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**Exposure and Stream Corridor Based Recreation**

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## **Review of Literature: Potential Benefits of Urban Nature Exposure and Stream Corridor Based Recreation**

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### **Abstract**

This paper examines research and theories which support the argument that within the context of the urban ecosystem, natural areas such as parks, greenways, and stream corridors as places for recreation and leisure have potential to provide a multitude of benefits to the health and quality of life of people living in and visiting urban environments. These benefits contribute to those which are already being realized in more natural areas, such as restoration from mental fatigue and improved sense of wellbeing. This is important because most people in the United States and many other parts of the world live in urban areas, and the number is growing (Grimm, Feath, Golubewski, Redman, Wu, Bai & Briggs, 2008). To ensure that this growing population has access to opportunities that could contribute to a healthy and satisfying quality of life, all potential resources for recreation and leisure, such as those mentioned above, should be explored for possible utilization.

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**Keywords:** urban nature; health benefits; urban streams; outdoor recreation

### **Rationale: Benefits of Urban Stream Corridors as Nature**

From a public health perspective, in the United States (U.S.), as in other industrialized and technology-dominated places in the world, there is a rising number of health problems that are associated with urban living, unhealthy lifestyles, the changing nature of work, and the mental demands that fulfilling work obligations may entail. Much of the world's population lives in urban areas, and the numbers are growing. Thus, there is a need to recognize and support existing and emerging opportunities for enhancement of public health that may be found in urban areas.

### **Population Trends**

Recent global population patterns show a shift from most people residing in rural or non-urban areas to a majority inhabiting urban areas. Since the year 1900, the total percentage of the global population that lives in urban environments has changed from 10% to more than 50% (Grimm, et al., 2008). Ninety five percent of the total increase in global population over the next 40+ years is anticipated to occur in cities and urban areas (Grimm, et al., 2008). Because in the foreseeable future most of the world's population will live in urban areas, it is important to explore the opportunities that may be found in urban nature. This review discusses current research areas in human health and natural environments that could be related to outdoor recreation and leisure. Nature has been conceptualized as a source of potential benefits for human health and wellbeing, as a place for relaxation, exercise, contemplation, and as a way to offset the stresses of living and working in modern contexts.

### **Current State of Human Health in Developed Countries**

Obesity from inactivity and poor diet, mental fa-

tigue and stress from an increasingly technology oriented nature of work, extended screen use, and living in the built urban environment are just a few examples of the health and wellbeing issues that we are facing as a modern society (Jiang, Li, Larsen, & Sullivan, 2014). Children today are spending less time in outdoor play, persons ranging in age from 8 to 18 years spend over 7 hours per day engaged in some type of screen oriented media, and visits to the National Parks have dropped 20% since 1981 (Atchley, Strayer & Atchley, 2012). Some health problems that have been associated with mental stress and fatigue are immune system suppression, cancer, stroke, and depression (Jiang, et al., 2014). In the U.S., obesity from inactivity and poor diet, mental fatigue from an increasingly technology oriented nature of work, mental stress from extended screen use, and living in the built urban environment mostly separated from the systems that provide for us are just a few examples of the health and wellbeing issues that we are facing (Jiang, et al., 2014).

### **Nature and Human Health**

Human health has been defined by the World Health Organization as a "state of complete physical, mental, and social wellbeing and not merely the absence of disease" and refers to the emotional, environmental, intellectual, physical, social, and spiritual health of humans (World Health Organization, 2006). The benefits of multiple types of exposure to nature have been considered as a treatment for current and rising health problems such as obesity, high blood pressure, heart problems, and increasingly sedentary lifestyles fostered by living in modern contexts (Dustin, Bricker & Schwab, 2010). Research suggests that there are relationships between outdoor recreation participation and health benefits (Dustin et al., 2010). Quality of life is a conceptual framework that is related to human health, and is a

“multidimensional construct that has subjective and objective components, and is influenced by personal and environmental factors” (Wang, Schlalock, Verdugo, & Jenaro, 2010, p.218). Beyond the ecosystem services that urban natural areas such as stream corridors and linear parks provide, as places for recreation, leisure, and self-propelled transportation, they should be thought of as a resource for maintenance and improvement of the quality of life.

