

Artificial Light Effects on Plants and Wildlife

Artificial night lighting is typically used to provide benefits such as an increase in safety and crime prevention, enhanced recreation, and aesthetics. Its widespread use varies in intensity by several orders of magnitude from faint skyglow reflected from distant cities to direct illumination of urban and suburban areas. While artificial lighting can provide benefits to people it can also affect plants and wildlife.

Plants and wildlife depend on the daily sun cycle to govern behaviors such as reproduction, nourishment, and sleep and to provide key information by enabling vision, regulating circadian cycles (i.e., biological processes that follow a 24-hour cycle), and phenological events. When used in more natural settings artificial night lighting alters the timing, distribution, and wavelength of light cycles. As a result, artificial light can affect circadian rhythms and other critical behaviours (e.g., foraging, reproduction, communication) in both plants and wildlife.

The effects of artificial light on plants have mostly been documented under experimental conditions similar to levels for artificial night lighting, and fewer studies have examined effects in the natural world or the effects of diffuse or ambient light. Artificial lighting can influence the response of plants to photoperiod, including increased foliar injury, increased frost damage from the retention of leaves later into the fall and earlier bud-burst in the spring, increased flower production, flower failure, and abnormal plant development. Alterations to budburst and leaf-fall may also increase exposure and damage by fungal pathogens and browsing by herbivores. The spectrum of light used for artificial night lighting is also a factor, as the regions of the spectrum to which plant photoreceptors are sensitive overlaps with the high red to far-red ratio of most common forms of outdoor lighting and the blue-rich light from LEDs. Most effects of artificial lighting have been documented with deciduous trees and domesticated plants, and the effects on herbs, shrubs, and native plants are less known.

The number of studies investigating the effects of artificial night lighting on wildlife has been increasing. Most effects of night lighting arise from the disruption of circadian rhythms, which influence a range of species interactions, physiological processes and behaviours (e.g., movement, migration, reproduction, foraging). Species specific effects include increased or decreased mortality and injury (i.e., due to predation or collisions with buildings), attraction or avoidance of lit areas, and orientation or disorientation from artificial light. Artificial lighting may create barriers for species that avoid lit areas or have increased predation rates resulting in the fragmentation of habitat. The hues of artificial light from LED lamps can also negatively affect wildlife: blue and white hues were found to be the worst, and yellow, amber and green were found to be more benign. Wildlife that are known to be negatively affected by artificial lights

include mule deer (*Odocoileus hemionus*), deer mice (*Peromyscus maniculatus*), nocturnal migrating birds, nocturnal moths, and some slow-moving bat species (e.g., *Rhinolophus hipposideros*). Nocturnal migrating birds in particular can be disoriented by artificial lighting, resulting in collisions with buildings and other artificial structures when lighting is visible to the sky or not shielded. Conversely, a lack of response to artificial lighting has been documented in some species such as racoons (*Procyon lotor*), Pacific tree frogs (*Pseudacris regilla*), mink (*Neovison vison*), and striped skunk (*Mephitis mephitis*).

Potential Concerns within Bowen Park

The vegetation in Bowen Park is primarily mature second-growth forest, although portions of the park have been partially cleared and seeded with grass. The forested portion is mixed deciduous and coniferous, including western redcedar (*Thuja plicata*), bigleaf maple (*Acer macrophyllum*), Douglas fir (*Pseudotsuga menziessi*), grand fir (*Abies grandis*), western hemlock (*Tsuga heterophylla*), and red alder (*Alnus rubra*). The shrub and herb layers are well-developed in areas but invasive species such as English ivy (*Hedera helix*), Daphne laurel (*Daphne laureola*), English Holly (*Ilex aquifolium*) and Himalayan blackberry (*Rubus armeniacus*) are well-established. Due to the lack of knowledge of the effects of artificial lighting on herbs, shrubs, and coniferous trees, potential effects are likely limited to deciduous trees (e.g., bigleaf maple, red alder). These species are common and abundant in the City. They make up less than one third of the trees present and may already be affected by artificial light from the surrounding city. Overall, there is little evidence to suggest that there would be any significant adverse effects of lighting on plants within the park and the potential to adversely affect listed or notably important plants is considered to be very low.

Several listed species of wildlife have been documented in Bowen Park, including Band-tailed Pigeon (*Patagioenas fasciata*), Common Nighthawk (*Chordeiles minor*), Great Blue Heron (*Ardea herodias*), and Olive-sided Flycatcher (*Contopus cooperi*). Many species of nocturnal migrant songbirds have also been documented in Bowen Park and artificial lighting could have a negative effect if not properly directed or shielded.

With appropriate light selection, placement and shielding, the potential for significant adverse effects on wildlife is also considered to be relatively low. There are no specific species or populations of concern that would warrant a more detailed analysis given the light options being considered at Bowen Park. Furthermore, the trail is not within or immediately adjacent to specific environmentally sensitive habitats or ecosystems of concern such as watercourses, riparian areas or significant migratory routes of sensitive species.