**Ecosystem Type: WETLANDS**

**Category: Climate Stabilization**

1. **Materials**

***Supplier*** – Wetlands supply shade for climate stabilization. Shade is supplied by the wetland canopies and can have a different effect for various land use types (Wei, Jingang, and Yubi, 2015; McLaughlin and Cohen, 2013; Shaw and Bible, 1996). In urban areas, shade from the canopies help cool the environment (Wei, Jingang, and Yubi, 2015; McLaughlin and Cohen, 2013; Shaw and Bible, 1996). Wetland plants may also have a role in climate stabilization because they supply oxygen (Poindexter and Variano, 2013; Laanbroek, 2010). One study found that oxygen is an important factor in “climate forcing” throughout geologic time (Poulsen, Tabor, and White, 2015). Since wetlands release oxygen through photosynthesis and the transpiration of water, they could play an even more vital role in climate stabilization other than just providing shade (Pokorný, Kvĕt, Rejšková, and Brom, 2010; Gutowski, Wei, Vörösmarty, and Fekete, 2007).

***Driver*** – not applicable

***Demander*** – not applicable

1. **Nutrition**

***Supplier*** – not applicable

***Driver*** - not applicable

***Demander*** - not applicable

1. **Energy**

***Supplier*** – not applicable

***Driver*** - not applicable

***Demander*** - not applicable

1. **Mediation of Waste, Toxics, and Other Nuisances**

***Supplier*** – not applicable

***Driver*** – not applicable

***Demander*** – not applicable

1. **Mediation of Flows**

***Supplier*** – Wetlands are known for their ability to exchange moisture, energy, and momentum with the atmosphere (Gutowski, Wei, Vörösmarty and Fekete, 2007). Evapotranspiration provided by wetlands plays an important role in climate stabilization because the process affects the microclimate (Zhang, Zhu and Jiang, 2016; McLaughlin and Cohen, 2013). Wetlands in urban areas are especially important because they alleviate the heat island effect (McLaughlin and Cohen, 2013). The heat island effect is when urban areas are hotter due to trapping heat. Vegetation, like wetlands, can help reduce the heat by turning water from a liquid to a vapor. Water released as a vapor helps cool sites (Pokorný, Kvĕt, Rejšková, and Brom, 2010).

***Driver*** – not applicable

***Demander*** – no literature review available at this time

1. **Maintenance of Physical, Chemical, and Biological Indicators**

***Supplier*** – Wetlands play a role in climate stabilization by reducing greenhouse gases such as carbon dioxide. One study found that depressional wetlands can sequester a net amount of greenhouse gas to 3.2 Mg of carbon dioxide per hectare (Gala and Young, 2015). Another study found that mangroves in India sequestered about 1.5 tonne of carbon per hectare per year (Bassi, Kumar, Sharma, and Pardha-Saradhi, 2014). Sequestration is the ability of wetland plants and autotrophic organisms to fix carbon dioxide through photosynthesis (Olsson et al., 2015). By doing this, carbon dioxide gets transformed to organic compounds locked away from the atmosphere (Olsson et al., 2015). Wetlands are important sinks of carbon because they have accumulated one-third of the global terrestrial carbon (Keller, 2011). In addition, wetlands regulate the microclimate of urban and rural land cover types (Zhang, Zhu, and Jiang, 2016). These ecosystems play an important role of stabilizing the microclimate in all seasons due to their ability to store heat and perform evapotranspiration (Zhang, Zhu, and Jiang, 2016; Pokorný, Kvĕt, Rejšková, and Brom, 2010).

***Driver*** – not applicable

***Demander*** – not applicable

1. **Spiritual, Symbolic, Religious, and Social Experiences**

***Supplier*** – not applicable

***Driver*** – not applicable

***Demander*** – not applicable

1. **Physical and Intellectual Interactions w/ Biota, Ecosystems, and Land/Seascapes**

***Supplier*** – not applicable

***Driver*** - not applicable

***Demander*** - not applicable

**Sources:**

Gutowski, W.J. Jr., Wei, H., Vörösmarty, C.J., Fekete, B.M. (2007). Influence of Arctic Wetlands on Arctic Atmospheric Circulation. *Journal of Climate, 20,* 4243-4254. doi: 10.1175/JCLI4243.1

Laanbroek, H.J. (2010). Methane emission from natural wetlands: interplay between emergent macrophytes and soil microbial processes. A mini-review. *Annals of Botany, 105,* 141-153. doi:10.1093/aob/mcp201.

McLaughlin, D.L., Cohen, M.J. (2013). Realizing ecosystem services: wetland hydrologic function along a gradient of ecosystem condition. *Ecological Applications, 23*(7), 1619-1631. Doi: 10.1890/12-1489.1

Poindexter, C.M., Variano, E.A. (2013). Gas exchange in wetlands with emergent vegetation: The effects of wind and thermal convection at the air-water interface. *Journal of Geophysical Research: Biogeosciences, 118,* 1297-1306. doi:10.1002/jgrg.20099.

Pokorný, J., Kvĕt, J., Rejšková, A., Brom, J. (2010). Wetlands as energy-dissipating systems. *Journal of Industrial Microbiology & Biotechnology, 37,* 1299-1305. doi: 10.1007/s10295-010-0873-8.

Poulsen, C.J., Tabor, C., White, J.D. (2015). Long-term climate forcing by atmospheric oxygen concentrations. *Science, 348*(6240), 1238-1241. doi: 10.1126/science.1260670.

Shaw, D.C., Bible, K. (1996) An Overview of Forest Canopy Ecosystem Functions with Reference to Urban and Riparian Systems. *Northwest Science, 70,* 1-6.

Wei, Z., Jingang, J., Yubi, Z. (2015). Change in Urban Wetlands and Their Cold Island Effects in Response to Rapid Urbanization. *Chinese Geographical Science, 25*(4), 462-471. doi: 10.1007/s11769-015-0764-z.

Zhang, W., Zhu, Y., Jiang, J. (2016). Effect of the Urbanization of Wetlands on Microclimate: A Case Study of Xixi Wetland, Hangzhou, China. *Sustainability, 8*(9), 1-13. doi:10.3390/su8090885.