### **Theoretical Background**

#### **Attention Restoration Theory**

The Kaplans’ (Kaplan & Kaplan, 1989; Kaplan, 1995) Attention Restoration Theory (ART) has been used to study many different types of ways in which the human animal may use certain environments and settings as means to restorative ends, specifically those settings containing some element of nature, as a way to restore mental energies and mental fatigue. Some of the discussion surrounding current research will reference some of the components of ART, so an explanation of the theory is hereby deemed relevant. ART is conceived from an evolutionary perspective (Kaplan, 1995), and postulates that people only have so much directed attention, which is the kind of mental attention needed to work in a high level of cognitive functioning and complete the types of complex tasks that are common in our every day lives, such as writing, organizing, reading, and other tasks that take concentration and directed mental energies (Kaplan & Kaplan, 1989). Directed attention is willful, voluntary, focused, takes effort (James, 1892), and is “susceptible to fatigue” (Kaplan, 1995, p.171). It has also been indicated as being crucial for a person’s ability to inhibit impulsive behavior, acting or speaking without thinking, or acting in socially unacceptable ways (Kaplan, 1995). From an evolutionary

standpoint, “this apparent limitation might have been quite reasonable” (Kaplan, 1995, p. 171).

To be able to pay attention by choice to one particular thing for a long period of time would make one vulnerable to surprises. Further, much of what was important to the evolving human-wild animals, danger, caves, blood... was (and still is) innately fascinating and thus does not require directed attention.” (p.171).

In the way that a reservoir can run out of water if the volume of water leaving the dam is greater than that which is flowing in from tributary streams, directed attention is thought to be a finite mental resource (Kaplan, 1995). It can be depleted with intensive or prolonged use without opportunity to replenish the mechanisms of the brain that operate to perform tasks requiring intense focus and directed attention (Kaplan & Kaplan, 1989). A person is said to be in a state of mental fatigue if the outflow of mental energies has been depleted with unmatched chance for restoration, or inflow of attentional resources. Symptoms or signs of mental fatigue can be “inaccuracy, impulsivity, irritability, and incivility” (Herzog, Maguire, & Nebel, 2003, p. 159).

ART postulates that natural environments can be settings in which a restoration of attention and cognitive functioning capacity may occur; these settings are known as restorative settings (Kaplan & Kaplan, 1989). An experience in a restorative setting engaged in outdoor recreation or adventure may have human health benefits such as recovery of directed attention capacity, reflection, and “clearing away mental noise” (Herzog, Maguire, & Nebel, 2003, p.159). The components that make up restorative settings in ART (Kaplan

& Kaplan, 1989) are being away, fascination, extent, and compatibility.

Being away refers to settings where a person can be physically or mentally “away” from everyday settings and situations that may require directed attention (Kaplan, 1995). It is believed that modern settings and built and urban environments which require or evoke mental processes that are different than those used in nature interactions result in mental fatigue. Being away in nature or novel environments enables the mental processes involved in directed attention to rest (Herzog, et al., 2003). Fascination refers to “effortless attention” (Herzog, Maguire, & Nebel, 2003, p. 160), and refers to a setting in which the attention by a person is held without any directed effort required (Kaplan, 1995). Soft fascination leaves some mental capacity to let the mind wander, contemplate, and reflect inwardly. Softly fascinating settings may contribute to experiences in nature being restorative (Kaplan et al., 1998; Herzog et al., 2003). Natural settings generally have fascinating qualities such as clouds, birds, varied textures and colors of the physical landscape, water and its reflections, and trees swaying in the breeze, all of which may capture the attention of people without them having to concentrate or apply directed attention (Kaplan, 1995). Extent refers to the quality of a landscape where it contains sufficient content and structure to distract, softly engage, and occupy the mind for long enough to relieve it of the burdens of using directed attention (Herzog, et al., 2003). Compatibility refers to the ways in which a setting may fit with the goals of a person and the ability of the setting to accommodate those goals. Natural settings are thought of as being highly compatible with the inclinations and purposes of those people who seek them (Kaplan, 1995).

