – Irreg flood max accr



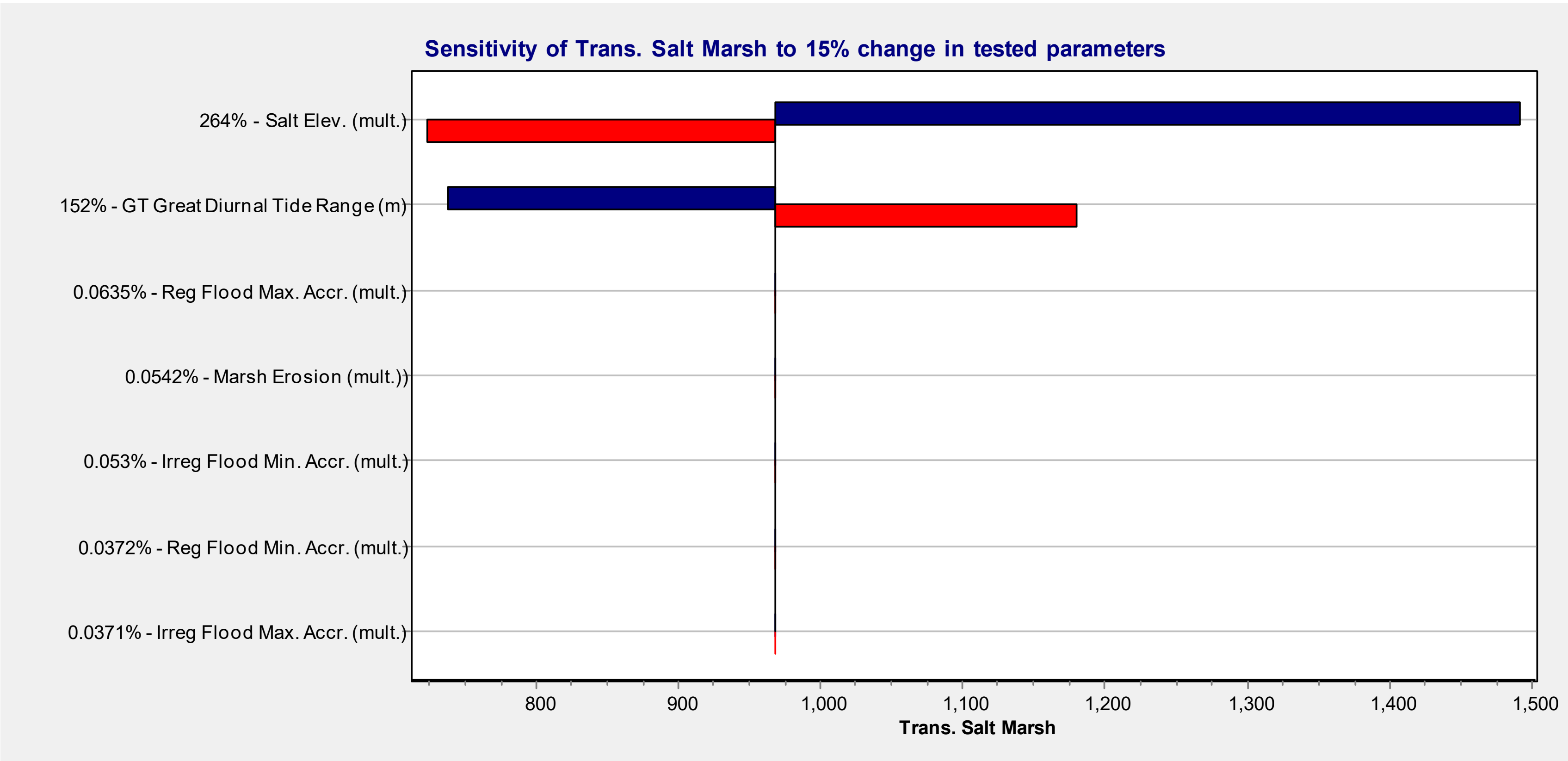
Lower Maurice - Effects – Irreg flood min accr



