Eco-Health Relationship Browser Notecards:

Double-sided (*has connections on back of card*)

United States Environmental Protection Agency

These materials are part of EPA Report #EPA/600/R-18/186.

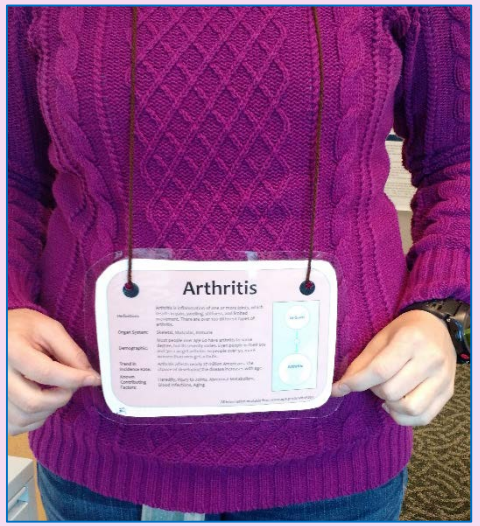
Instructions:

1. Print out these Notecards DOUBLE-sided *(preferably in color so that the categories are visibly distinct for students (ecosystems in **green**, ecosystem services in **blue**, and health outcomes in **red**).*

   Optional: If you have time, cut out and laminate the cards. If you don't have time, students can just hold the paper cards in their hands. You could also slide the pieces of paper into sheet protectors for a quick lamination substitute.

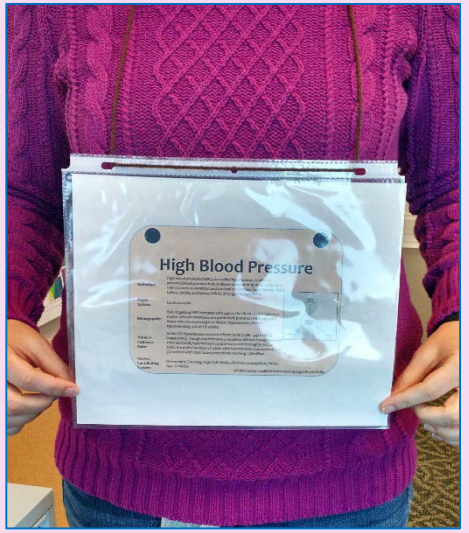
2. Punch holes in the black circles on the Notecards *(or, if in sheet protectors, use the existing holes in the sheet protectors).*
3. Using yarn or string, tie a loop (long enough to drape the card around the neck) around the Notecards.
4. Follow the instructions in the Lesson Plan: *Connecting ecosystems and human health.*
5. Store for use in future years—just a one-time set-up!

(notecards last updated 9/8/2017)



Have time? Laminate and hole-punch the notecards.

Don't have time? Use Sheet Protectors!



Eco-Health Relationship Browser Notecards:
Double-sided (*has connections on back of card*)

(last updated 8/14/2017)

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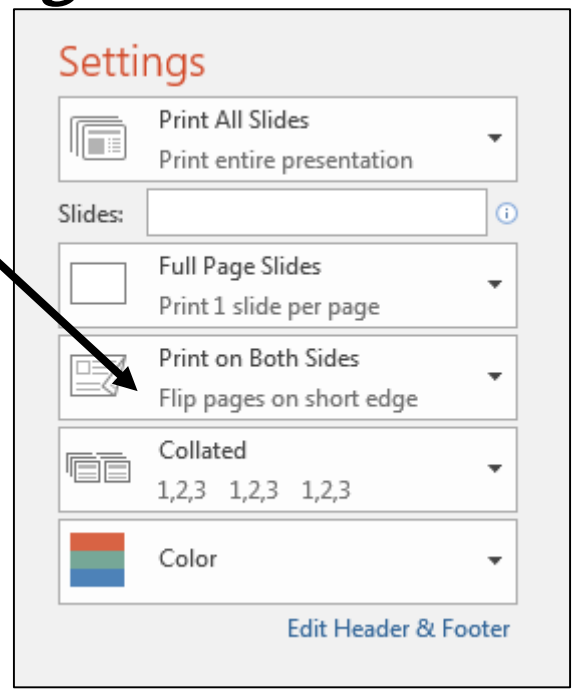
If printing double-sided, choose to "***flip on short edge***" when in the Printing Window.