### **Psycho Evolutionary Theory**

Psycho Evolutionary Theory (PET: Ulrich, 1983) proposes that recovery from mental and physical stress occurs in settings that evoke interest, pleasantness, and calm (Ulrich, 1983). Certain landscapes, such as streams, may have structural components that are associated with restoration (Ulrich, 1983). And, “humans are attracted to relatively calm water or relatively open vistas because they represent evolutionary designated places of safety, shelter, or refreshment” (Ewert et al., 2014, p.73). Streams are ideal environments for finding scenes with the dimensions of nature that are associated with stress relief, which are structure, depth, and content (Han, 2001).

Structure refers to the visual complexity of an environment (Han, 2001). An urban river or stream and corridor, which may still have some views of a complex and distracting man made environment, may still have lower visual complexity as compared to concrete dominated sections of the urban environment. Rivers certainly have depth, which includes visually aesthetic elements (Ewert et al., 2014) such as unique textures of the rocks, trees, and plants that line an urban stream, the visual element of the constantly changing texture of the surface of the water, landscape reflection in the water, and the potentially aesthetically pleasing vistas that change with every turn in the stream as one travels through its corridor. Rivers also have environmental content, which refers to the qualities of a natural environment that may be perceived to provide support to human life (Ewert et al., 2014). As a place of support, rivers have historically provided security of food, water, and transportation for humans. Like ART, Psycho Evolutionary Theory is an explanatory framework that offers further support to the idea that experiencing urban nature can have benefits to the health of people.



### **Promoting Human Health: Urban Green Pathways and Water Based Recreation**

The following section is intended to provide definitions for a subsequent discussion of research relevant to outdoor recreation and leisure in urban natural areas in promotion of physiological and psychological dimensions of human health. As previously stated, most people live in urban or urban proximate areas, and as such, many people do not have financial, time, or transportation access to areas with higher degrees of naturalness or wilderness. Specifically, this document creates an argument for the use of urban natural areas such as urban proximate nature trails, designated pathways through tended and untended natural areas on/through college campuses, and greenway trails (often running along rivers and streams) as places for physical and psychological maintenance through walking, jogging, bicycling (for leisure or transportation utility), and contemplation. Also discussed is the use of river trails for canoeing, kayaking, and stand up paddle boarding as forms of exercise for physiological maintenance, and interaction with novel environments for stress relief and psychological health. Lastly, this article creates an argument for promoting emerging forms of river recreation areas; their uses and potential benefits will be discussed.

#### **Definitions**

**Urban Ecosystem.** Urban landscapes, though dominated by human development, activities, and associated impacts, are still an ecosystem with trees, soil, and animals, which are all impacted by natural forces such as wind, rain, and sunshine, and should be thought of to contain nature. The urban forest is part of the urban landscape, and “includes the present and potential vegetation that provides benefits within a land area associated with and influenced by urban populations” (Hauer,

Casey & Miller, 2008, p.6). Within an evolving urban ecological framework, urban areas are considered “heterogeneous, dynamic landscapes, and complex, adaptive, socioecological systems in which the delivery of ecosystem services links society and ecosystems at multiple scales” (Grimm et al., 2008). As ecosystems, urban landscapes possess to some degree the natural properties that represent those inherent to rural, wild, and nature dominated ecosystems that surround them. Therefore there is still nature in the urban and sub-urban landscape, such as that which is found in the form of street trees, parks, greenways, stream corridors, and areas that may have reverted to a more natural state. As places with aesthetic qualities, urban nature areas and trails therein may impact perceived quality of life and sense of well-being (Chon, 2004).

**Historic Connection: Humans and Water.** Today, as in the past, aquatic environments are held in importance by society and have been cited as a common theme among people’s favorite places (White, Smith, Humphries, Pahl, Snelling & Depledge, 2010). Urban streams and their floodplains, because of their general undesirability for development due to the high potential for destruction or damage of buildings in periods of flood, are generally found as natural areas and may be surrounded by remnant wooded and vegetated corridors. Possible health benefits of spending time in nature in general may also be placed in the same context as spending time in urban nature (such as stream corridors) on established trails and greenways, or as experienced by being on the river in a canoe or kayak, in leisure time. If urban streams are viewed as having some degree of natural qualities, exposure to them should be considered to have some of the same potential benefits.