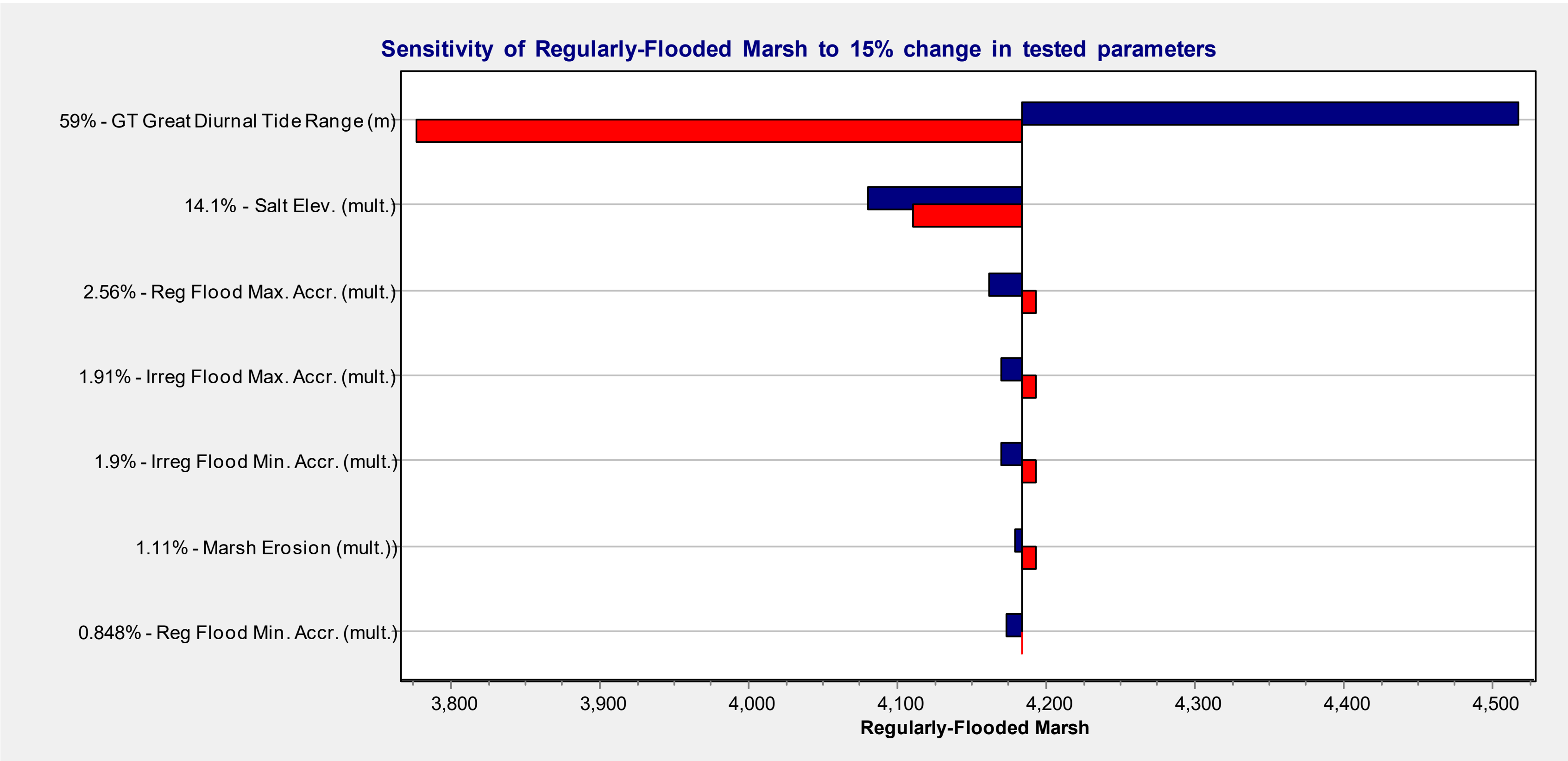
Tornado plots –

Dennis

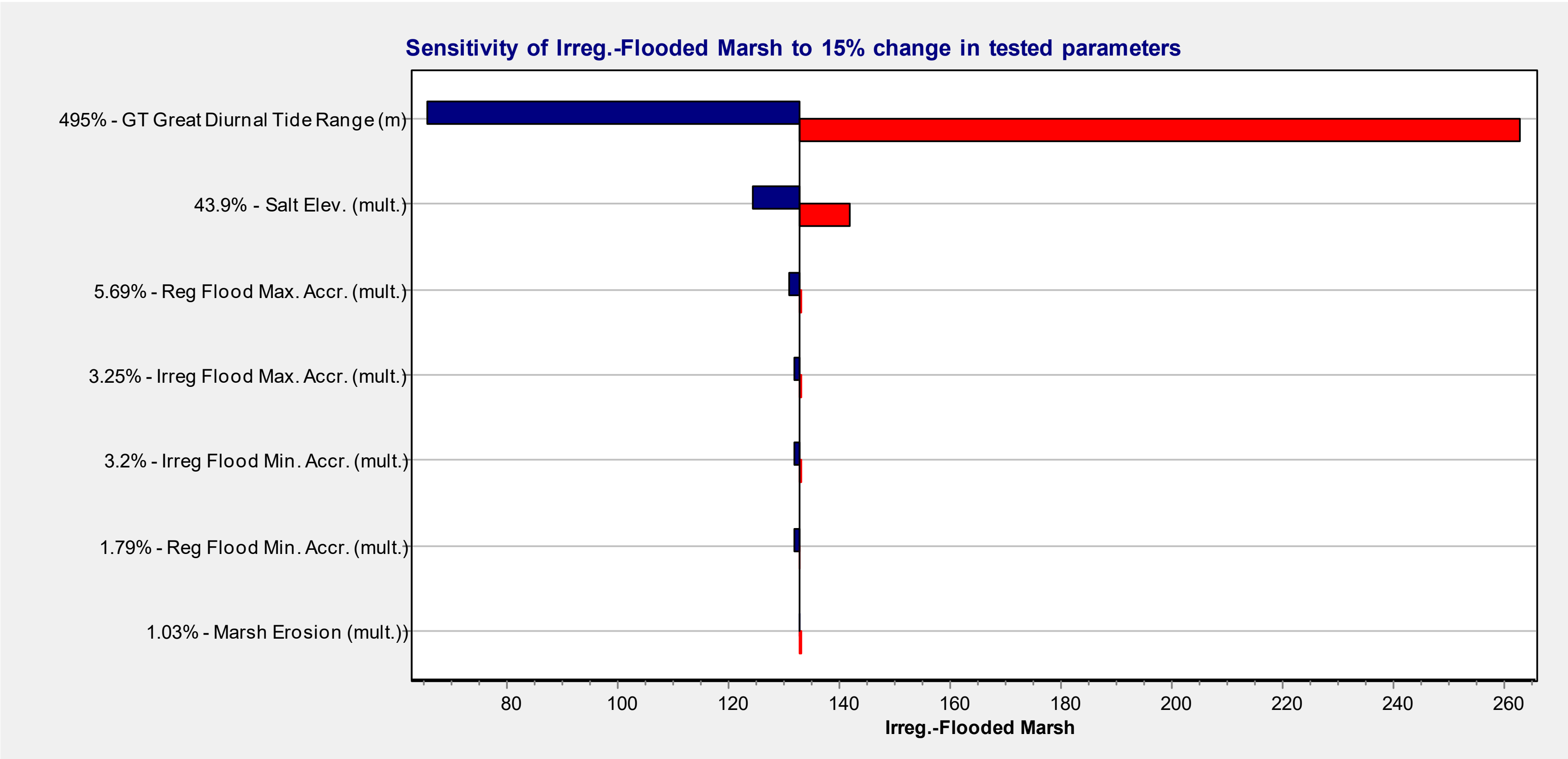
Dennis - Transitional Salt Marsh



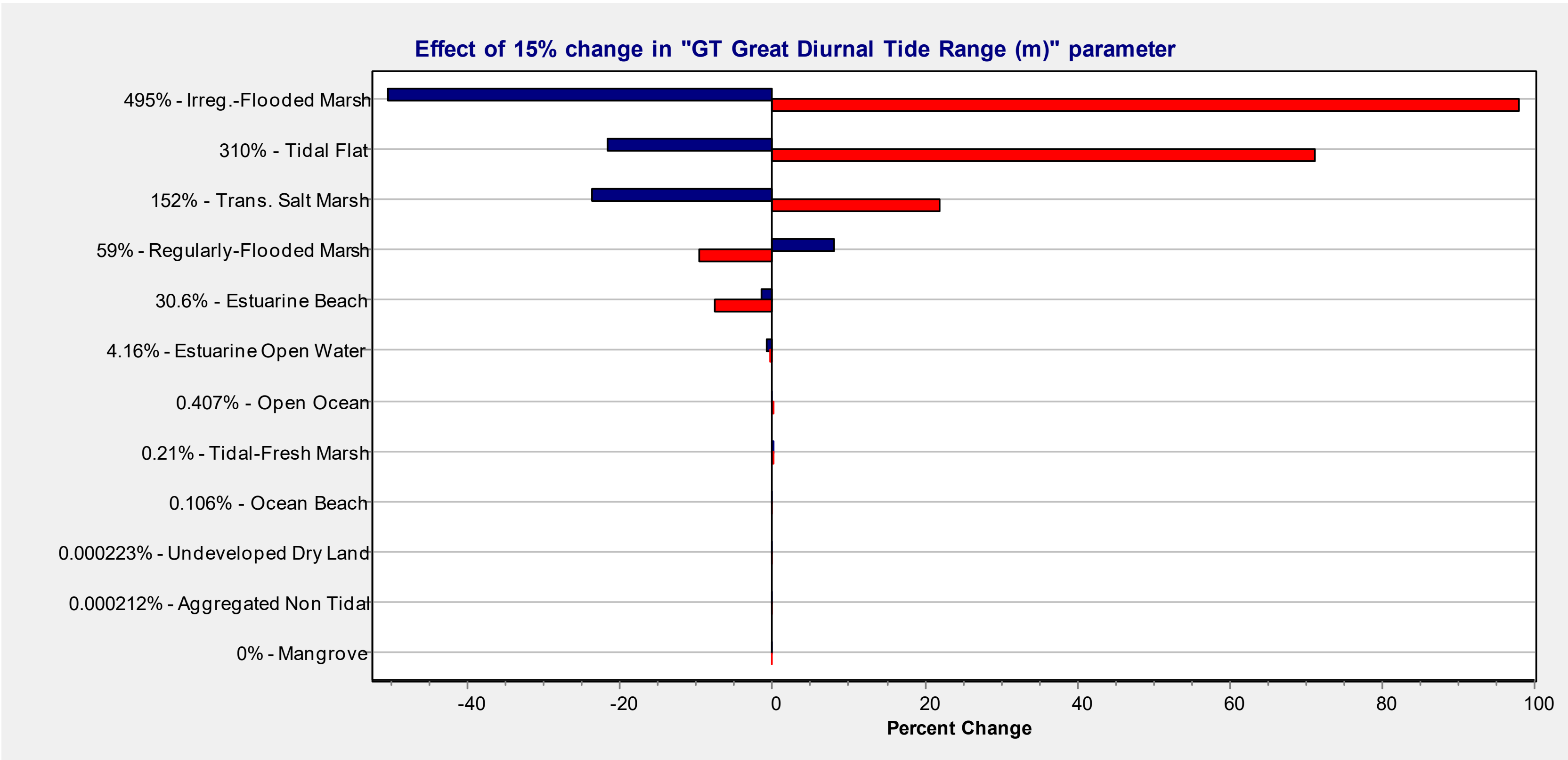
Dennis - Regularly-Flooded Marsh



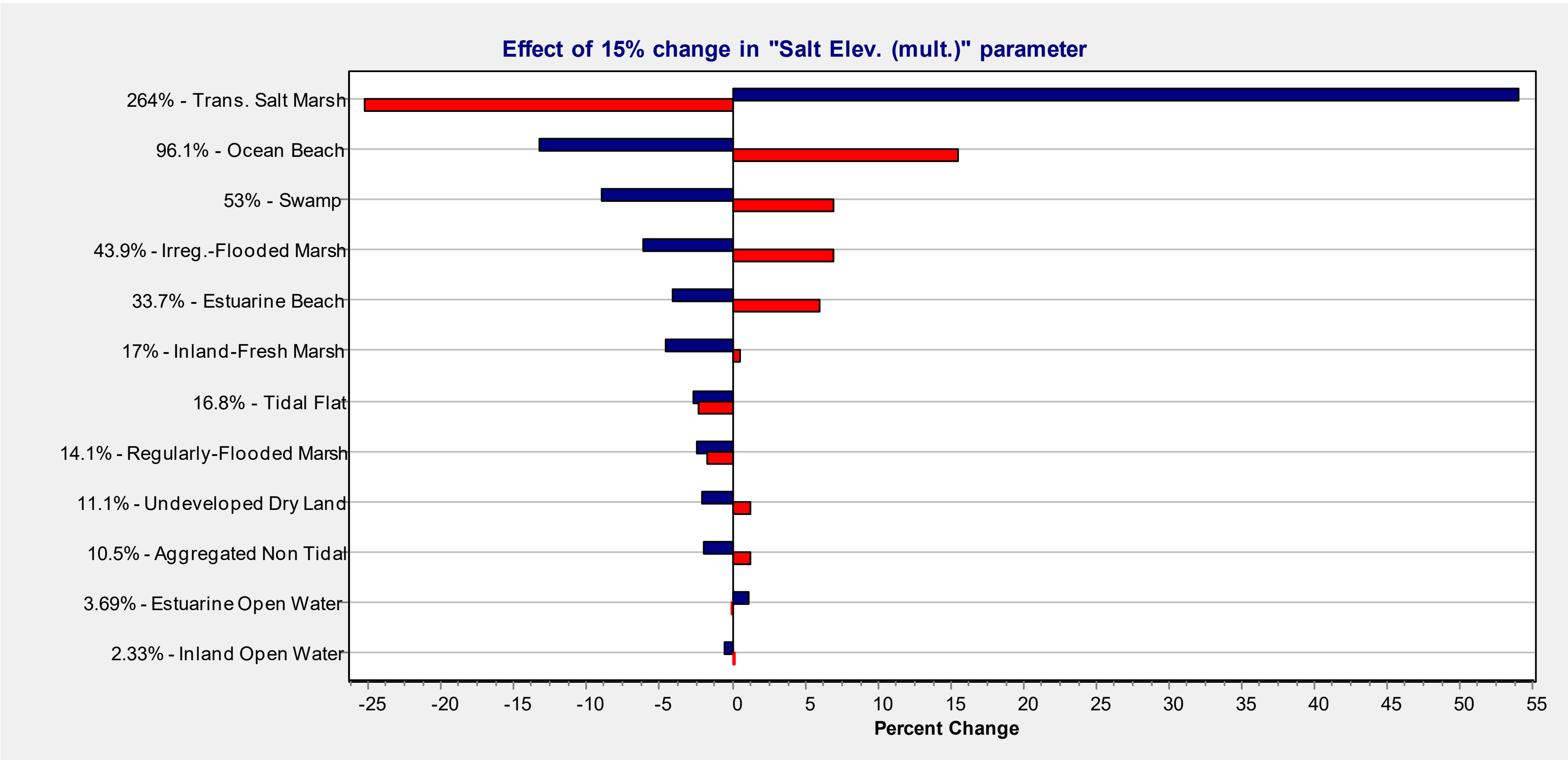
Dennis - Irregularly-Flooded Marsh



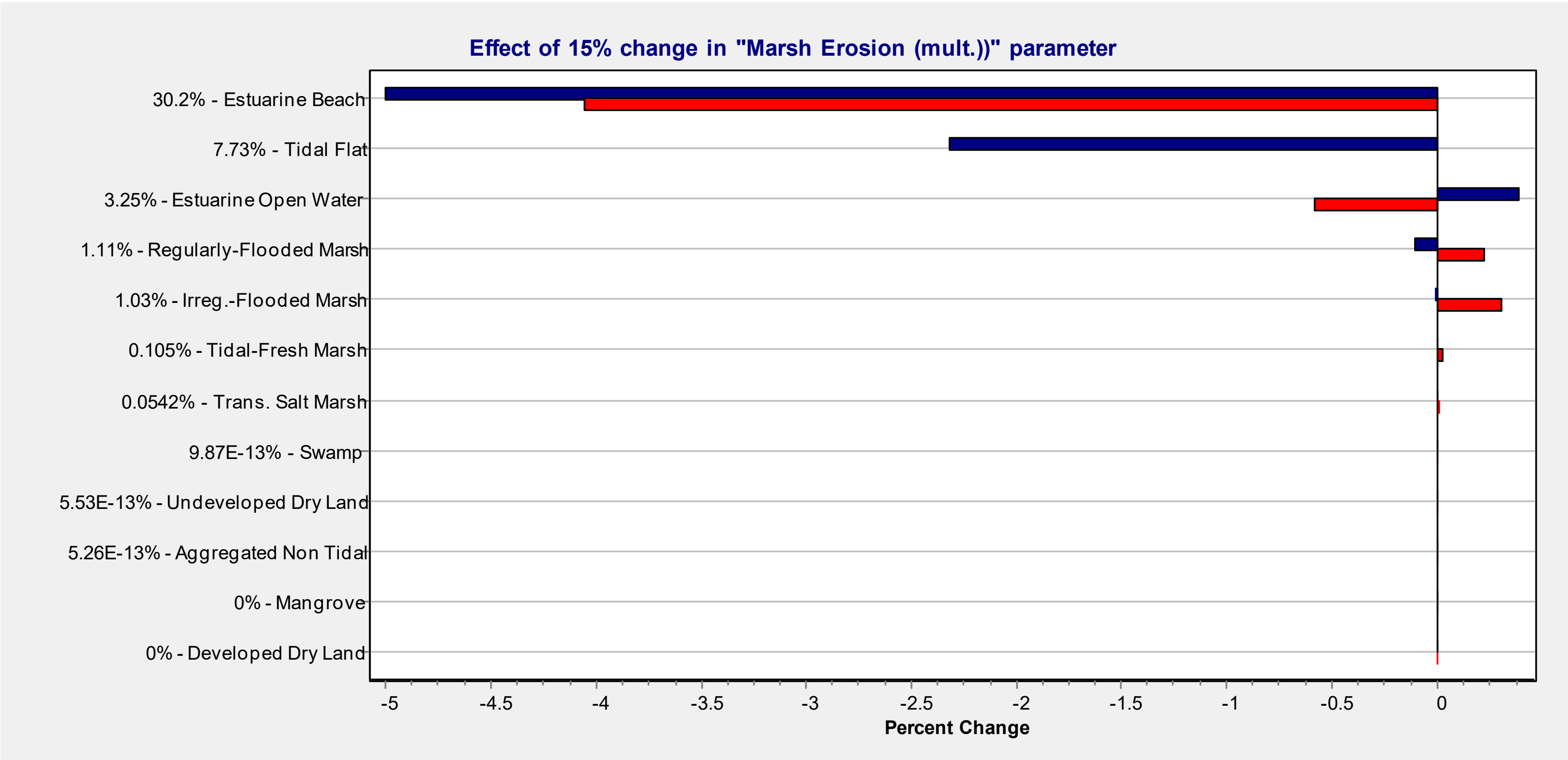
Dennis - Effects - GT



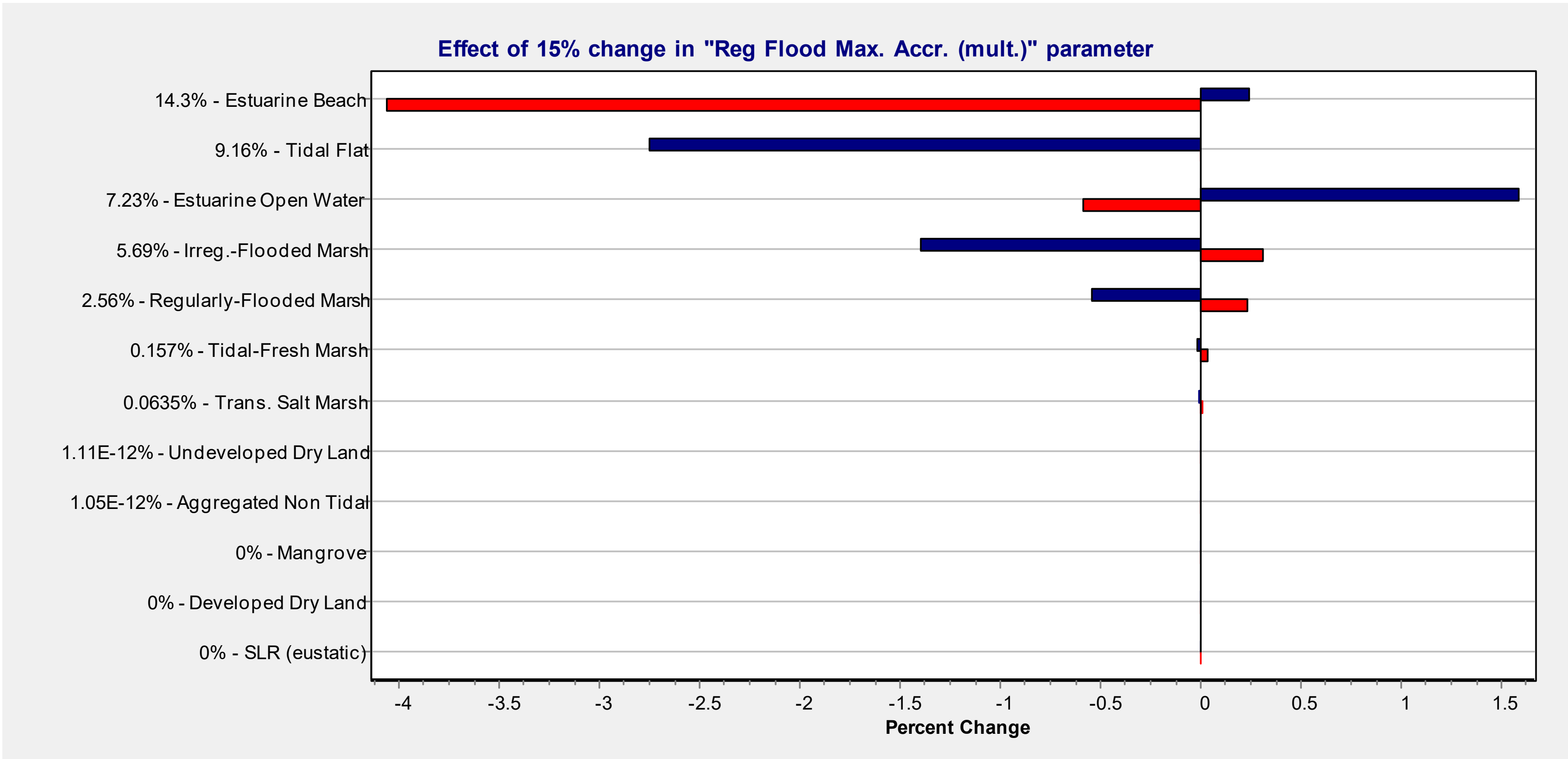
