## Determining Site-specific Weights

The ecosystem benefits described above have all been related to the acreage predictions of land-cover types that come out of SLAMM simulations. However, these equations do not take into account quality of habitat, for example. (In one location with a higher marsh density, more carbon sequestration could be assumed to occur than another location with lower density.) For this reason, site-specific weights are provided for the user to add information about each site when available. These are especially important for such categories as "recreation" in which the location and historic use of a marsh may be considered in providing weights.

If no information is available for a specific ecosystem service, all sites may be weighted evenly. In this case, one acre of wetland will be assumed to provide the same amount of benefit across sites.

### Nutrient sequestration

Tidal marshes are important for improving water quality. In particular they can sequester organic Carbon and nutrients that may otherwise lead to additional climate disruption or eutrophication of estuarine systems. The nutrient sequestration ecosystem services quantify the relative amount of organic Carbon, Nitrogen and Phosphorus that may be accumulated based on landcover types. The ratios of nutrient sequestration were derived from the work of Loomis and Craft (2010). It is important to note that this work does not specifically account for methane emissions that may occur in freshwater wetlands.

The intention of the weight assigned to each nutrient is to represent how valuable the parcel may currently be for sequestration.

### Recreation

Recreation is divided into three categories: Dry land (trails, ball fields, open space, etc.), Wetland, and "Natural services to underserved communities." Each is described below.

**Marsh-Land Recreation.** Wetland recreation describes the current value of an area for recreation in wetlands, which might include bird watching or the presence of boardwalk areas for nature observation and enjoyment.

**Natural services to underserved communities.** This ecosystem service combines the currently available areas and their proximity to underserved or at risk communities. This allows one to give priority to areas that are located in or near areas where few other natural areas exist for recreation.

**Nekton habitat (proximate to fishing areas).** Nekton are animals that are able to move independently of water currents and include bony fish and aquatic mammals, turtles, snakes, octopus, squid, and shrimp. In particular, nearshore nekton habitat is important for juvenile fish to ensure the maintenance of healthy fish population. Salt marsh edge vs. interior is considered especially important habitat (Peterson and Turner 1994).

The weight assigned to this service is intended to represent the value of a particular parcel for supporting healthy nekton ecosystems that directly impact important recreational fishing sites.

**Habitat**

**Nekton habitat.** Nekton are animals that are able to move independently of water currents and include bony fish and aquatic mammals, turtles, snakes, octopus, squid, and shrimp. In particular, nearshore nekton habitat is important for juvenile fish to ensure the maintenance of healthy fish population. Salt marsh edge vs. interior is considered especially important habitat (Peterson and Turner 1994).

The weight assigned to this service is intended to represent the general benefits of a particular parcel for supporting healthy nekton ecosystems (not including recreational fishing benefits).

**Habitat connectivity.** This service represents the degree of connectivity within a habitat by calculation the length of marsh edge per unit marsh area. Large marshes that are not fragmented have a low marsh edge density while narrow, fringing marshes, especially those that are fragmented and breaking apart, have a lot of edge.

**Bird Habitat.** High marsh habitat is especially important bird habitat for several species (Nicole Maher, Personal Communication) This utility is the benefits of high marsh in particular as a critical bird habitat.

**Wave Attenuation**

This benefit quantifies the capability of the marsh system to provide some level of protection against storm surges. Normally, this is done by estimating the amount of energy that a marsh system can absorb when storm water reaches the system. In this tool, the “width” of the marsh is used to differentiate between parcels. As a simple rule of thumb, the energy absorbed may be assumed proportional to the width, though more complex models suggest a more complicated relationship to storm track, etc. (Wamsley et al. 2010). The spatial weights assigned to the parcels should reflect the value of infrastructure and quantity of population protected. Site-specific weights could be estimated using available data or assigned by expertise knowledge.

**Political/Cultural/Historic value**

This service accounts for the value of maintaining existing marshes to people for other reasons. Site specific weighting is critical, or alternatively this ecosystem benefit may be assigned to an overall weight of zero.

**Weighting different utilities**

The “ecosystem service relative rank” represents the value that is given in the decision making process in comparison to other ecosystem services listed. If a user is mostly interested in recreation, for example, high weights could be given to those services and much lower (or zero) weights to nutrient sequestration.

Stakeholders should weight ecosystem services according to the level of importance for their particular decision. However, the spatial definition of the parcels to be examined also plays a role in this. A marsh-only parcel definition will not allow the user to assess dry-land recreation, for example. A marsh-only parcel definition will also not allow a user to assess the ecosystem services of marshes predicted to migrate beyond their existing footprints.

Loomis, M. J., and Craft, C. B. (2010). "Carbon Sequestration and Nutrient (Nitrogen, Phosphorus) Accumulation in River-Dominated Tidal Marshes, Georgia, USA." *Soil Science Society of America Journal*, 74(3), 1028.

Peterson, G. W., and Turner, R. E. (1994). "The Value of Salt Marsh Edge vs Interior as a Habitat for Fish and Decapod Crustaceans in a Louisiana Tidal Marsh." *Estuaries*, 17(1), 235.

Wamsley, T. V., Cialone, M. A., Smith, J. M., Atkinson, J. H., and Rosati, J. D. (2010). "The potential of wetlands in reducing storm surge." *Ocean Engineering*, 37(1), 59–68.