Urban rivers and streams can be relaxing places, and experiencing them may contribute to

stress relief. As landscapes they offer fewer distractions for the brain and less information to manage than the built environment does, and there are evolutionary connections to why humans are naturally drawn to and enjoy places and scenes with water (Finlayson, 2014). Spending time on or along those streams found in an urban setting may provide a reprieve from the scenes and sounds of the built environment, a welcome change of pace, and a way to experience nature without having to travel far. Ulrich (1983) said that scenes with structure, depth, and content, which may be encountered in urban natural areas. Stream corridors, may “evoke sensations of mild to moderate interest, pleasantness, and relaxation” (Ewert et al., 2014, p.73).

**Urban Nature and Human Health Research.** Recent studies have begun to dissect how the urban ecosystem may provide human benefits beyond ecosystem benefits. Akpinar (2016) studied how the quality of urban green spaces might be associated with physical activity and health, and found multiple linkages between urban green space and health, most significantly, that distance from living space to urban green space is associated with frequency of exercise, level of stress, and mental health. People living closer to urban green space were found to exercise more frequently, and reported lower levels of stress and high levels of mental health. And, Bertram and Rehman (2015) examined how the distance lived from green space impacts life satisfaction and well-being. Another study indicated physiological, attentional, and emotional stress-recovery in urban green spaces (Bowler, Buyung-Ali, Knight, & Pullin, 2010). Clearly there are positive linkages between human health and urban natural areas.

**Nature Based Recreation in Urban Areas.** There are many well-established relationships between increased physical activity and improve-

ments in physiological health, including the prevention of cardiovascular disease, diabetes, various types of cancer, hypertension, obesity, and osteoporosis (Warburton, Nicol, & Bredin, 2006), and other benefits that could be experienced by people using urban nature trails for recreation purposes. Several studies have compared human health benefits of physical activity in nature as compared to physical activity in an urban environment and found that activity in some form of nature is better at contributing to a variety of outcomes (Bratman, Daily, Levy, & Gross, 2015). People may recover more quickly from mental stress and have reduced negative affect and arousal with time spent in settings with natural components as compared to settings with little or no natural values, such as those that are encountered in building dominated urban areas (Jiang et al., 2014).

Higher levels of nature found in urban environments have been positively correlated to more positive mood and stress recovery (Jiang et al., 2014). Studies have shown the psychological benefits of exposure to urban nature areas to be positive impact to mood, vitality, and restoration as compared to those of exposure to a building dominated area (Tyrvaainen, et al., 2014). A meta-analysis about activity in the natural environment that compared measurements of well-being in natural versus non-natural urban environments showed that activity in nature produced a significant decrease in negative feelings such as anger, sadness, and anxiety, and an increase in positive mood, such as tranquility (Bowler et al., 2010). Urban, sub-urban, and proximate nature trails should be viewed and promoted as places with opportunities for engaging in physical activities such as walking and other forms of exercise that have well accepted health benefits. Generally, existing literature supports the notion that there can be multiple and overlapping benefits to spending time in urban natural areas

such as parks, greenway trails, and (where available) stream corridors with/without trails.

**Aqueous Environment.** Because in most urban areas stream corridors are places with natural qualities, it is important to recognize contributions to the literature that strengthen the argument that urban streams and aqueous environments may be places with potential benefits to humans. White et al. (2013) examined feelings of restoration recalled after visits to a variety of natural environments including woodlands, forests and hills, moorlands, and mountains. They found that visits to coastal parks, which are aqueous in nature, were most associated with restoration, and that urban playing fields were associated with least restoration; restoration was positively associated with visit duration, which the authors hint may show a dose-response effect. White et al. (2013) also examined the types of activities related to restoration and in their study concluded that while setting was related to differences in feelings of restoration, activity type is not associated. Several recent studies support the notion that rivers and lakes in urban centers and developed areas have value as natural places in which human health can be maintained or improved (Volker & Kistemann, 2013; White, et al., 2010). Barton and Pretty (2010) studied the emotional states of individuals before and after visits to natural settings, and concluded that, although visits to all natural environments included in the study (urban green spaces, rural landscape, forest/woodland, aquatic environments, and wilderness) were shown to improve mood, visits to aquatic environments were more effective in providing the same effects.