Dennis - Effects – Salt elevation



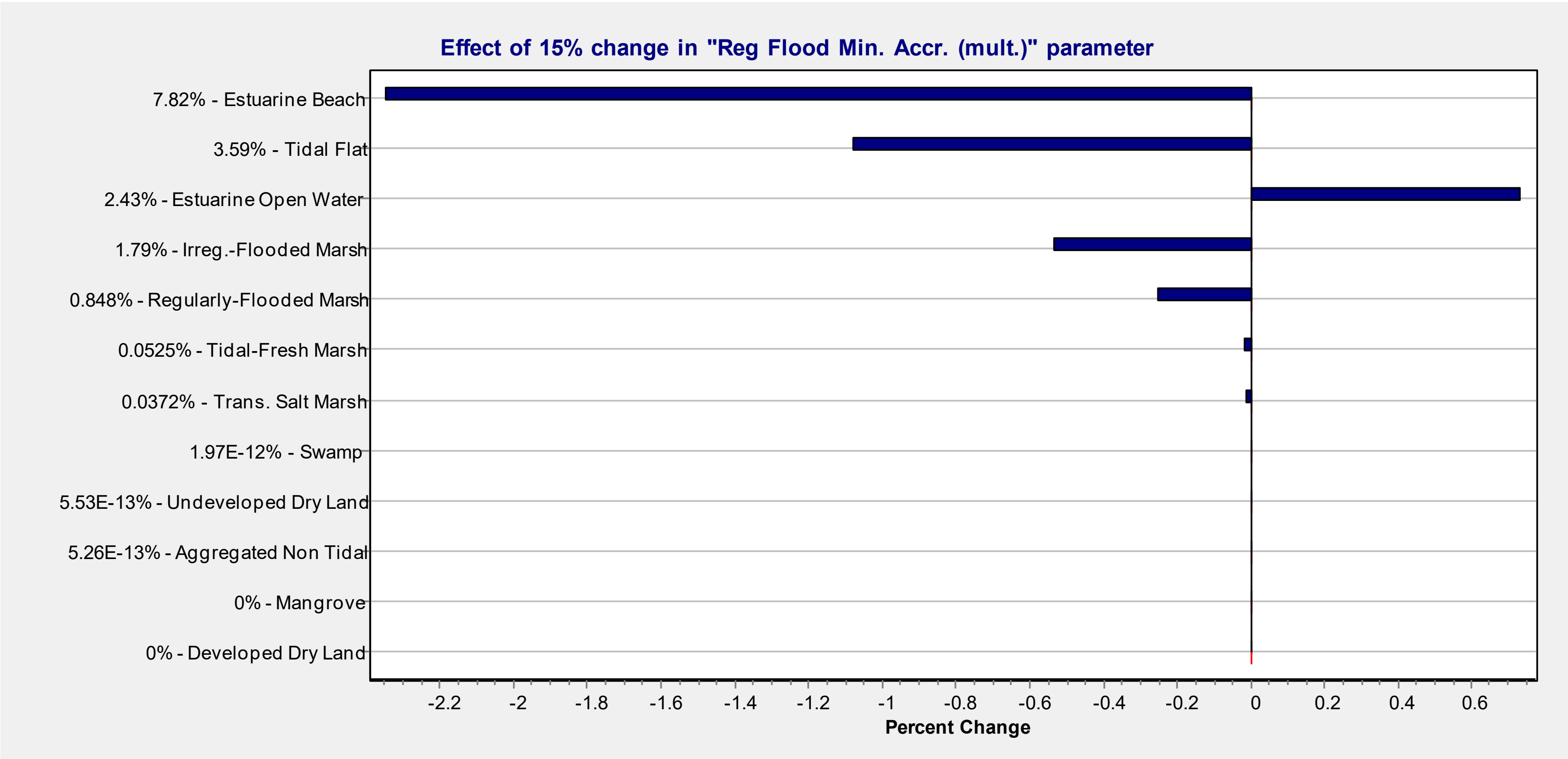
Dennis - Effects – Marsh erosion



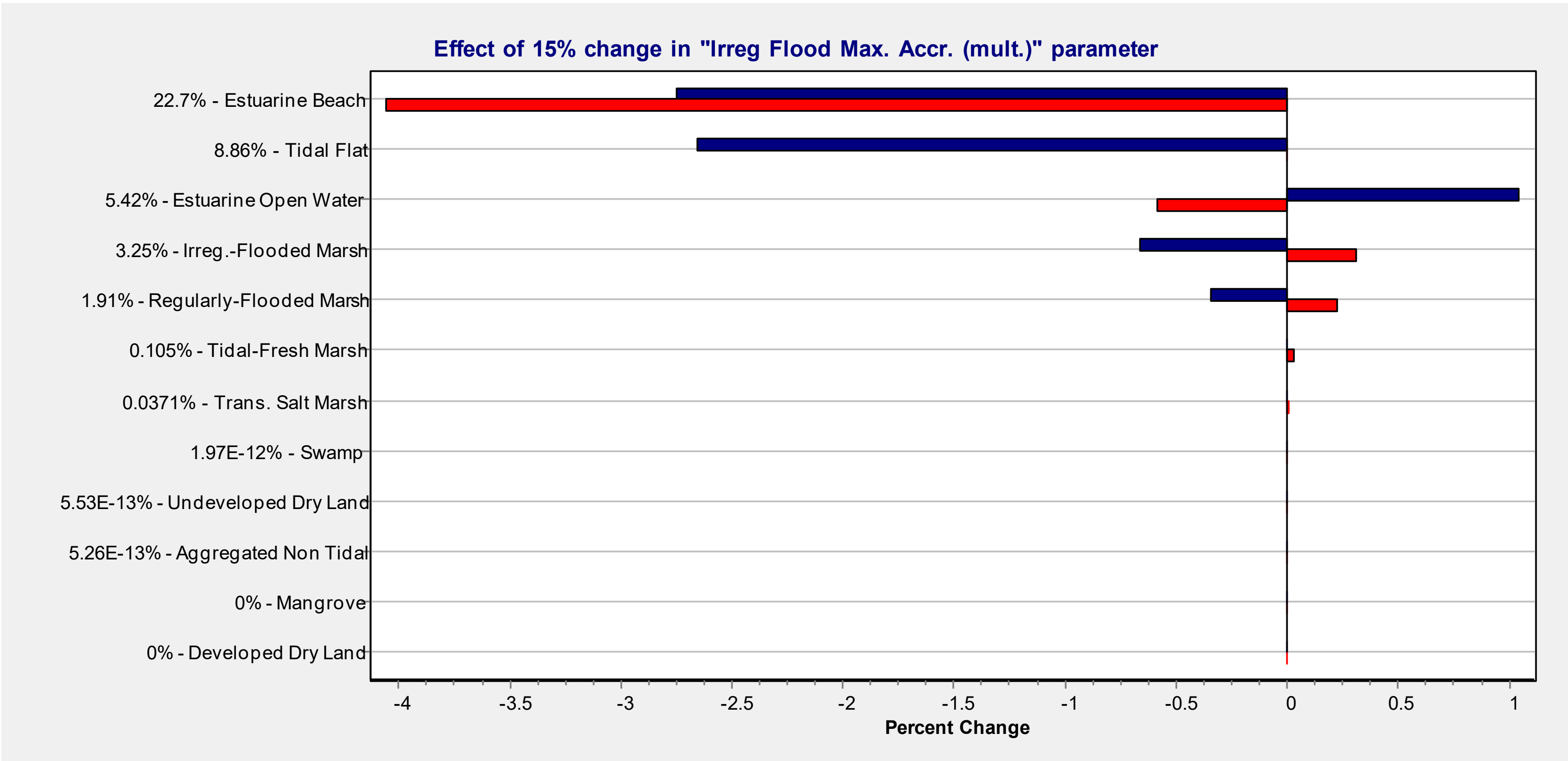
Dennis - Effects – Reg flood max accr



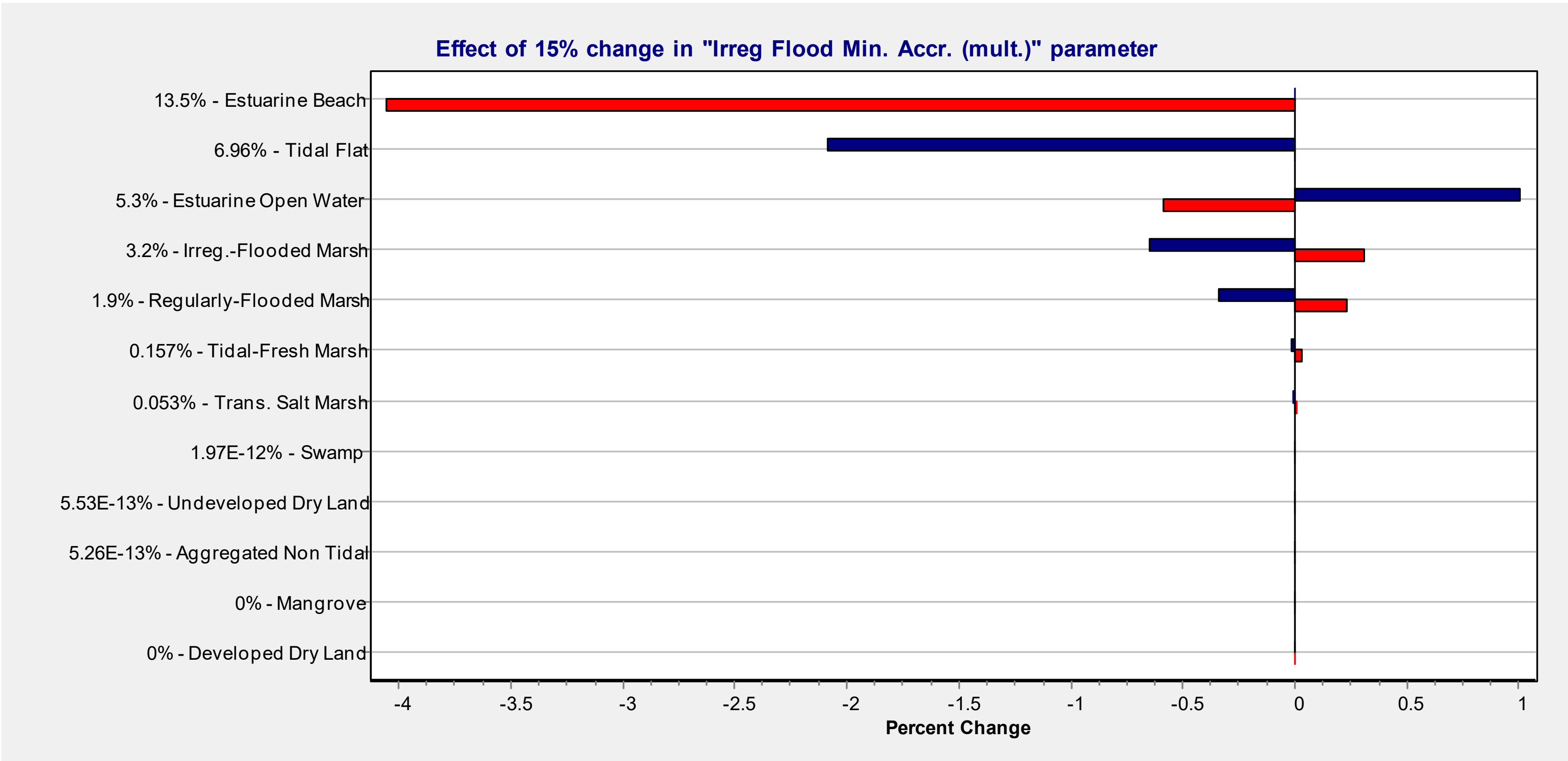
Dennis - Effects – Reg flood min accr



Dennis - Effects – Irreg flood max accr



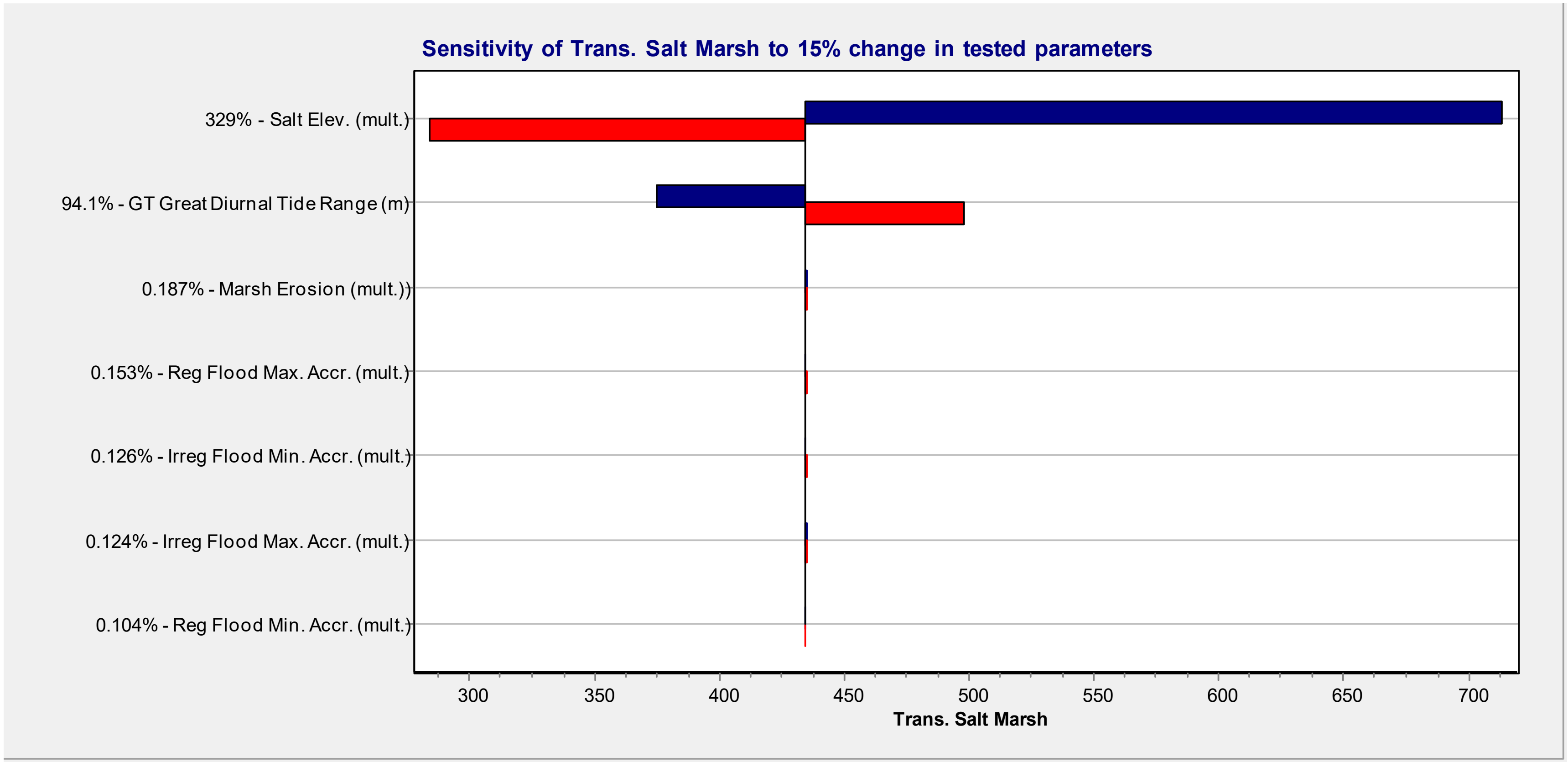