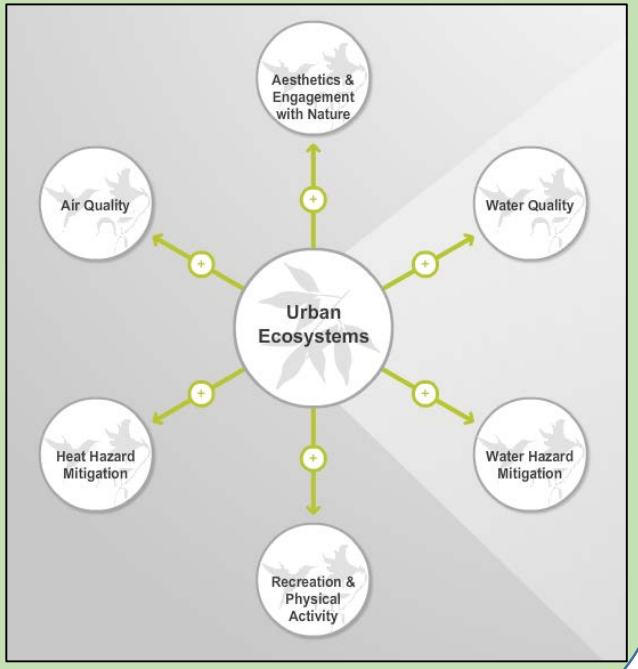


Urban Ecosystems

All information available from www.epa.gov/EnviroAtlas

Urban Ecosystems

Urban ecosystems are dynamic systems that contain both built and natural environments. Urban ecosystems include all green and blue spaces within the area, such as parks, cemeteries, lakes and streams, along with human components. Urban ecosystems can mimic the function of natural ecosystems and thus provide their own important ecosystem services that contribute to human well-being in those urban areas.



All information available from www.epa.gov/EnviroAtlas

Agro-Ecosystems

All information available from www.epa.gov/EnviroAtlas

Agro-Ecosystems

Agro-ecosystems are ecosystems that have been modified by humans for the primary purpose of producing food, fiber or agricultural products (Huggins, 2000). Agro-ecosystems can provide various ecosystem services such as regulation of soil and water quality and carbon sequestration (Power, 2010). Agro-ecosystems may contain cover crops, wetlands, wind rows and wildlife habitats. They can also assist with pollination and pest control/regulation and are often popular for recreation and with bird watchers and hunters.

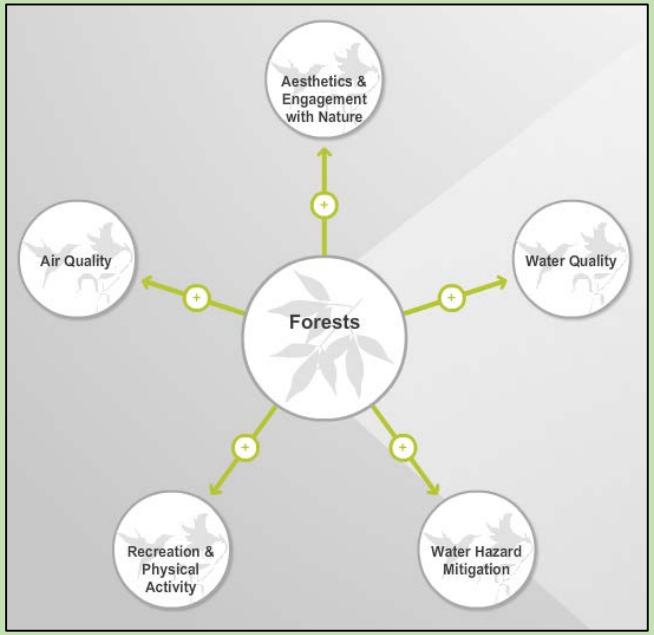
All information available from www.epa.gov/EnviroAtlas

Forests

All information available from www.epa.gov/EnviroAtlas

Forests

Forest ecosystems are dominated by trees, where the crown cover exceeds 10% and the area is larger than 0.5 hectares. There are multiple types of forests: tropical, wetland, and community-managed forests. Forests are made up of different tree and plant species that vary according to climate, geography, and hydrology. Forests are often managed for the goods that they provide, such as timber and paper products. Forests also provide other services, such as filtering pollutants from water and air that would be virtually impossible to replace using technology. Forests are also used for recreation activities such as hiking and camping.



