**Ecosystem Type: RIVERS AND STREAMS**

**Category: Clean and Plentiful Waters**

1. **Materials**

***Supplier*** – Rivers and streams are sources of clean and plentiful waters. The flow of water in these ecosystems plays an integral part in the planet’s water cycle and supports all forms of life (Karr and Chu, 2000). The amount of water available by these ecosystems depend on its length and density. For example, headwater streams typically take up the length of over two-thirds of a river, connecting uplands with riparian lands to supply a source of water for human use (Freeman, Pringle, and Jackson, 2007).

***Driver*** – The ability of streams and rivers to supply clean and plentiful waters can be influenced by pollutants like metals and nutrients. As a result, limits are placed on these inputs to protect users from the potentially harmful effects they have on humans.

***Demander*** – Many users depend on the availability of clean and plentiful waters supplied by rivers and streams including those within agricultural, domestic, and industrial sectors. For example, agriculture has the largest use of freshwater resources for food production (Calzadilla, Rehdanz, and Tol, 2010). In 2005, thermoelectric-power generation had the second highest use of water—about 201 billion gallons per day (Kenny et al, 2009).

1. **Nutrition**

***Supplier*** – not applicable

***Driver*** -not applicable

***Demander*** - not applicable

1. **Energy**

***Supplier*** – not applicable

***Driver*** – not applicable

***Demander*** – There is a demand for plentiful waters to supply energy, particularly for thermoelectric power generation. In 2005, thermoelectric power accounted for almost 41 percent of all freshwater withdrawals (Kenny et al, 2009).

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

***Supplier*** – Rivers and streams supply the mediation of wastes, toxics, and other nuisances because of their biological features like the aquatic plant and animal species living in and around the ecosystem. For example, aquatic microorganisms can be used for treatment, also known as bioremediation, of wastes like industrial effluents and gasoline (Boopathy, 2000).

***Driver*** – The ability of streams and rivers to mediate waste, toxics, and other nuisances are impacted by water use and pollutants. The demand for water in uses such as thermoelectric power generation (Kenny et al., 2009), irrigation (Falkenmark and Rockstrom, 2006), and drinking water (Falkenmark and Rockstrom, 2006) decreases the availability of water to supply these important ecosystem services.

***Demander*** – not applicable

1. **Mediation of Flows**

***Supplier*** – Rivers and streams influence the mediation of flows available for clean and plentiful waters. Aquatic species in this ecosystem can help slow the flow of water to sustain the supply of water resources available for human consumption (Morrice et al., 1997).

***Driver*** – The ability of streams and rivers to mediate flows is impacted by water use and the amount of impervious area that they are connected to. Impervious surfaces increase the flow of water to this ecosystem and severely changes the stream’s ability to treat water that is used as clean and plentiful waters (Walsh, Fletcher, and Ladson, 2009).

***Demander*** – not applicable

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

***Supplier*** – Rivers and streams can support clean and plentiful waters by providing the maintenance of physical and chemical indicators such as absorbing nitrogen and sulfur deposition because of their ability to trap, alter and transport nutrients (Williamson et al., 2008). The nutrient retention changes based on the structure and function of available aquatic plants and connection of the stream with adjacent ecosystems (Valett et al, 1997).

***Driver*** – The ability of streams and rivers to mediate nutrients is impacted by water use and the amount of impervious area that they are connected to. Impervious surfaces increase the flow of water to this ecosystem and severely changes the stream’s ability to treat water that is used as clean and plentiful waters (Walsh, Fletcher, and Ladson, 2009). Pollutants highly influence stream chemistry and may decrease the ability of chemical uptake by stream soils and species to support clean and plentiful waters (Dosskey et al, 2010).

***Demander*** – not applicable

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

***Supplier*** – Streams and rivers provide resources for spiritual, symbolic, religious and social experiences. For example, the Greeks and Romans have used streams to represent inspiration in their poetry and stories because they believed the ecosystems were holy (Crowther, 1979).

***Driver*** – The ability of streams and rivers to provide spiritual, symbolic, religious and social experiences are affected by water use and impairment by metals and nutrients. Pollutants highly influence stream chemistry and may decrease the ability of chemical uptake by stream soils and species to support clean and plentiful waters (Dosskey et al, 2010). This may prevent individuals from enjoying water for these experiences.

***Demander*** – not applicable

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

***Supplier*** – Streams and rivers supply clean and plentiful waters for physical and intellectual human interactions. These ecosystems supply aquatic species that provide experiences like fishing (Willis and Garrod, 1999), education, and aesthetics (Moyle, 1986). In addition, activities like boating and swimming can occur in these ecosystems.

***Driver*** – Pollutants and water use impacts the ability of humans to physically and intellectually interact with clean and plentiful waters provided by rivers and streams. Scientists have found that contamination sources from animal fecal wastes can harm individuals who swim in waters polluted from coliform bacteria and have a high chance of gastrointestinal illness (Calderon, Mood and Dufour, 1991).

***Demander*** - not applicable

**Sources:**

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