Dennis - Effects – Irreg flood min accr



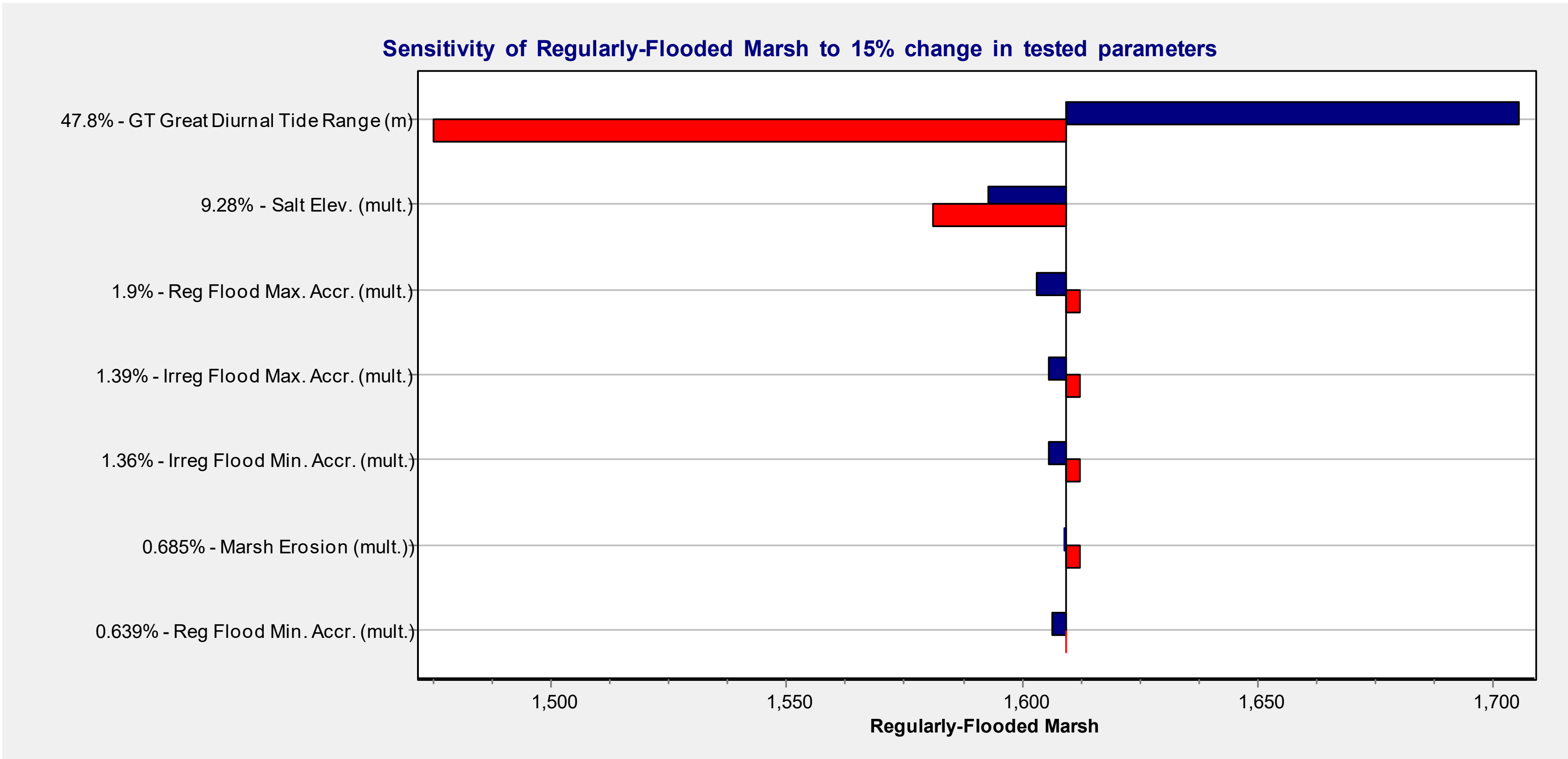
Tornado plots –

Reeds Beach

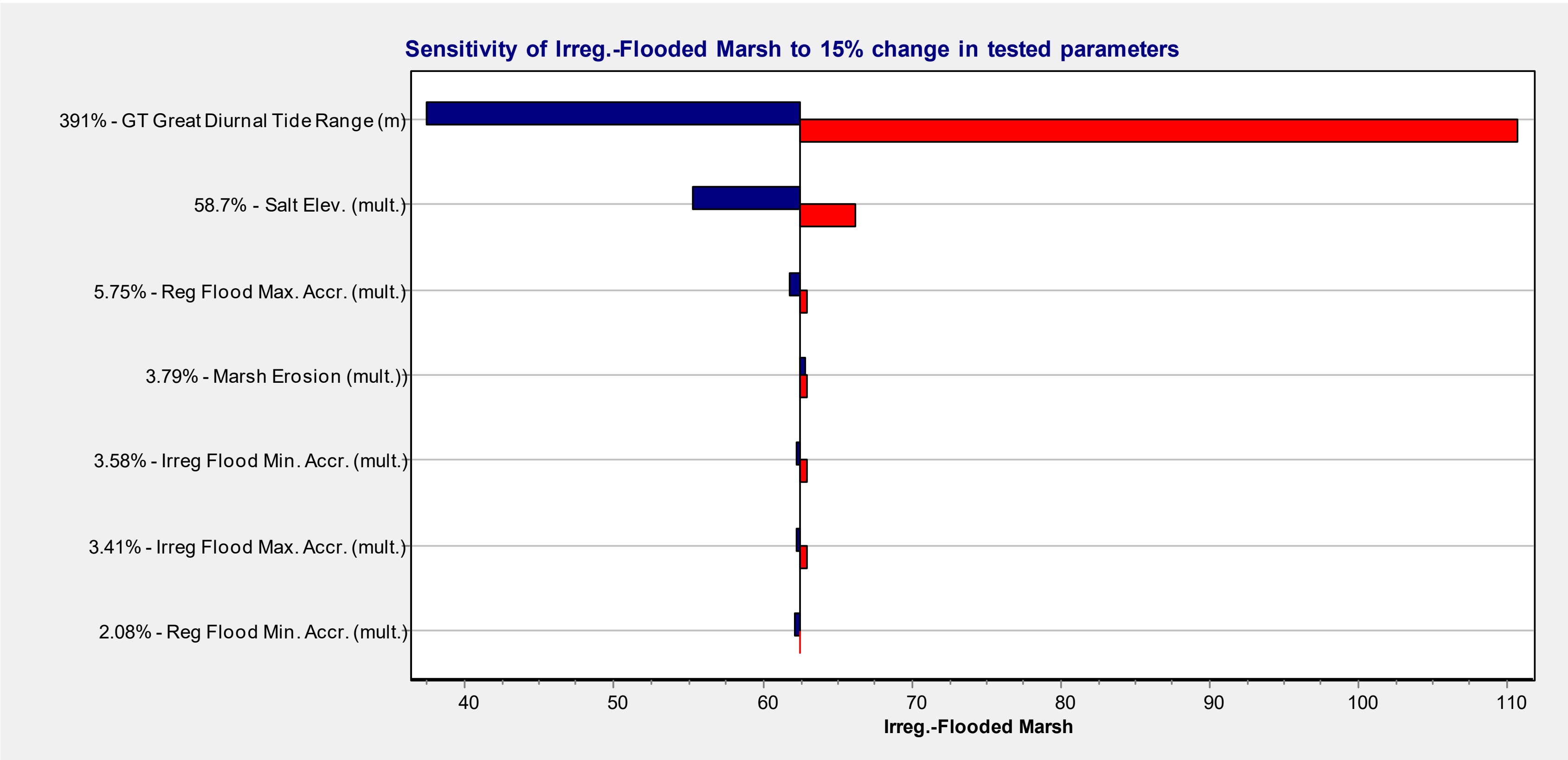
Reeds Beach - Transitional Salt Marsh



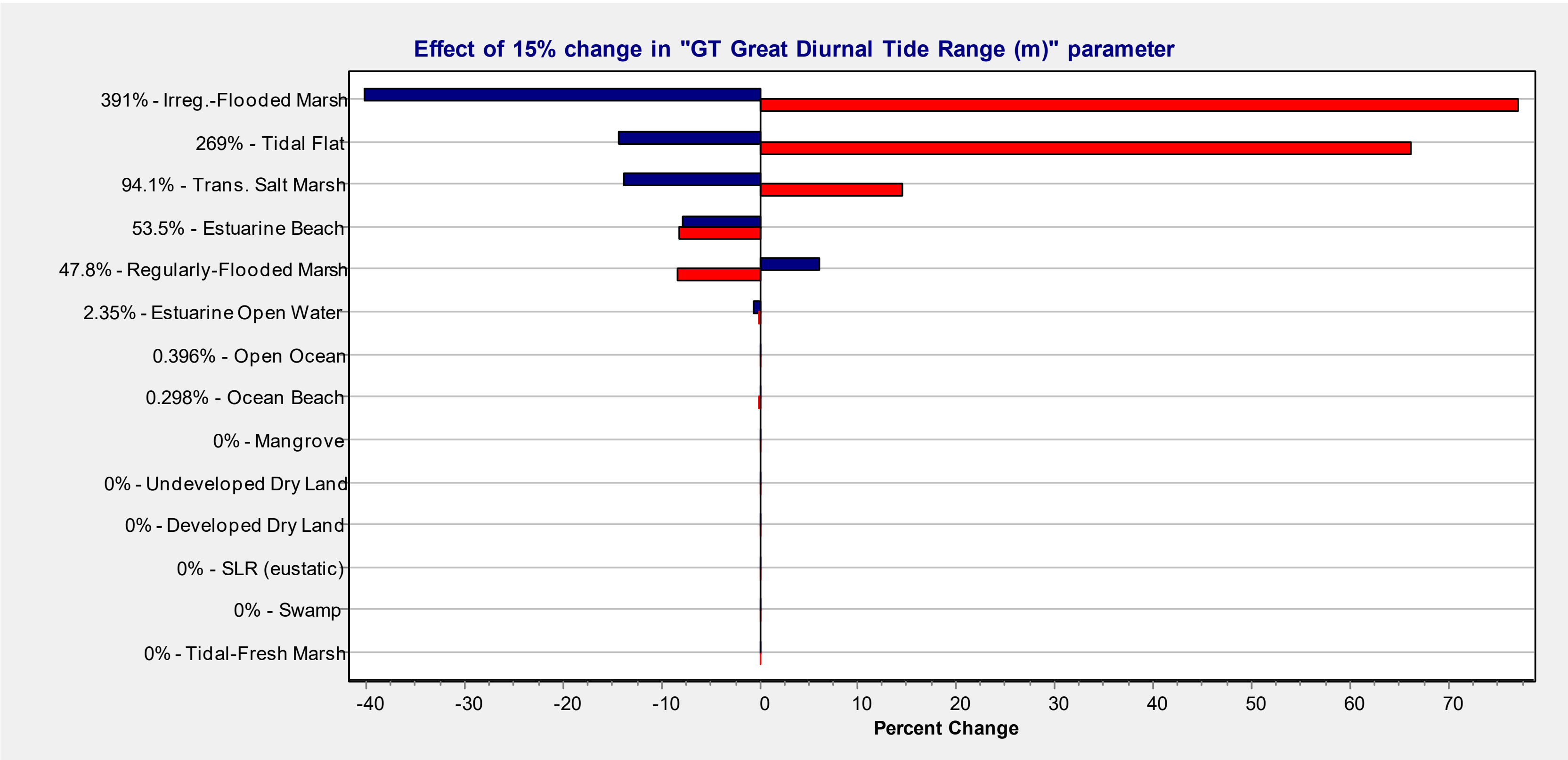
Reeds Beach - Regularly-Flooded Marsh



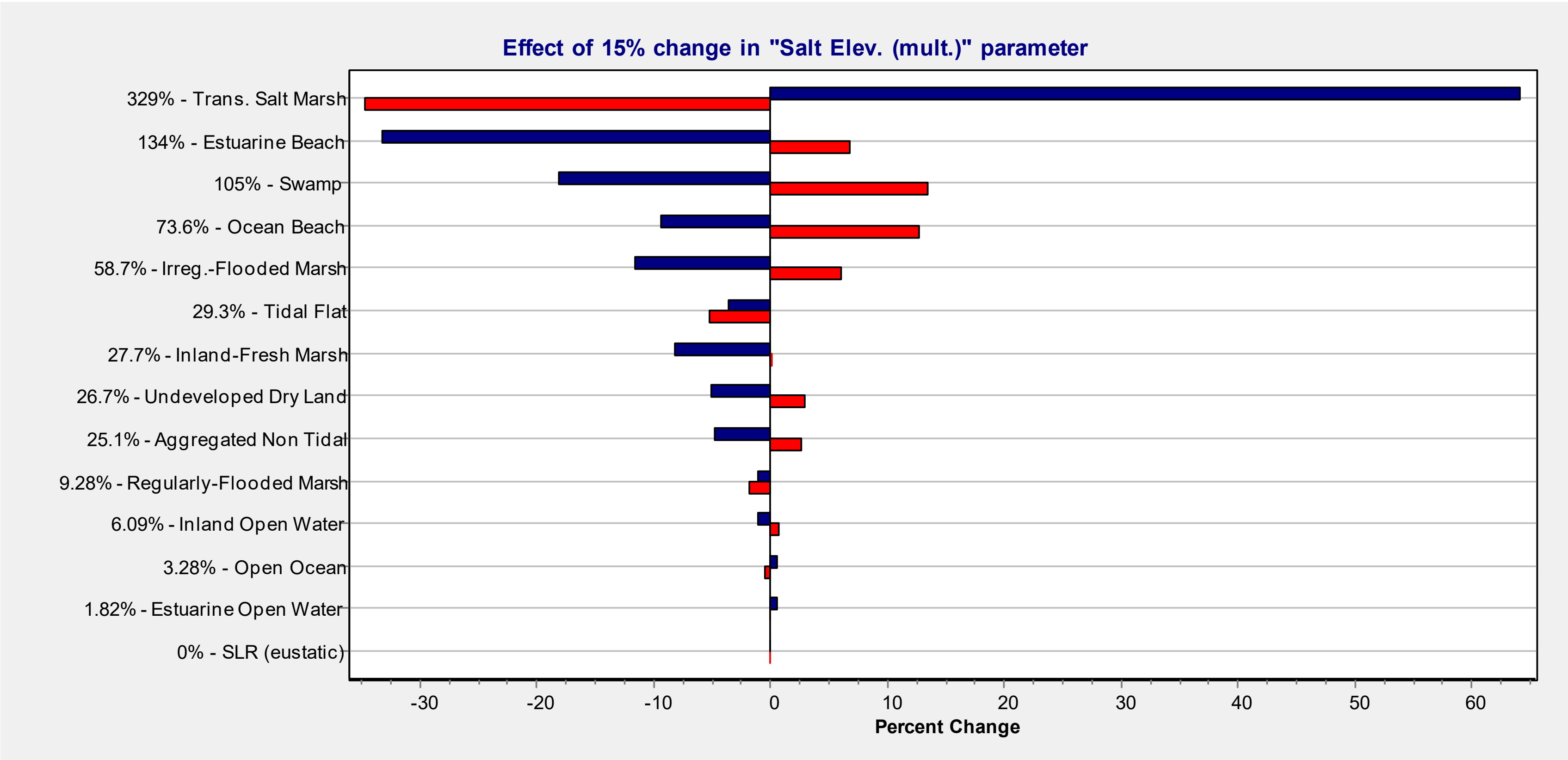
Reeds Beach - Irregularly-Flooded Marsh



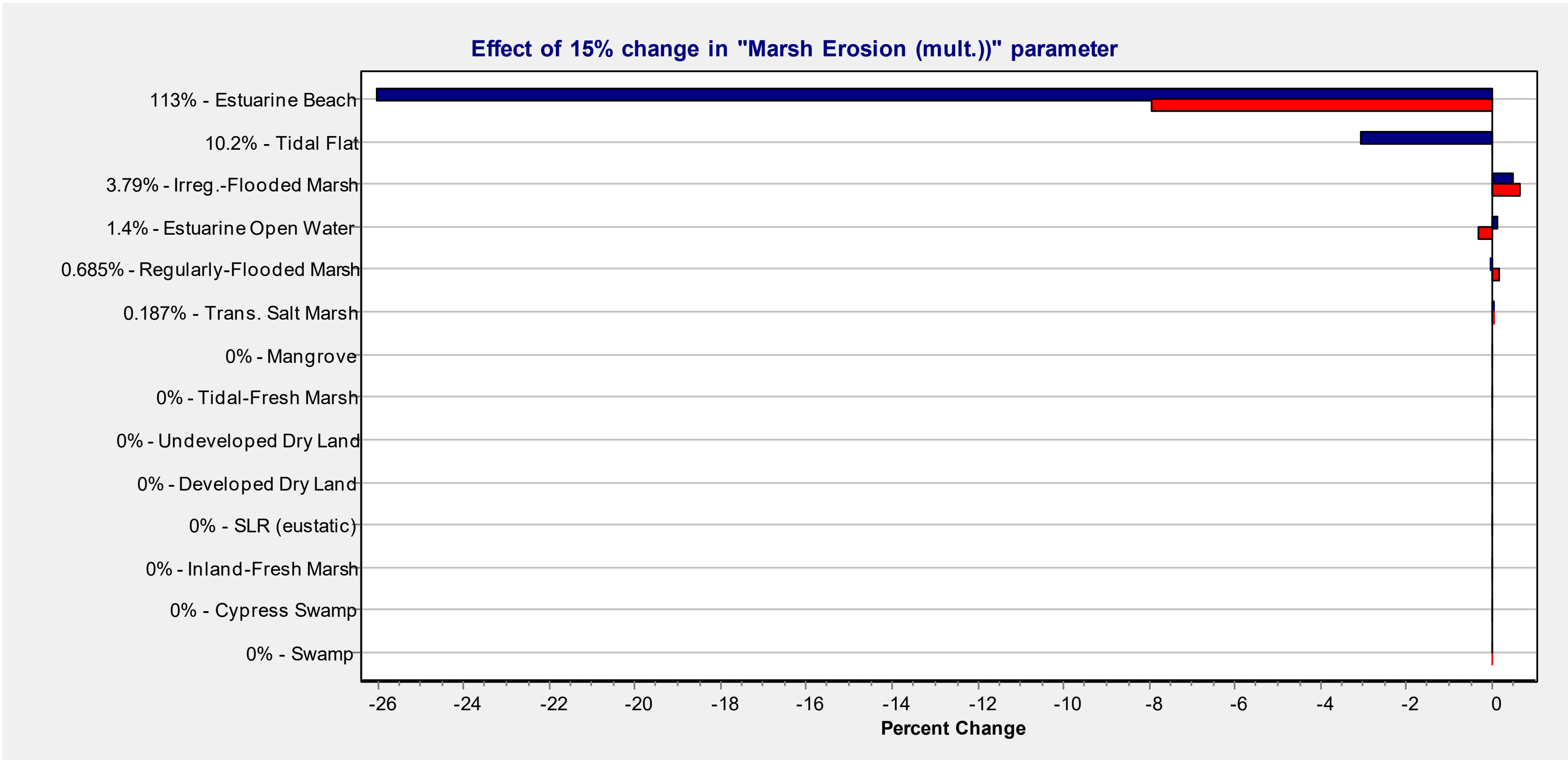