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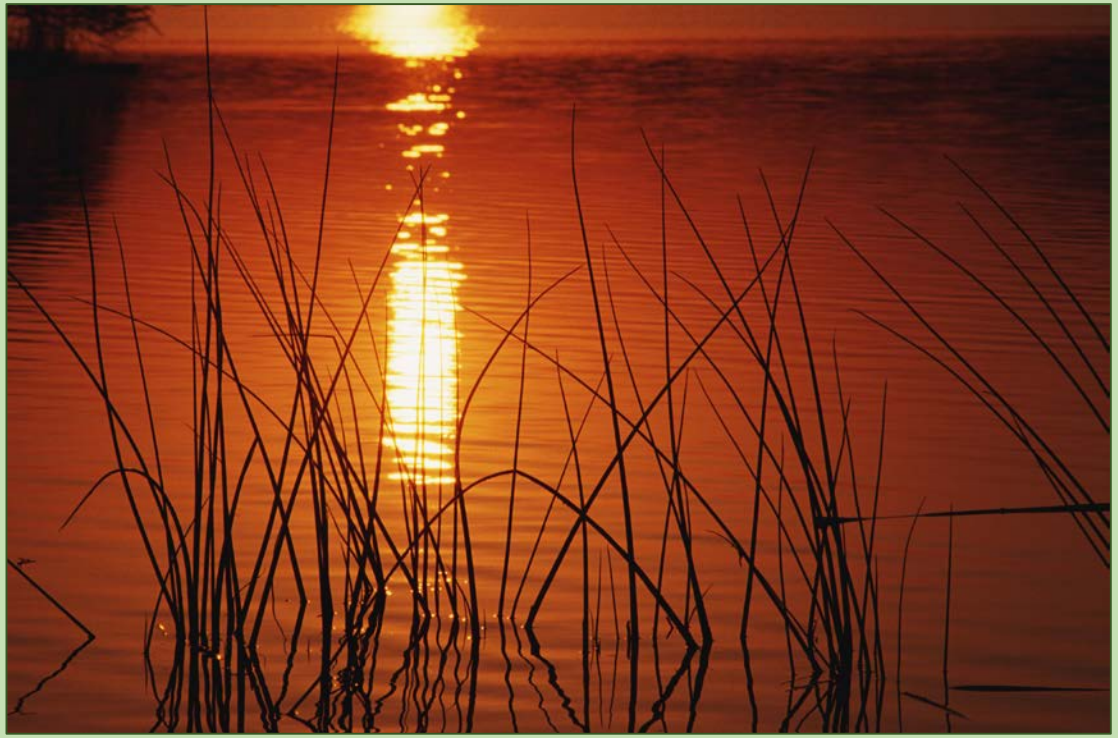
Wetlands



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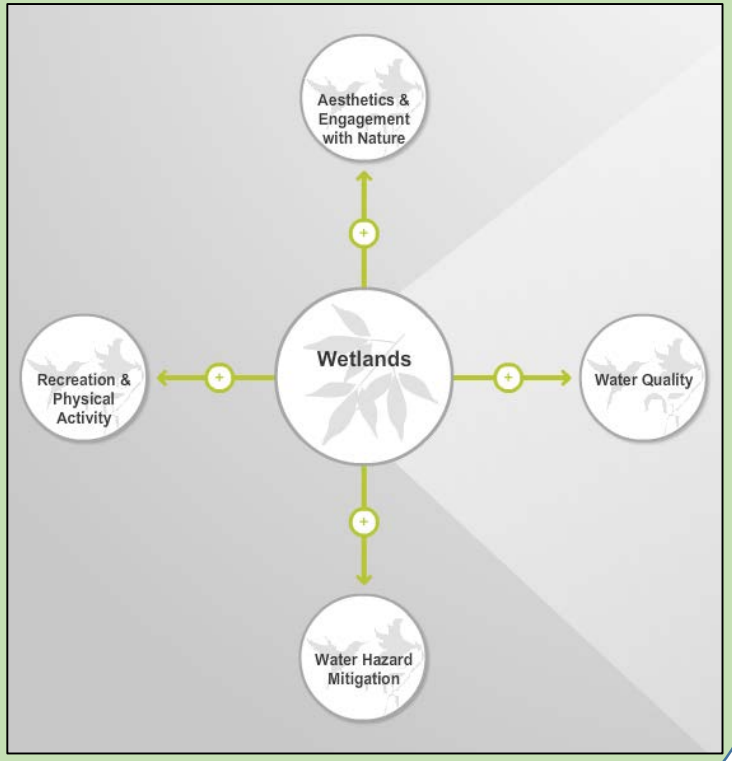
Wetlands

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Some common wetlands in the US include coastal salt marshes, peat bogs, lowland swamps, and even rivers and lakes. Wetlands are often rich in bird species and thus are prime bird watching areas. They also provide opportunities for other recreation activities such as fishing and hunting.



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ADHD

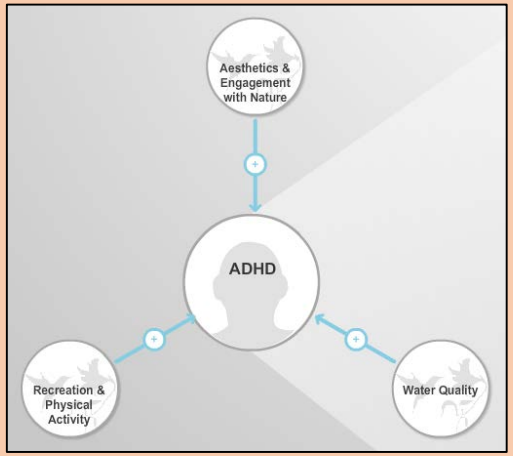
Definition: Attention-deficit/hyperactive disorder (ADHD) is the most common neurobehavioral disorder of childhood. It manifests as an unusually high and chronic level of inattention, impulsivity/hyperactivity or both.

