**Ecosystem Type: FORESTS**

**Category: Recreation, Culture, and Aesthetics**

1. **Materials**

***Supplier*** – Forests are suppliers of materials that enhance the livelihood of people. One study found that the loss of forests link to increasing poverty, especially for individuals that live in developing countries (Sunderlin et al, 2005). Areas that promote community forestry have an impact on household income because the harvested timber can be sold in the market (Malla, 2000). Wildlife in the forests also provide materials for people. For example, bats have been hunted recreationally for food across the world (Craig and Syron, 1992).

***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*** – Protecting forests from activities such as mining can help reduce the negative effects produced. Mining may cause an increased exposure to nickel ore deposits, which can decrease the species composition (Jaffre, Munzinger, and Lowry II, 2010). Listing trees in the International Union for Conservation of Nature (IUCN) can forbid harmful actions, and require greater coordinated efforts that maintain the integrity of the ecosystem (Jaffre, Munzinger, and Lowry II, 2010).

***Driver*** – The increasing occurrence of nitrogen deposition can cause soil acidification, which raises the presence of ammonium (Bobbink, Hornung, and Roelofs, 1998).

***Demander*** – not applicable

1. **Mediation of Flows**

***Supplier*** – There are different types of forests that depend on the flow of water so people can enjoy them recreationally, culturally, and/or aesthetically. For example, swamp and mangrove forests need water for proper functioning. Learning how to manage them requires understanding of their hydrology (Lewis III, 2005). Applying this understanding with a program like the International Union for Conservation of Nature or the Gap Analysis Program (GAP) can improve the presence of forests for use by people.

***Driver*** – not applicable

***Demander*** – not applicable

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

***Supplier*** – The presence of forests for recreation, culture, and aesthetics is influenced by a variety of factors. Initiatives like the red list and Gap Analysis Program (GAP) protect forests because they promote the maintenance and care for trees (Stoms, 2000). The red list was established by the International Union for Conservation of Nature (IUCN) and ranges species on a scale of least threatened to extinct. Several countries have participated in this program to identify trees that need to be protected so the effects of deforestation are minimized (Gonzalez-Espinosa et al, 2011). GAP allows land managers and planners to categorize ecosystem types like forests into specific biogeographic sites to improve management techniques (Jennings, 2000).

***Driver*** – Certain gaseous elements affect the provision of trees for recreation, culture, and aesthetics. One major driver of change in forests is the deposition of nitrogen to the environment from pollutants (Arbaugh et al, 2003, Bowman et al, 2008). A study found that areas with high nitrogen pollution had the greatest change in forest composition where trees with greater tolerance to ozone pollutants outgrew the more sensitive species (Arbaugh et al, 2003). Nitrogen deposition can increase the acidity in soil, which can reduce the biomass of plants such as ferns, conifers, and flowering plants (Bowman et al, 2008).

***Demander*** – not applicable

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

***Supplier*** – There are people that have a sense of enjoyment when they know that forests still exist (Diaz et al, 2006). The loss of forest biodiversity can affect the human well-being because they know that this impacts the necessities of life.

***Driver*** – not applicable

***Demander*** – not applicable

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

***Supplier*** – Studies have shown that forests provide humans an experience that leaves them feeling happier and closer to nature (Williams and Harvey, 2001).

***Driver*** -not applicable

***Demander*** - not applicable

**Sources:**

Arbaugh, M. et al (2003) Photochemical smog effects in mixed conifer forests along a natural gradient of ozone and nitrogen deposition in the San Bernardino Mountains. *Environment International*, *29*(2-3), 401-406. <https://doi.org/10.1016/S0160-4120(02)00176-9>.

Bobbink, R., Hornung, M., and Roelofs, J.G.M. (1998) The effects of air-borne nitrogen pollutants on species diversity in natural and semi-natural European vegetation. *Journal of Ecology, 86*(5), 717-738. DOI: 10.1046/j.1365-2745.1998.8650717.x. [abstract only]

Bowman, W.D. et al (2008) Negative impact of nitrogen deposition on soil buffering capacity. *Nature Geoscience, 1*, 767-770. doi:10.1038/ngeo339. [abstract only]

Carr, D.S., and Williams, D.R. (1993) Understanding the Role of Ethnicity in Outdoor Recreation Experiences. *Journal of Leisure Research, 25*(1), 22-38. [abstract only]

Craig, P. and Syron, W. (1992) Fruit Bats in American Samoa: Their Status and Future. *Biological Report,* 90(23), 145-149.

Diaz, S. et al (2006) Biodiversity loss threatens human well-being. *PLoS Biology, 4*(8): e277. DOI: 10.1371/journal.

Gonzalez-Espinosa, M. et al (2011) *The Red List of Mexican Cloud Forest Trees.* Fauna and Flora International: Cambridge, UK. ISBN: 9781903703281.

Jaffre, T., Munzinger, J., and Lowry II, P.P. (2010) Threats to the conifer species found on New Caledonia’s ultramafic massifs and proposals for urgently needed measures to improve their protection. *Biodiversity Conservation, 19*(5), 1485-1502. <https://doi.org/10.1007/s10531-010-9780-6>. [abstract only]

Jennings, M.D. (2000) Gap analysis: concepts, methods, and recent results\*. *Landscape Ecology, 15*(1), 5-20. <https://doi.org/10.1023/A:1008184408300>. [abstract only]

Lewis III, R.R. (2005) Ecological engineering for successful management and restoration of mangrove forests. *Ecological Engineering, 24*, 403-418. doi:10.1016/j.ecoleng.2004.10.003.

Malla, Y.B. (2000) Impact of community forestry policy on rural livelihoods and food security in Nepal. *Unasylva, 51*(202), 37-45. [abstract only]

Stoms, D.M. (2000) GAP management status and regional indicators of threats to biodiversity. *Landscape Ecology, 15*(1), 21-33. <https://doi.org/10.1023/A:1008105026956>. [abstract only]

Sunderlin, W.D. et al (2005) Livelihoods, Forests, and Conservation in Developing Countries: An Overview. *World Development, 33*(9), 1383-1402. doi:10.1016/j.worlddev.2004.10.004.

Williams, K., and Harvey, D. (2001) Transcendent Experience in Forest Environments. *Journal of Environmental Psychology, 21*(3), 249-260. doi:10.1006/jevp.2001.0204.