Reeds Beach - Effects – GT



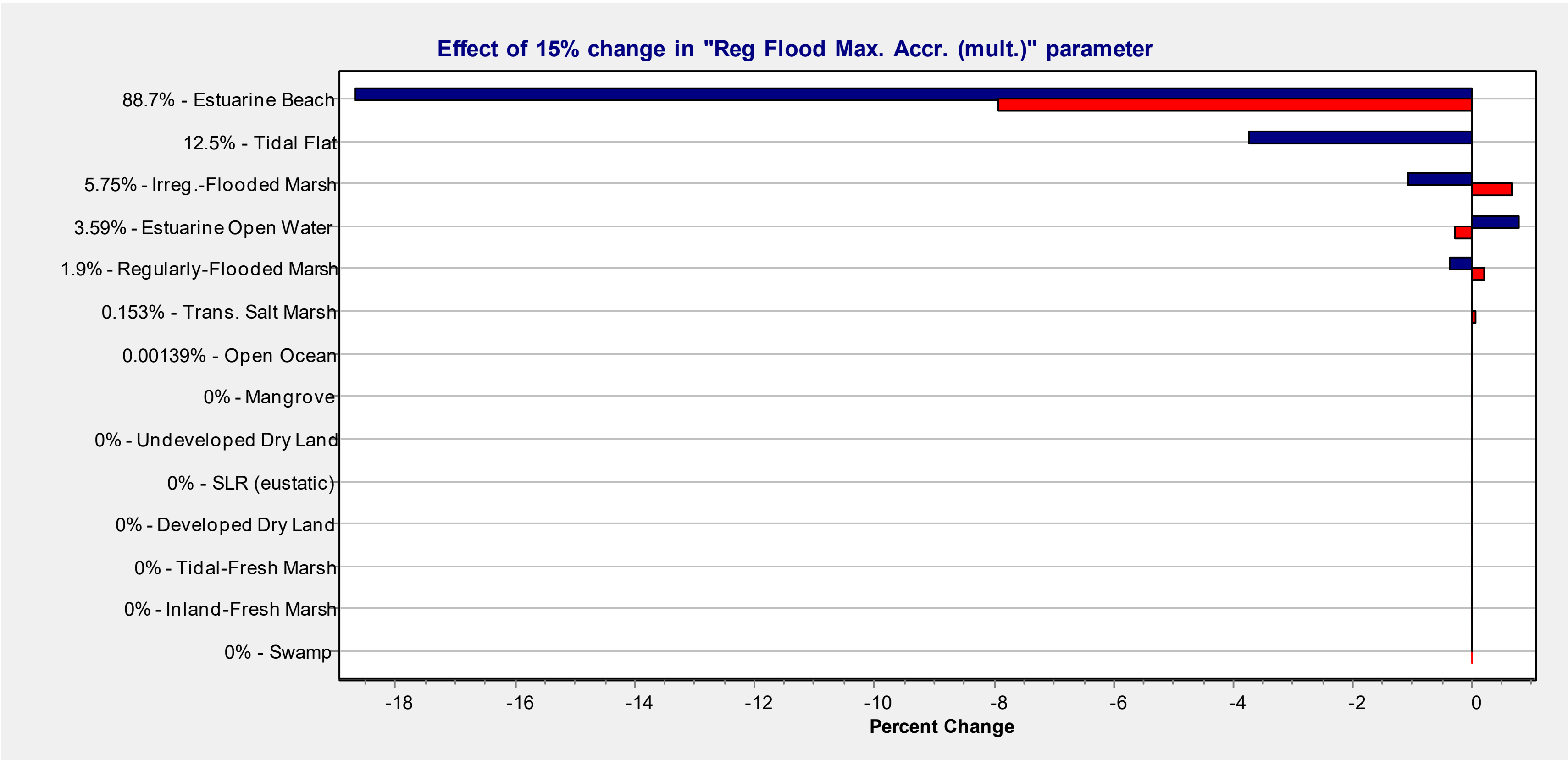
Reeds Beach - Effects – Salt elevation



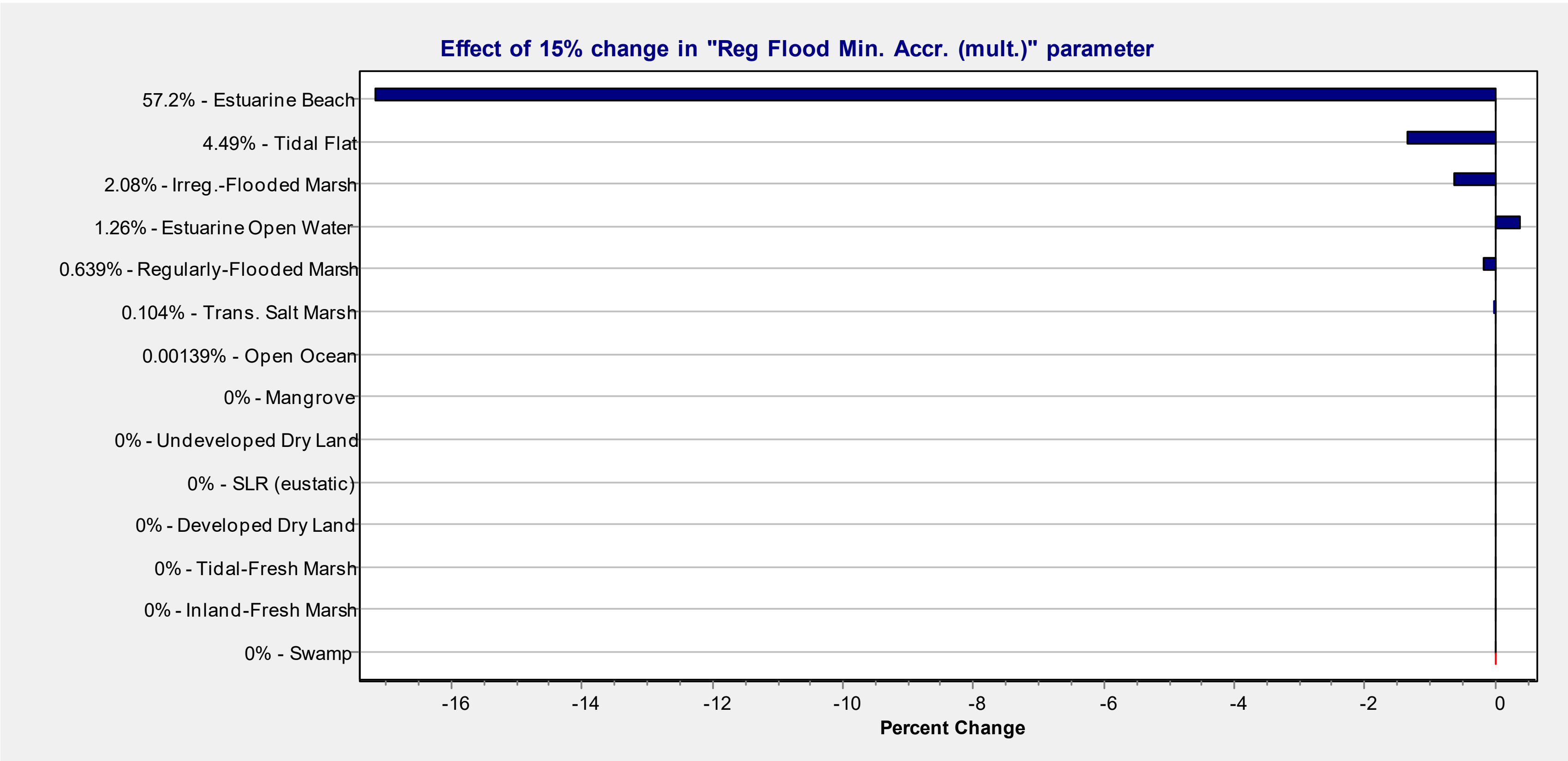
Reeds Beach - Effects – Marsh erosion



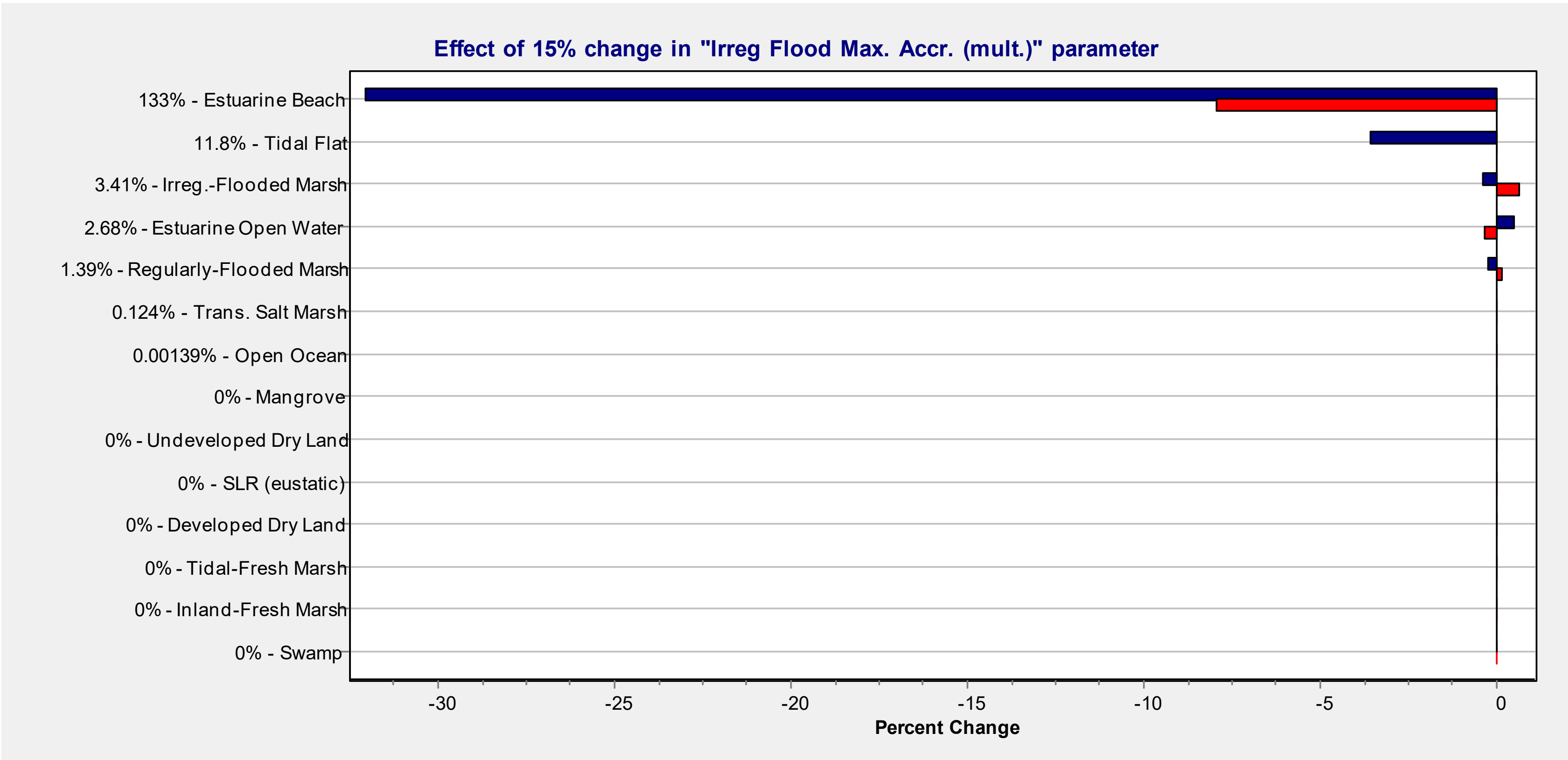
Reeds Beach - Effects – Reg flood max accr



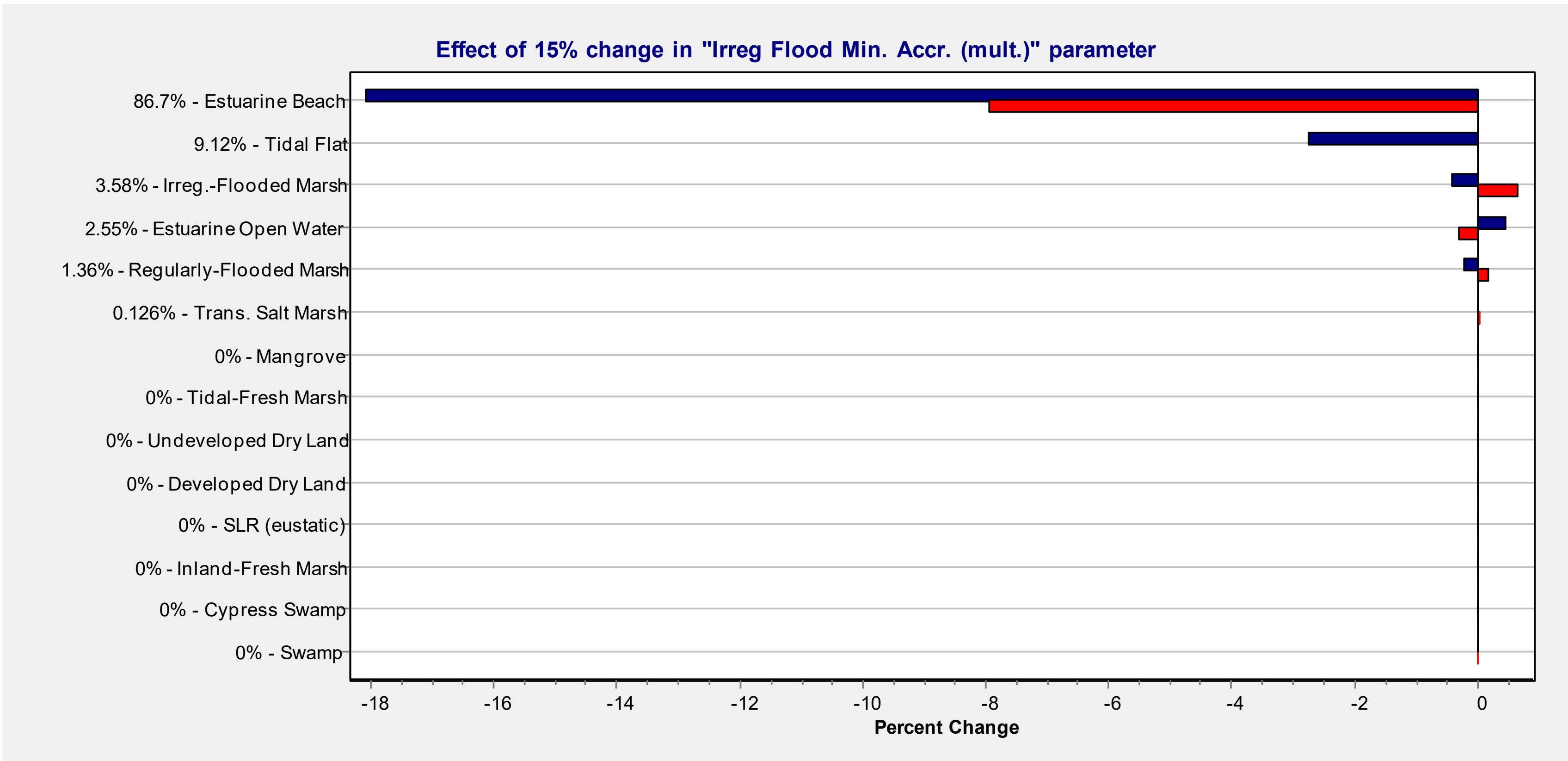
Reeds Beach - Effects – Reg flood min accr



Reeds Beach - Effects – Irreg flood max accr



Reeds Beach - Effects – Irreg flood min accr



Appendix L

Comparison of outcomes under different model protection scenarios

To assess marsh migration potential, we ran SLAMM simulations for three different model protection scenarios:

- "Protect None": All cells are subject to inundation and can be converted to other habitat types in the simulations
- "Protect Developed Dry Land": The cells designated as developed dry land are protected from inundation and cannot be converted to other habitat types in the simulations
- "Protect All Dry Land": The cells designated as dry land (inclduing developed and undeveloped dry land) are protected from inundation and cannot be converted to other habitat types in the simulations.