Organ System: Nervous System

Demographic: ADHD is a common condition that affects children and adolescents, while ADD is more common in adults.

Trend in Incidence Rate: ADHD affects more than 2 million school-aged children. Recent statistics indicate that among children aged 6 to 11 years the incidence of ADHD is approximately 7%.

Known Contributing Factors: Premature Birth, Fetal Trauma (including that from infection or drug/alcohol exposure)



All information available from www.epa.gov/EnviroAtlas

ADHD: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

ADHD / AESTHETICS & ENGAGEMENT WITH NATURE:

Several studies suggest spending time/exercising in green settings versus other environments has a positive effect on children with ADHD. - Evidence -[1] Access to green space, including gardens, parks, and playgrounds, was found to be related to fewer conduct, peer and hyperactivity problems in children (Flouri et al., 2014; n=6,384, United Kingdom). [6] In ten-year old children, the odds of hyperactivity or inattention problems were almost one and a half times higher for children living further than 500m from urban green spaces than those within 500 meters (Markevych et al., 2014; n=1,932, Munich, Germany).

ADHD / RECREATION & PHYSICAL ACTIVITY:

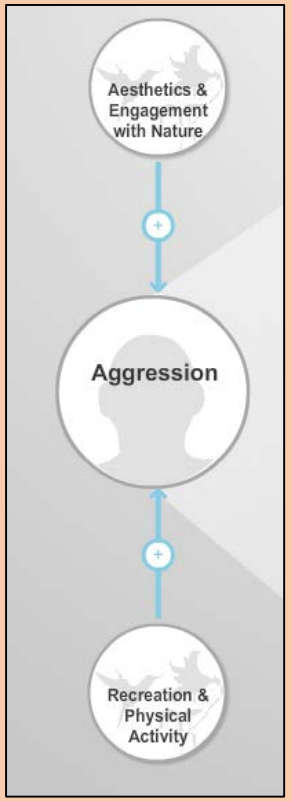
Children with ADD/ADHD experience reductions in symptoms following exercise in green environments.- Evidence -[1] Children with ADHD function 10% better after activities in green settings, when compared to activities indoors and activities in the built outdoor environment (Faber et al., 2001; n=96, USA).

ADHD / WATER QUALITY:

A pilot study was conducted to determine the effect of Manganese (Mn) levels in water on hyperactive behaviors in children exposed. Children who received water from a well with higher Mn concentrations (610 micro-g/L vs 160 micro-g/L) also had higher Hair Manganese (MnH) concentrations MnH was significantly and directly associated with oppositional (defiance) and hyperactivity behaviors- two predictors of ADHD risk (Bouchard et al., 2007; n=46, Quebec).

Aggression

Definition:	Aggression often manifests in the form of hostility - a multidimensional construct consisting of cognitive, affective and behavioral dimensions. These include cynicism and mistrust; feelings of anger, irritation, rage, contempt; and various acts of physical and verbal aggression.
Organ System:	Nervous
Demographic:	Individuals from any race, ethnicity, gender or age group can experience hostility. Men, especially between the ages of 20 - 30, exhibit more physical aggression and hostile behavior than women. Evidence suggests, however, that women in romantic relationships may exhibit as much hostile behavior as their partner.
Known Contributing Factors:	Low Economic Status, Vitamin Deficiency, Alcohol Use, Testosterone



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Aggression : Eco-Health Connections

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AGGRESSION / AESTHETICS & ENGAGEMENT WITH NATURE:

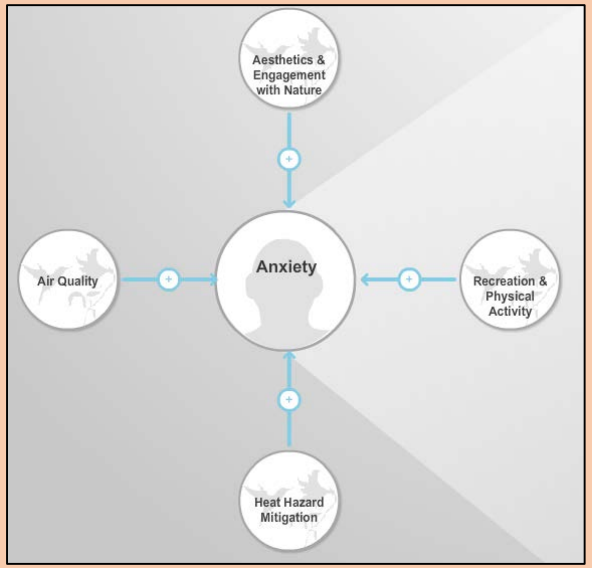
Walking outdoors or being exposed to a natural setting reduces feelings of aggression, anger and hostility. Evidence – [1] Those individuals who had higher levels of nearby nature reported fewer acts of aggression and violence against others. Nearby nature was related to lower scores on multiple indices of aggression against partners and one index of aggression against children (Kuo et al., 2001; n=145, Chicago). [2] People who took part in green exercise reported reduced feelings of anger and hostility by 4% after the activity (Pretty et al., 2005; n=263, UK). [3] Taking a walk outdoors can reduce feelings of anger by nearly 8% (Peacock et al., 2007; n=20, UK). [4] Running outdoors can reduce feelings of hostility by 80% (Harte et al., 1995; n=10 males, Australia). [5] Exposure to a natural setting reduces feelings of aggression by 1.95 points on a 5-point scale, while exposure to an urban setting reduces aggression by 0.82 point on a 5-point scale (Ulrich et al., 1991; n=120, Delaware).