While there have been studies that focus on restorative qualities of aquatic environments, few actually explore which elements of aquatic environments may drive this. White et al. (2010) provided some hypotheses about the mechanisms

through which higher preference for water, positive affect, and restorative properties may be driven. They posit that visual properties and soundscapes of, and the potential for non metaphoric immersion in the aquatic environment may be part of what makes people prefer water landscapes over those with no water and which gives aquatic environments their restorative properties (White et al., 2010). First, because of the ways in which water reflects light (Fernandez & Wilkins, 2008) and the image of the surrounding landscape to the extent that the view is afforded, a type of fascination may be experienced by people viewing the landscape, which supports the notion of ART that fascination is part of what may make an environment restorative. For example, consider the mesmerizing ways in which the surface of any body of still or moving water can dance around, ripple, or perfectly reflect the view of the landscape. This dynamic viewing environment is also weather and condition dependent, ever changing, and a potentially infinite source of restoration through fascination. White et al. (2010) noted that aquatic environments may produce sounds that are more restorative than those found in non-aquatic nature or urban environments, and that as of 2010 there has been no work done associated with water that has “decomposed the restorativeness of different, and particularly aquatic, sounds” (White et al., 2010, p.491). Water provides a unique opportunity for immersion in an aqueous environment (Rew, 2008), which is fundamentally different than the gaseous atmosphere in which we live.

Research has shown that environments, urban and natural, with the element of water are favored over those that are lacking (White, et al., 2013; Volker & Kistemann, 2013; White, et al., 2010). Rivers and streams are conceptually endless sources of fascination including opportunities to encounter things that are, for most people, out of



the ordinary and potentially interesting. Examples of sources of fascination that may be found on rivers and streams (greenways coursing along streams included) are living things such as snails, birds, fish, and plants with flowers; simply watching the reflection and textures of water as it flows over the stream bed can be mesmerizing and fascinating. Being near an aquatic environment may entail encountering a novel environment that is out of the ordinary and constitutes being away from the realm of day-to-day encounters in urban or rural life. Walking along or floating in a canoe or kayak down rivers are ways to engage with an aquatic environment; ever changing sounds of running water may be relaxing. Traveling upon or simply peering into the water from a greenway trail, or seeing where water meets land may distract, engage, and occupy the mind, relieving it of the burdens of having to concentrate or focus intently. Many streams have dynamic qualities, such as changing levels of flow and gradient, pleasant sounds, open views, whitewater, and other dimensions that, depending on the individual, are compatible with goals of those seeking a change from most other terrestrial environments, including the urban landscape. All of these components experienced in any number of combinations may potentially contribute to restoration of mental fatigue.

**Bird Sounds and Restoration.** Though most of the literature that investigates the restorative qualities of nature focuses on the visual components found therein, there is emerging research that deals with the sounds of nature and their contribution to the restorative qualities of nature and recreational or educational experiences that may happen there. As places which may attract and harbor urban wildlife such as songbirds, amphibians, and insects, urban natural areas should be considered for their potential to contribute to human health and wellbeing because they support animals

which may contribute to the restorative potential of an environment.

As places of nature, aquatic environments generally have birds and are thought of places where birds live. Positive relationships were found between listening to sounds of water and bird songs and motivation to work (Jahncke, Hygge, Halin, Green, & Dimberg, 2011). Ratcliffe, Gatersleben and Sowden (2013) identified several dimensions of positive association between bird songs and restoration from attention fatigue and stress in their study on the relationships between bird song and attention restoration and stress recovery. They found that bird sounds were indicated by study participants to be restorative through positive association with pleasant events, and that resulting states of positive mood state and low arousal were perceived to help in alleviating stress (Ratcliffe, et al., 2013).

The acoustic properties of bird songs that may be encountered while recreating in the outdoors, (often melodic, beautiful, and pleasing to the ear) were also found to be associated with participants' ability to relax and recover from stress, as well as making people feel happy (Ratcliffe, et al., 2013). It should be noted that not all bird sounds, such as those made by a crow or raven, were rated positively; sounds made by songbirds were generally associated with positive affect (Ratcliffe et al., 2013). Other dimensions that were found by Ratcliffe, et al. (2013) between attention restoration and stress relief included the welcome distraction and chance for escape from mental demands that bird sounds may provide, which can be related to the concept of fascination in Attention Restoration Theory (Kaplan, 1995), which suggests that natural distractions found in nature can provide an alternative source of mental focus, which is believed to be beneficial to restoration of attention fatigue (Ratcliffe et al., 2013).

