PATRICIA CULLIGAN, Ph.D.

DEAN OF THE UNIVERSITY OF NOTRE DAME'S COLLEGE OF ENGINEERING

Patricia Culligan is the Matthew H. McCloskey Dean of the University of Notre Dame's College of Engineering. Since her appointment on August 1, 2020, she has overseen and supported its 200 faculty, 100 staff, and 2,500 students, undergraduate, graduate, and postdoc. Culligan previously was Department Chair and Carleton Professor of Civil Engineering and Engineering Mechanics at Columbia University. While at Columbia, she was the founding associate director of Columbia's Data Science Institute; a member of the Executive Committee of the Earth Institute; and Co-Founder of the Collaboratory @Columbia, which supports the development of cross-cutting curricula for a data-rich world. She also served as Columbia Engineering's vice dean of academic affairs.

Culligan is a Chartered Engineer, registered with the UK Engineering Council, and a Fellow of both the American Society of Civil Engineers and the British Institution of Civil Engineers. She is internationally recognized for her expertise in water resources and environmental engineering. Her research focuses on sustainable urban infrastructure, and the application of advanced measurement, sensing, and modeling techniques to improve water, energy, and environmental management. Some of her recent work examines the role of green infrastructure in supporting urban sustainability, and human health and well-being in the face of environmental stressors.

Culligan earned her doctorate and master's degrees in Engineering from the University of Cambridge. She holds a bachelor's degree in Civil Engineering from the University of Leeds. She also earned a diploma in Language, Literature, and Civilization from the Université d'Aix-Marseille III. She is the author or co-author of seven books, seven book chapters, and more than 175 technical articles. In 2021, the American Society of Civil Engineers awarded her the H. Bolton Seed Medal for expanding the boundaries of geo-environmental and sustainability engineering.

The Wonder of Nature

PATRICIA CULLIGAN, Ph.D.

I wandered lonely as a cloud
That floats on high o'er vales and hills,
When all at once I saw a crowd,
A host, of golden daffodils.

William Wordsworth's poem beautifully conjures the wonder and delight that nature can evoke in the midst of everyday human activity, uplifting spirits, alleviating angst, and inspiring moments of pure joy.

The connections between nature, human health and well-being, and happiness are strong and well-studied. In several recent collaborative research projects in which I was privileged to engage, we identified clear relationships between connectedness to nature and subjective well-being. Participants interviewed in a New York City park reported high levels of happiness strongly correlated to feeling a breeze, seeing trees, and gazing at an open sky.[1]

We also found that people's access to nature, and especially green spaces, correlated with higher levels of subjective well-being during the early stages of the global COVID-19 pandemic, when many found themselves isolated and deprived of activities that they value.[2]

Furthermore, our study into the linkages between green infrastructure and perceptions of urban greening strategies demonstrated that vegetation ranks highly among the benefits that people most frequently identify with urban green infrastructure programs.[3]

While the scientific data that my collaborators and I collected can confirm the beneficial effects of human connectedness to nature, our data cannot explain the origins or details of this connection.

Theories regarding the evolutionary origins of human affiliation with nature have, however, been put forward.

For example, the Biophillia Hypothesis proposes the existence of an ancestral adaptation that drives humans to appreciate natural environmental conditions, because such an emotional attachment is beneficial for survival. The more recent Topophilia Hypothesis suggests that human connectedness with nature is better characterized as a developmental behavioral system that is based on gene adaptation, as well as on local environment interactions that promote cultural learning.[4]

In addition, a study by Yang et al.[5] points to a relationship between one's experiencing awe, a self- transcendent emotion, and one's connectedness to nature. Steller et al.[6] describe awe as an emotion that promotes prosocial behavior and collaboration, because it is characterized as a response to *being in the presence of something vast that the individual does not immediately understand*. Evolutionary claims about the function of awe are founded on the importance of reducing self-interest in order to achieve group goals necessary for survival.

When connecting to nature, people report sensing a greater presence and a wonder at the *existence* of the world. This kind of wonder is separate from curiosity about how our world evolved and how it functions. Understanding the origins and details of our connectedness to nature is not enough to explain our wonder at *existence*.

Quoting the Papal Encyclical Laudato si': "*From panoramic vistas to the tiniest living form, nature is a constant source of wonder and awe. It is also a continuing revelation of the divine."* (LS85)

Footnotes:

1. M. Maurer, L. Zaval, B. Orlove, V. Moraga, and P. Culligan, "More than Nature: Linkages Between Well-Being and Greenspace Influenced by a Combination of Elements of Nature and Non-Nature in a New York City Urban Park," *Urban Forestry & Urban Greening*, 2021, doi: 10.1016/j.ufug.2021.127081.
2. M. Maurer et al., "Understanding Multiple Dimensions of Perceived Greenspace Accessibility and Their Effect on Subjective Well-Being During a Global Pandemic," Frontiers in Sustainable Cities, 2021, doi: 10.3389/ frsc.2021.709997.
3. R. M. Elliott et al., "Identifying Linkages Between Urban Green Infrastructure and Ecosystem Services Using an Expert Opinion Methodology," Ambio, 2020, doi: 10.1007/s13280-019-01223-9.
4. T. Beery, K. Ingemar Jönsson, and J. Elmberg,"From Environmental Connectedness to Sustainable Futures:Topophilia and Human Affiliation with Nature," *Sustainability* (Switzerland), 2015, doi: 10.3390/su7078837.
5. Y. Yang, J. Hu, F. Jing, and B. Nguyen, "From Awe to Ecological Behavior: The Mediating Role of Connectedness to Nature," *Sustainability* (Switzerland), 2018, doi: 10.3390/su10072477.
6. J. E. Stellar et al., "Self-Transcendent Emotions and Their Social Functions: Compassion, Gratitude, and Awe Bind Us to Others Through Prosociality," *Emotion Review*, 2017, doi: 10.1177/1754073916684557.