AGGRESSION / RECREATION & PHYSICAL ACTIVITY:

Study participants reported reduced feelings of anger/hostility by almost 4% after participating in physical activity (Pretty et al., 2005, n=263, UK).

Anxiety

Definition:	Anxiety is characterized by excessive and unrealistic worry about everyday tasks that interferes with normal functioning. Several types of recognized anxiety disorders exist.
Organ System:	Nervous
Demographic:	Children and adults
Trend in Incidence Rate:	Anxiety disorders are the most common mental illness in the U.S., affecting 18% of adults, according to leading specialists in anxiety treatment.
Known Contributing Factors:	Chemical Imbalance in the Brain, Lack of Exercise, Poor Diet, Stressful Environments



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Anxiety : Eco-Health Connections

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ANXIETY / AESTHETICS & ENGAGEMENT WITH NATURE: Spending time in green space and exercising outdoors can significantly reduce anxiety; this effect is increased by the presence of water.- Evidence - [1] Both meditative and athletic walking in a forested environment reduced reported anxiety more than either of these activities in an indoor environment. (Shin et al., 2013; n=139 young women, Korea).

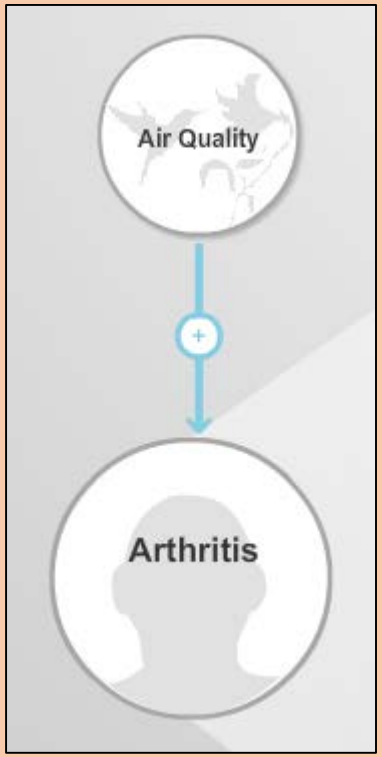
ANXIETY / RECREATION & PHYSICAL ACTIVITY: Exercising reduces feelings of tension and anxiety. Intensity and duration of the exercise, as well as surroundings while exercising (indoor vs outdoor; natural vs other view), can affect the level of reduction.- Evidence -[1] Study participants reported reduced feelings of tension-anxiety by roughly 7% after exercising for 20 minutes on a treadmill. This reduction increased when participants viewed pleasant rural and urban scenes while exercising (Pretty et al., 2005; n=100, UK).

ANXIETY / HEAT HAZARD MITIGATION: The # of anxiety and stress-related disorders often increases during extreme heat events.- Evidence -[1] The study found a 9.7% increase in hospital admissions for stress-related disorders, such as anxiety and panic disorders, during heat waves (Hansen et al., 2008; n=1.16 mill., Adelaide, Australia).

ANXIETY / AIR QUALITY: Prior-week Ozone levels of 0.025ppm in Los Angeles, California were associated with an anxiety score of 1.07, while Ozone levels of 0.044pm were associated with an anxiety score of 1.33-with a higher score representing higher levels of anxiety on a scale from 0 to 4. Thus, a higher level of ozone was associated with a modest increase in anxiety levels (Evans et al., 1988; n=1,002 adults, Los Angeles, California).