Participants in the aforementioned study also noted that the unique qualities of bird songs provide a source of novelty in sound as compared to the common sounds encountered every day in urban environments, and that the novelty of those sounds created a perceived distance from urban life, and provided a symbol for environments that are different from those encountered in urban areas (Ratcliffe et al., 2013); this report is directly related to “being away” (ART, Kaplan, 1995). This is supported by the work of Berlyne (1960; 1971), which suggests that novelty is positively associated with interest and arousal. In essence, the novelty inherent in the qualities of bird song may allow us a mental escape from our stressful everyday environments, which can be related to the ART construct of fascination and being away.

### **Human Health Promotion**

**Greenways and Terrestrial Trails Follow River Corridors.** Smith and Hellmund (1993) cite that greenway corridors are desirable in urban environments because of their ability to contribute to quality of life of humans by providing vegetative cover, places to experience nature, and for aesthetic value. One report indicated that urban river parkways provide health benefits by providing places to exercise and avenues for active commuting, and by contributing to lowering healthcare costs (Jackson, et al., 2014). Also, Jackson et al. (2014) reported positive relationships between river parks and mental health, children’s health, and sense of community for those living in the area. Exercise in nature, such as using urban greenway trails, may mitigate mental fatigue and illness, and simply viewing and spending time in nature has been shown to reduce stress, calm, and have psychologically restorative qualities (Jackson, et al., 2014). Urban environmental and human health can be improved by presence of vegetated river and stream corridors, such as those that would be attrac-

tive for use as greenways and water trails, through well recognized ecosystem services such as slowing, storing, and cleaning storm water, improving air quality, and reducing the urban heat island effect (Jackson, et al., 2014). The quality of life of people living in urban environments may be enriched through water based recreation activities, such as canoeing and kayaking on water trails, which may provide opportunities for wellness through physical activity (Schneider, 2009).

**Urban Streams as Water Trails.** Officially designated and managed river trails are not a new thing, yet water based river trails for canoeing and kayaking located in urban settings are a somewhat recent phenomenon in the U.S. The National Park Service (NPS) says that “water trails are networks of points along the water that people can access using human powered boats” (NPS, 2015). Water based river trails, though under researched, show promise of providing some of the same benefits that have been found through research of urban river parkways, which in essence are the terrestrial version of water based river trails. Because of the environmental, scenic, and ecological benefit parallels that potentially exist with urban river parkways and urban water based trails, findings relevant to benefits of interacting with nature via urban river parkways and terrestrial trails can be applied to urban water trails.

Generally, a section of river or other body of water that is an urban water trail has developed and accessible water access points for canoeing and kayaking, and may have maps, interpretive information, and other useful signage along the route and at access points. Urban water trails may be managed by a municipality, state, or under federal provisions. Current media has shown examples of the rising incidence and popularity of urban water trails. Recently, the U.S. government officially designated several rivers as National Water

Trails for boating and general river access under the National Water Trails System created in 2012, which is written under the National Trails System Act of 1968. It should be made clear that not all National Water Trails are located in urban landscapes, and not all urban water trails are National Water Trails.

Whatever the designation, urban water trails could be considered as linear parks and have been gaining increasing coverage in the media due to recent growth in availability and popularity. For example, in 2012 the Chattahoochee River in and near Atlanta, Georgia was the first river to be designated as a National Water Trail, with a 48-mile section of river designated within the Chattahoochee River National Recreation Area (“Chattahoochee River NRA Water Trail,” 2016). Designation as a National Water Trail means that “signage, technical assistance, and resources will be provided to build on and promote the development of quality water trails” (“Resources and Library: Water & Boating Trails,” 2016). To date, there are several National Water Trails that pass through urban landscapes including those on the Chattahoochee River in Atlanta, the Bronx River in New York, the Hudson River in New York (ends in Manhattan), and the Willamette River in Oregon (“Resources and Library: Water & Boating Trails,” 2016).

