# Bio-transition zone: Reintroduction of biodiversity through vegetated, dynamic building envelope systems

by

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# ABSTRACT

Throughout the Industrial and Post-Industrial Ages humankind has become ever more divorced from its natural relationships. We as a species have evolved not in the sterile, air-conditioned environs in which we now reside, but in an interdependent relationship with the larger ecosystem; our very DNA holds the record of human-environment interaction throughout time. But what of the benefits of modern living that are associated with this increasing separation from natural environmental systems? The conveniences and comforts we experience today within our mechanically-controlled environments have largely become necessary to society's functioning, however economically and environmentally costly. The concrete jungles of today have become barren landscapes where only the most resilient species can exist. Cities have supplanted natural environments rich in biodiversity through the nearly exclusive utilization of impervious materials. Studies now prove that high levels of biodiversity improve the health of all species, including humans,[1,2,3,4] by permitting beneficial biological processes that otherwise maintain natural environments. The challenge within contemporary cities lies with the justification and means of reintroducing biodiversity into currently constrained built environments. If buildings incorporated vegetated landscapes into the building envelope, biodiversity would increase, the urban heat island effect would diminish, indoor and outdoor air quality would improve, mechanical loads on building systems would reduce, storm water runoff would be mitigated, and public health and welfare would dramatically improve.

To provide a means for contextual comparison, I explore the island of Manhattan at three time points: 15th century Mannahatta, Manhattan today, and a version of Manhattan that is projected into the near future as a biological hybrid city named Biome-Manhattan. I present four scales known today as macro, meso, local, and micro at each of the three


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[1] Grifo, Francesca, Joshua Rosenthal, and Thomas E. Lovejoy. "Biodiversity and Human Health: A Guide for Policymakers." Washington, D.C.: Island Press, 1997. 1-8.
[2] Robinson, J. G. "Conservation Biology and Real-World Conservation." *Conservation Biology* 20 3 (2006): 658-69.
[3] Connery, K. "Biodiversity and Urban Design: Seeking an Integrated Solution." *Journal of Green Building* 4 2 (2009): 23-38.
[4] Pullin, A. S., and T. M. Knight. "Doing More Good Than Harm - Building an Evidence-Base for Conservation and Environmental Management." *Biological Conservation* 142 5 (2009): 931-34.

time points. The scope of this investigation will focus on the development and analysis of the incorporation of biodiversity into the facades of existing buildings in Manhattan via retrofit and imply the immediate quantitative benefits that can be achieved through the improvement of air quality, alteration of wind speed, and temperature mitigation for the indoor and outdoor built environment while maintaining the primary focus on qualitative benefits. Case studies examine current technologies of vertical garden systems, double-skin façade implementation, and vegetated double-skin façade systems. Design consideration will investigate retrofitting existing building construction types with Bio-transition zones to illustrate the future implications of substantially reintroducing biodiversity back into human urban environments. Special consideration is given to the importance of contact to the soil layer to facilitate maximizing biodiversity.