Arthritis

Definition:	Arthritis is inflammation of one or more joints, which results in pain, swelling, stiffness, and limited movement. There are over 100 different types of arthritis.
Organ System:	Skeletal, Muscular, Immune
Demographic:	Most people over age 60 have arthritis to some degree, but its severity varies. Even people in their 20s and 30s can get arthritis. In people over 50, more women than men get arthritis.
Trend in Incidence Rate:	Arthritis affects nearly 27 million Americans. The chance of developing the disease increases with age.
Known Contributing Factors:	Heredity, Injury to Joints, Abnormal Metabolism, Blood Infections, Aging



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Arthritis : Eco-Health Connections

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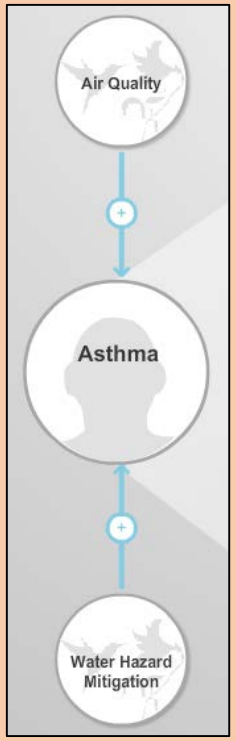
ARTHRITIS / AIR QUALITY:

Women living within 50 meters of a major road or interstate in the United States are at a 31% increased risk of Rheumatoid Arthritis compared with women living more than 200 meters away from major roadways (Hart et al., 2009; n=90,297, USA).

Asthma

Definition:	Asthma is a chronic disease of the airways that makes breathing difficult. With asthma, there is inflammation of the air passages that results in a temporary narrowing of the airways that carry oxygen to the lungs.
Organ System:	Respiratory
Demographic:	Both children and adults have asthma, although in 2009 a higher percentage of children (9.6%) were reported as having asthma when compared to adults (7.7%). Diagnoses were especially high among boys (11.3%). In 2009, the highest rate of asthma among racial/ethnic groups was 17% for non-Hispanic black children.
Trend in Incidence Rate:	Asthma affects 24.6 million Americans. The CDC reports that the number of people in the U.S. diagnosed with Asthma grew by 4.3 million, from 7.3% of the population to 8.2%, between 2001 and 2009.



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Asthma : Eco-Health Connections

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ASTHMA / AIR QUALITY: When air pollution increases, the odds of having an asthma attack worsen. Though vegetation can remove air pollutants, green space has been shown to have neutral or negative implications for asthma.- Evidence - [1] Residential proximity to forest land (within 300m) was not associated with children's asthma prevalence. However, residential proximity to parkland was associated with 60% higher relative prevalence of asthma, potentially due to the common practice of siting non-native species in parks as opposed to forests (Dadvand et al., 2014; n=3,178, Spain). [2] When total suspended particulates are greater than or equal to 181 micro-g/m3 in Taiwan, the odds of having asthma increase by 32%. When carbon monoxide is greater than or equal to 0.80 ppm, the odds of having asthma increase by 23%, and when ozone is greater than or equal to 0.022 ppm, the odds of having asthma increase by 7% (Wang et al 1999; n=165,173 adolescents, Taiwan).

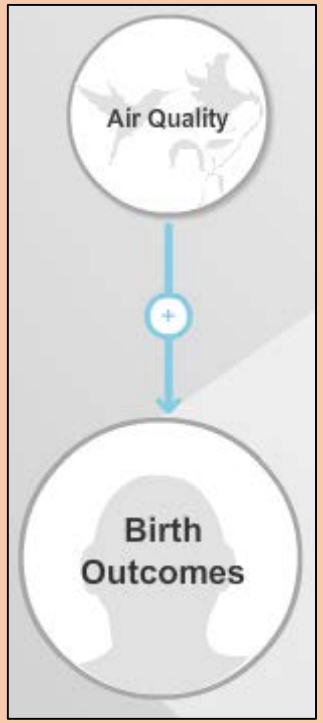
ASTHMA / WATER HAZARD MITIGATION: Dampness and mold in the home are associated with reported asthma symptoms in people with and without pre-existing conditions. Thus, events such as flooding that increase dampness/mold in the home may increase asthma symptoms.- Evidence -[1] In determining the association between the respiratory health of young children and home dampness and molds, researchers determined that the odds of asthma for children were increased 29% when dampness and/or mold were present in the home (Dales et al., 1991; n=13,495, Canada).

Birth Outcomes

Definition: For the purposes of the browser, birth outcomes can mean multiple adverse outcomes or issues associated with pregnancy or birth. These may include preeclampsia, high blood pressure, preterm birth, low birth weight, birth defects, and miscarriage.