Many other urban water trails may be found in cities and urban areas around the country; a quick Google search provided access to information about water trails in Milwaukee, Wisconsin; Detroit, Michigan; Bend, Oregon, and many others. For example, in 2013 after more than 50 years of being off limits, a 2.5 mile soft bottom section of the Los Angeles River in the heart of Los Angeles, which is complete with rapids, tree lined islands, vistas of the mountains, and plentiful wildlife, became open to unrestricted public use

for recreation (Martinez & Button, 2013). Clearly, even in an urban area such as Los Angeles, river corridors as natural areas suitable for recreation can provide some contribution to ecological and human health through services and opportunities that they provide.

**Emerging opportunities for urban areas: whitewater parks.** Because of human needs for water, most towns are built around or near a river or stream (Baker, 2009). Historically speaking, many towns’ streams have been dammed for a multitude of uses such as providing drinking water, generating hydropower to run mills, producing electricity for domestic use in the community, and for industrial purposes such as running a mill, or making beer and spirits (Baker, 2009). Many towns also were built near high gradient streams (perfect for whitewater parks) before the advent of fossil fuel based economies and fossil fuel based power generating technologies (Baker, 2009). There is emerging literature that supports the idea that restoring rivers to a more natural state is good for the river as well as having economic benefits to proximal communities (Acuna, Diez, Meleason, & Eloegi, 2013), and potential benefits as venues for physical activity and recreation exist.

River restoration projects may have big impacts in the future in urban areas. There is a recent trend of tearing down dams on urban streams and making whitewater parks out of them, which restores the streambed to a more natural state. The historically common practice of leaving unused and obsolete manmade features such as dams, mid river rubble piles, and small lakes in place has left many unaesthetic and dangerous water features on and in streams passing through urban areas. Over 50 towns in the U.S. have chosen to use this as an opportunity to restore their rivers and streams and to revitalize their communities by tearing down dangerous dams and creating streamside parks

with more natural looking and functioning features in their place, and the number is growing (Acuna, et al., 2013). There are ecologic and economic benefits to restoring rivers for their human health and ecosystem benefits (Acuna, et al., 2013).

The whitewater park of reference is not the type of artificially constructed and privately operated water park with chlorinated water being pumped up to the tops of huge slides for people to ride down, complete with wave pools in which to swim or float, but rather is an intentionally altered stream bed of a river that after restoration has whitewater features such as drops, waves, holes, eddy lines, riffles, runs, and calm pools in which to wade, swim, or fish. These features may be enjoyed by whitewater enthusiasts (canoeists, kayakers, and stand up paddle boarders), and are probably favored by fishermen over old dams and rubble piles as places to fish. These whitewater parks are generally built in the main part of a town with walkways and benches along the corridor, which turns them in essence into stream corridor parks, which provide multiple opportunities for recreation, access, and connectivity to existing natural resources such as greenway trails and urban parks. These parks have potential to bring economic and human health benefits to the local and regional populations of those cities that decide to plan, create, and follow through with such projects (Barnes, Forrester & Leone, 2013). If the current trends continue, our urban streams may yet show us their potential to provide goods such as ecosystem services, and human health benefits, and economic value may also be added to communities who adopt urban water trails (Barnes et al, 2013).

### Conclusion

It has been suggested that spending time in nature may facilitate or allow the human mind to transcend what are considered normal states of

mind. Time spent on urban streams/corridors in certain types of leisure could provide physical and physiological benefits by providing places for people to relax and experience nature for its aesthetic qualities. Urban streams may also provide places in which to recreate where people may engage in activities and experiences which may evoke a positive state of mind in which action merges with personal awareness and allows intense focus (Csikszentmihalyi, 1975); experiencing urban nature may evoke a positive state of mind with many physical and psychological benefits (Nakamura & Csikszentmihalyi, 2009). This type of positive experience may be facilitated by being in and traveling in urban nature in the form of parks and stream corridors with managed trails (land and water trails) as a recreationist runner, walker, nature observer, or in some cases, as a kayaker, canoeist, or fisherperson. This literature review has provided empirical evidence and theories to support and justify the conclusions and arguments that have been made therein.

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