Table L1 summarizes how much the results for transitional salt marsh, irregularly-flooded marsh and regularly-flooded marsh change by 2100 when the "Protect None" or "Protect All Dry Land" scenarios are used instead of the "Protect Developed Dry Land" scenario. The comparison is based on percent change in acreage using the results under the "Protect Developed Dry Land" senario as a reference. Percent change was calculated using the following equation.

$$\text{Percent change} = \frac{\text{acreage under “Protect Developed Dry Land”} - \text{ acreage under alternate scenario)} * 100}{\text{acreage under “Protect Developed Dry Land”}}\%$$

Positive numbers mean that the marsh acreage in the alternate scenario was lower than the "Protect Developed Dry Land" scenario. As listed in Table L1, changing to "Protect None" has very little effect on the outcome for all three salt marsh habitat types[1] (the mean percent change is <0.3%). Changing to the "Protect All Dry Land" scenario has a large effect on regularly-flooded and transitional salt marsh at certain sites, particularly the Delaware sites where large areas of low-lying undeveloped dry land border the marshes. Here is an example of how to interpret the results. At the Broadkill subsite, under the "Protect All Dry Land" scenario (where both undeveloped and developed dry land are protected from wetland conversion), the SLAMM simulations project that the amount of transitional salt marsh acreage in 2100 would be 94% less and the regularly-flooded marsh acreage would be 49% less than the projected acreages under the "Protect Developed Dry Land" scenario (under which undeveloped dry land is able to convert).

[1] Changing the "Protect None" scenario does, however, affect projections for developed dry land (which converts to flooded developed dry land).

Table L1. Percent change in acreage in 2100 if the "Protect All Dry Land" or "Protect None" model protection scenarios are used instead of the "Protect Developed Dry Land" scenario.

State	Site	Percent change = (acreage under protect dry developed in 2100 - acreage in 2100 under alternate scenario/acreage under protect dry developed in 2100)*100					
		Irreg.-Flooded Marsh		Regularly-Flooded Marsh		Trans. Salt Marsh	
		Protect All Dry	Protect None	Protect All Dry	Protect None	Protect All Dry	Protect None
DE	Broadkill	0.09 %	0.04 %	48.91 %	-0.01 %	93.93 %	0.09 %
	Mispillion	0.03 %	-0.03 %	33.42 %	-0.30 %	86.07 %	0.03 %
	St. Jones	0.62 %	0.93 %	14.98 %	1.09 %	79.85 %	0.16 %
NJ	Dividing	-0.06 %	0.00 %	7.39 %	0.00 %	47.27 %	0.00 %
	Maurice	-0.51 %	0.00 %	3.58 %	0.00 %	35.57 %	0.00 %
	Reeds	0.30 %	0.31 %	2.98 %	0.08 %	26.33 %	0.01 %
	Dennis	0.44 %	0.44 %	2.33 %	0.07 %	20.78 %	0.00 %
	Mean	***0.13 %***	***0.24 %***	***16.23 %***	***0.13 %***	***55.69 %***	***0.04 %***
	StDev	***0.37 %***	***0.35 %***	***18.13 %***	***0.44 %***	***30.35 %***	***0.06 %***
	Min	***-0.51 %***	***-0.03 %***	***2.33 %***	***-0.30 %***	***20.78 %***	***0.00 %***
	Max	***0.62 %***	***0.93 %***	***48.91 %***	***1.09 %***	***93.93 %***	***0.16 %***

Tables L2-L4 include actual acreages for each protection scenario at each time step (time zero, 2025, 2050, 2075, 2100) for transitional salt marsh, regularly-flooded marsh and irregularly-flooded marsh, respectively. Results are based on the intermediate SLR scenario (Sweet et al. 2017).

Table L2. Transitional salt marsh - comparison of results across the three different model protection scenarios.

Site	Model protection scenario	Acres of transitional salt marsh				
		2007	2025	2050	2075	2100
Broadkill (DE)	Protect All Dry	607.9	417.5	337.0	210.9	110.0
	Protect Dry Developed	1626.7	1583.3	1974.1	2220.6	1813.1
	Protect None	1626.7	1583.3	1974.1	2221.5	1811.4
Dennis (NJ)	Protect All Dry	835.3	943.2	1192.8	1921.4	1895.7
	Protect Dry Developed	836.8	965.8	1315.0	2229.5	2392.9
	Protect None	836.8	964.6	1314.8	2229.5	2392.9
Dividing (NJ)	Protect All Dry	317.6	327.4	311.9	331.5	522.3
	Protect Dry Developed	326.0	403.2	565.9	802.7	990.4
	Protect None	326.0	403.2	565.9	802.7	990.4
Maurice Lower (NJ)	Protect All Dry	411.8	451.4	592.0	603.3	548.2
	Protect Dry Developed	421.1	480.8	718.2	849.7	850.8
	Protect None	421.1	480.8	718.2	849.7	850.8
Mispillion (DE)	Protect All Dry	717.5	566.8	690.3	436.5	272.0
	Protect Dry Developed	2194.0	1902.6	2482.1	2199.6	1953.2
	Protect None	2194.0	1902.6	2483.5	2203.1	1952.6
Reeds (NJ)	Protect All Dry	236.6	255.1	353.2	571.9	791.0
	Protect Dry Developed	237.7	266.8	413.0	729.7	1073.7
	Protect None	237.7	266.5	412.7	729.5	1073.7
St Jones (DE)	Protect All Dry	79.8	93.5	114.9	95.2	89.5
	Protect Dry Developed	164.0	197.7	304.6	359.0	444.4
	Protect None	164.0	197.7	304.6	358.6	443.7

Table L3. Regularly-flooded marsh - comparison of results across the three different model protection scenarios.

Site	Model protection scenario	Acres of regularly-flooded marsh				
		2007	2025	2050	2075	2100
Broadkill (DE)	Protect All Dry	3955.4	4485.1	5495.3	5839.3	2573.2
	Protect Dry Developed	3955.8	4678.8	5907.4	6931.7	5036.7
	Protect None	3955.8	4678.8	5907.8	6948.0	5037.4
Dennis (NJ)	Protect All Dry	421.6	455.7	934.4	4782.2	10043.2
	Protect Dry Developed	421.6	472.0	939.3	4814.4	10282.6
	Protect None	421.6	455.7	934.6	4810.2	10275.4
Dividing (NJ)	Protect All Dry	1707.7	1893.3	3119.2	4834.4	5124.2
	Protect Dry Developed	1707.7	1893.5	3121.5	4914.9	5533.0
	Protect None	1707.7	1893.5	3121.5	4914.9	5533.0
Maurice Lower (NJ)	Protect All Dry	1299.5	1379.6	1904.3	3437.6	5436.4
	Protect Dry Developed	1299.5	1379.6	1899.9	3467.2	5638.5
	Protect None	1299.5	1379.6	1899.9	3467.2	5638.5
Mispillion (DE)	Protect All Dry	7164.4	7547.1	8159.7	9556.6	8066.3
	Protect Dry Developed	7165.8	8166.8	9188.7	11991.7	12114.5
	Protect None	7165.8	8166.8	9237.8	12107.4	12151.0
Reeds (NJ)	Protect All Dry	235.0	255.0	464.4	1847.9	3843.5
	Protect Dry Developed	235.0	262.4	467.0	1861.9	3961.4
	Protect None	235.0	255.0	464.5	1860.0	3958.2
St Jones (DE)	Protect All Dry	1862.6	1882.1	1998.3	2766.9	3344.1
	Protect Dry Developed	1865.2	1922.3	2102.1	3076.5	3933.5
	Protect None	1865.2	1922.3	2102.1	3058.6	3890.7

Table L4. Irregularly-flooded marsh - comparison of results across the three different model protection scenarios.

Site	Model protection scenario	Acres of irregularly-flooded marsh				
		2007	2025	2050	2075	2100
Broadkill (DE)	Protect All Dry	1613.0	1301.0	547.9	832.2	348.3
	Protect Dry Developed	1613.0	1301.0	547.8	832.2	348.4
	Protect None	1613.0	1301.0	547.9	832.6	348.3
Dennis (NJ)	Protect All Dry	8315.7	8256.9	7885.3	4614.8	321.7
	Protect Dry Developed	8315.7	8274.9	7891.6	4619.4	323.1
	Protect None	8315.7	8256.9	7885.3	4614.8	321.7
Dividing (NJ)	Protect All Dry	4700.6	4482.2	3259.2	1393.9	675.4
	Protect Dry Developed	4700.6	4482.2	3254.9	1390.6	674.9
	Protect None	4700.6	4482.2	3254.9	1390.6	674.9
Maurice Lower (NJ)	Protect All Dry	4804.3	4717.7	4216.8	2633.6	392.2
	Protect Dry Developed	4804.3	4717.7	4208.4	2626.5	390.2
	Protect None	4804.3	4717.7	4208.4	2626.5	390.2
Mispillion (DE)	Protect All Dry	2067.6	1943.1	1678.9	786.9	356.4
	Protect Dry Developed	2067.6	1943.1	1670.4	784.6	356.5
	Protect None	2067.6	1943.1	1678.9	789.4	356.6
Reeds (NJ)	Protect All Dry	3277.8	3260.9	3113.3	1840.0	152.1
	Protect Dry Developed	3277.8	3264.0	3115.3	1841.9	152.5
	Protect None	3277.8	3260.9	3113.3	1840.0	152.1
St Jones (DE)	Protect All Dry	1354.8	1344.6	1253.1	576.4	108.1
	Protect Dry Developed	1354.8	1344.6	1258.6	581.5	108.8
	Protect None	1354.8	1344.6	1258.6	578.8	107.8

Reference

Sweet, W., Kopp, R. E., Weaver, C., Jayantha, O., Horton, R. M., Thieler, E. R., and Zervas, C. (2017). "Global and regional sea level rise scenarios for the United States". NOAA Tech. Rep. NOS CO-OPS, 083. Available online: https://tidesandcurrents.noaa.gov/pub.html