Organ System: Main: Reproductive, other systems

Known Contributing Factors: Obesity, Older age, First Pregnancy, Multiple Pregnancy (twins+)



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Birth Outcomes:

Eco-Health Connections

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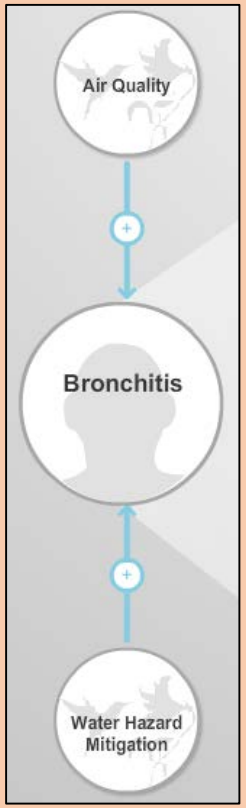
BIRTH OUTCOMES / AIR QUALITY:

Exposure to air pollution has been positively correlated with negative birth outcomes such as preeclampsia, preterm birth and heart defects in newborns. - Evidence –[1] In relation to traffic-generated air pollution, the risk of preeclampsia increased 33% and 42% for the highest NOx and PM2.5 exposure quartiles, respectively. Additionally, the risk of very preterm deliveries (gestational age less than 30 weeks) increased 128% and 81% for women in the highest NOx and PM2.5 exposure quartiles, respectively (Wu et al., 2009; n=81,186 live births, Southern California). [2] In a study that looked at the effects a pregnant mother's air pollution exposure would have on potential birth defects in their children, scientists found relationships between exposure levels to carbon monoxide (CO) and ozone and prevalence of birth defects. Odds ratios for a heart defect (a hole in the wall dividing heart chambers) increased in dose-response fashion with increasing carbon monoxide (CO) exposure in the second month of pregnancy. For this second-month exposure, the incidence of defects increased 62% for an exposure level of 1.14 to 1.57 ppm up to 195% for the highest exposure levels (greater than or equal to 2.39 ppm). (Ritz et al., 2002; Birth Defects Monitoring data 4 counties 1987-93, Southern California).

Bronchitis

Definition:	A condition resulting when the bronchial tubes, which carry air to the lungs, become inflamed and irritated. When this happens, the tubes swell and produce mucus. This results in coughing and wheezing that can last for up to 8 weeks.
Organ System:	Respiratory
Demographic:	Bronchitis is equally distributed among men and women.
Trend in Incidence Rate:	In the US, it has been estimated that almost 5% of the general population develops acute bronchitis each year.
Known Contributing Factors:	Cigarette Smoke, Compromised Immune System, Air Pollution/Irritants



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Bronchitis: Eco-Health Connections

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BRONCHITIS / AIR QUALITY:

Bronchitis rates and hospital admissions are highly correlated with air pollution, in particular PM10. Reductions in particulate matter could significantly reduce bronchitis cases in cities around the world.

Evidence – [1] As measured by PM10 concentration, bronchitis rates are 2.2 times higher in the most polluted Swiss city (33 micro-g/m3) when compared to the least polluted city (10 micro-g/m3) (Braun-Fahrlander et al., 1997; n=4,470, Switzerland).

[2] The author estimates that reducing annual concentrations of particulate matter in Jakarta, Indonesia from 90 micro-g/m3 to 75 micro-g/m3 (WHO guideline midpoint), could reduce yearly bronchitis cases in children by 125,000 (Ostro 1994; n=8.2 million, Jakarta, Indonesia).

[3] Declining PM10 was found to be associated with declining prevalence of bronchitis in children (OR=0.66) (Bayer-Oglesby et al., 2005; n=9,591, Switzerland).

BRONCHITIS / WATER HAZARD MITIGATION:

In determining the association between the respiratory health of young children and home dampness and molds, researchers determined that the odds of bronchitis for children were increased 14% when dampness and/or mold were present in the home (Dales et al., 1991; n=13,495, Canada).

Cancer

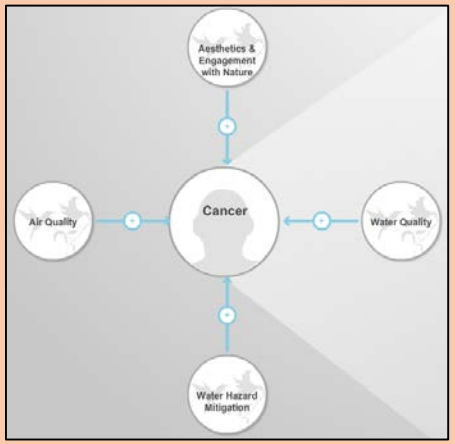
Definition: Cancer is the uncontrolled growth of abnormal cells in the body. Cancerous cells are also called malignant cells.

Organ System: Multiple

Demographic: Anyone can develop cancer, although the risk of being diagnosed with cancer increases with age. In 2007, there were 11.7 million Americans living with a history of cancer. About 78% of all cancers are diagnosed in persons 55 years of age or older.

Trend in Incidence Rate: Roughly 1.65 million new cancer cases were estimated to be diagnosed in the year 2015. Cancer is the second most common cause of death in the U.S. with more than 1,600 people a day dying from it.

