

## **Dark Sky Research – Human Health and Wildlife Impacts**

### **Summary:**

This accompanying white paper summarizes Dark Sky research conducted by staff to date, and information that has contributed to staff's development of an informational presentation and policy options, presented to the Planning, Building, Zoning and Environment Committee.

### **Human Health**

#### Areas of focus

- Disability Glare
  - Hormonal Disruption
  - Night Sky Heritage and Inherent Cultural Value
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- Nighttime glare is a reduction of visual function caused by light elsewhere in the field of vision<sup>1</sup>. It is an impact of intense blue light being emitted from outdoor light fixtures, causing hazardous roadway conditions<sup>2</sup>. A method to control this impact is through shielding of fixtures and reducing temperature rating of emitted light, as is recommended by the American Medical Association<sup>3</sup>.
  - Unnecessary outdoor artificial light at night (ALAN) can contribute to health concerns over sleep patterns. Low levels of exposure to blue light illuminance can cause disruptions to an individual's circadian rhythm via melatonin suppression<sup>4</sup>. There is some

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<sup>1</sup> (Aslam et al., 2007)

<sup>2</sup> (Bullough et al., 2008)

<sup>3</sup> (American Medical Association, 2016)

<sup>4</sup> (Council on Science and Public Health, 2012)

research to suggest disrupted sleep is a risk factor for chronic diseases such as hypertension, diabetes, and heart disease<sup>5,6,7</sup>.

- There is an inherent cultural value to the night sky as a source of inspiration, education, and beauty. By obscuring the night sky, light pollution disconnects people from this shared natural heritage<sup>8,9,10</sup>. Dark night skies are defined as an air-quality related value under the Clean Air Act<sup>8</sup>.

## Wildlife

### Areas of focus

- Migratory Birds
  - Nocturnal Reproduction
  - Predation
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- Bird species are at risk of becoming attracted to and disoriented by ALAN and crashing into buildings, increasing mortality, particularly during seasonal migratory patterns<sup>11,12,13</sup>. Lake County falls in the Mississippi Flyway Zone, where thousands of birds die each year from collisions with illuminated buildings<sup>11,14</sup>. Some methods demonstrated to be effective at controlling this impact have been maintaining unlit areas, reducing the duration of lighting, reducing trespass of lighting, and changing intensity of lighting<sup>11,13,15</sup>.

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<sup>5</sup> (Dudley, 2019)

<sup>6</sup> (Itani et al., 2017)

<sup>7</sup> (Yin et al., 2017)

<sup>8</sup> ("Night Skies Resource Brief," 2020)

<sup>9</sup> (Forest Preserves of Cook County, 2021)

<sup>10</sup> (Davis, 2021)

<sup>11</sup> (Ruppenthal, 2019)

<sup>12</sup> (Horton et al., 2019)

<sup>13</sup> (Cabrera-Cruz et al., 2018)

<sup>14</sup> (Migratory Bird Program Administrative Flyways, 2022)

<sup>15</sup> (Gaston et al., 2012)

- For many species, interactions with mates occur at nighttime. ALAN can negatively affect the ability of these species to effectively communicate their courtship dialogues and thereby reduce reproduction rates<sup>16</sup>.
- With greater lighting intensity comes a greater ability for predation of insects and other prey animals, impacting populations of both predators and prey<sup>17,18</sup>. Changes to interspecies interaction due to ALAN such as this can reduce an area's suitability as habitat for native species. Insects have demonstrated an attraction to artificial light and with insect population sizes on decline, ALAN further disrupts the balance of nocturnal ecology<sup>19,20</sup>.
- Kozushima Island, Japan, documented the return of nesting sea turtles after they retrofitted their lights to be warm-colored and fully shielded, and eliminated light spill on critical nesting habitat<sup>21</sup>.

## **Public Safety**

### Areas of focus

- Crime
  - Traffic Collisions
- Reducing street lighting trespass or duration has not been shown to have an impact on the aggregate counts of crime in an area<sup>22,23</sup>. For alleyways, there is research to suggest

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<sup>16</sup> (Firebaugh & Haynes, 2019)

<sup>17</sup> (Minnaar et al., 2014)

<sup>18</sup> (Miller et al., 2017b)

<sup>19</sup> (Davies, 2022)

<sup>20</sup> (International Dark-Sky Association, 2016)

<sup>21</sup> (Wilson, A. 2023)

<sup>22</sup> (Steinbach et al., 2015)

<sup>23</sup> (Tompson et al., 2022)

increased lighting increases rates of violent, property, and other types of crime<sup>24</sup>.

Directing light where it is needed at the ground can be achieved while shielding light from the sky.

- Reducing street lighting trespass or duration has not been shown to have an impact on the aggregate counts of traffic collisions in an area<sup>21</sup>. Glare from ALAN can create hazardous driving conditions, increasing the risk of collisions<sup>3</sup>.

## Marketing

- Outdoor Lighting Market
  - Signage
  - Location Lighting
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- The outdoor lighting market is expected to experience high growth over the next ten years, with highest increases in the Streets category and Smart Lighting technology as local governments focus on diminishing energy expenditures, decreasing maintenance costs, enhancing safety in public spaces, and reducing environmental impacts<sup>25,26</sup>.
  - According to a survey conducted by FedEx, 76% of Americans have entered a store they have never visited before based on its signage, 68% have made a purchase because a sign was noticed<sup>27</sup>. Preventing upward directing of light from signage does not prevent visibility to customers from below or on the street.
  - There is market research suggesting consumers prefer outdoor lighting that is warmer in temperature, considering it more likeable, more inviting, and more appropriate for use

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<sup>24</sup> ("The Chicago Alley Lighting Project: Final Evaluation Report," 2000)

<sup>25</sup> (Williams, 2022)

<sup>26</sup> (Shikha, V., Roshan, D., 2023)

<sup>27</sup> (FedEx Office Survey: Standout Signs Contribute to Sales, 2012)

than cooler temperature lighting<sup>28</sup>. In addition, it's been demonstrated brands which demonstrate a commitment to sustainability outperform competing brands which do not<sup>29</sup>.

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<sup>28</sup> (Shakir & Narendran, 2002)

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