Known Contributing Factors: Diet, Tobacco, Air/Water Pollution, Alcohol, Radiation, Medications, Genes



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Cancer: Eco-Health Connections

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CANCER / AESTHETICS & ENGAGEMENT WITH NATURE: [1] The odds of having skin cancer were 9% higher for people 45+ yrs. who at the time of the study were living in neighborhoods with greater than 80% green space, as compared to those with 0-20% green space. The odds were also 9% higher for people who reported spending 10+ hours outdoors per week versus 0-4 hours (Astell-Burt et al., 2013; n=267,072, Australia).

CANCER / WATER QUALITY: Contaminated water has been linked to increased cancer risk in affected populations. Known contaminants include chromium, wastewater effluent and nitrate, which have been associated with multiple cancer types.- Evidence -[1] Stomach cancer mortality in regions with Chromium contaminated water was 82% more likely in comparison with the regions without contaminated water. (Beaumont et al., 2008; Liaoning Province, China).

CANCER / WATER HAZARD MITIGATION: While investigating the connection between floods resulting from Hurricane Agnes (1972) and incidences of certain cancers, researchers found that from 1974-1977 the difference in rates of Leukemia & Lymphoma between the four-county area most affected by the flood and the remainder of upstate New York was significant. The rate in the four county areas was 32/100,000 while the rate in the rest of upstate New York was 24.4/100,000 (Janerich et al., 1981; n=10 million, Western and Upstate New York).

CANCER / AIR QUALITY: [1] Each increase of 10 micro-g/m3 fine particulate air pollution was associated with an 8% increase in lung cancer mortality (Pope III et al., 2002; n=500,000, USA).

Cardiovascular Disease

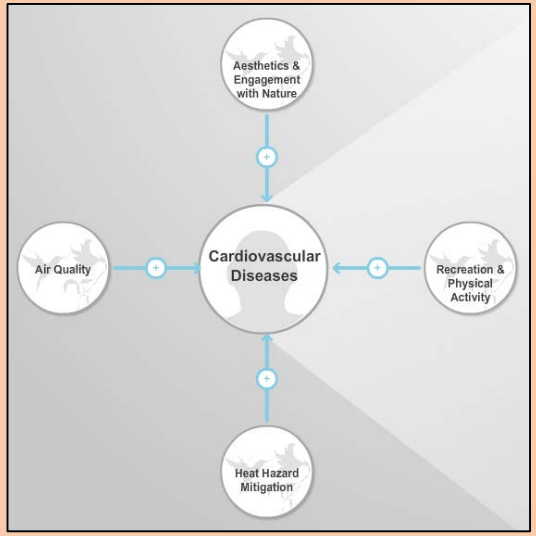
Definition: Cardiovascular Diseases are a group of diseases that affect the heart and blood vessels. These include several types of heart diseases, cerebrovascular disease, and arterial disease. Coronary heart disease, which is the leading cause of cardiovascular-related deaths, is a narrowing of the small blood vessels that supply blood and oxygen to the heart.

Organ System: Cardiovascular System

Demographic: CVDs are the leading cause of death worldwide. Those in low and middle income countries are disproportionately affected - roughly 80% of cases take place in these countries. In the U.S., CHD affects men roughly 40% more than women, while hypertension is slightly higher in women.

Trend in Incidence Rate: Worldwide, the number of people with cardiovascular diseases is rising and WHO estimates that by 2030, almost 23.6 million people will die from CVDs, mainly heart disease and stroke. In the United States, age-adjusted prevalence for coronary heart disease declined overall from 6.7% to 6.0% between 2006 and 2010.

Known Contributing Factors: Diet, Physical Inactivity, Tobacco Use, Alcohol Abuse, High Cholesterol, Access to Health Care, Socioeconomic Status



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Cardiovascular Disease: Eco-Health Connections

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CARDIOVASCULAR DISEASES / AESTHETICS & ENGAGEMENT WITH NATURE: Walking in green settings has been shown to positively affect the cardiovascular system, including reducing arterial stiffness.- Evidence- [1] Study subjects walking in a forest had significantly lower heart rates than those walking in an urban area (p less than 0.01) (Lee J, et al., 2014; n=48, Japan).

CARDIOVASCULAR DISEASES / RECREATION & PHYSICAL ACTIVITY: Authors found that the odds of hospitalization were 37% lower, and the odds of self-reported heart disease or stroke were 16% lower, among adults with highly variable greenness (high land use diversity) around their home, compared to those in neighborhoods with low variability in greenness (Pereira et al., 2012; n=1,415, Perth, Australia).

CARDIOVASCULAR DISEASES / HEAT HAZARD MITIGATION: A statewide and 6 sub-region study of California found that on average hospital admissions for cardiovascular diseases increased by 7% on peak heat-wave days (Guirguis et al., 2014; n=2,510, California, United States).

CARDIOVASCULAR DISEASES / AIR QUALITY: Studies show that cardiovascular-related hospital admissions and cardiovascular events, such as heart attack and stroke, are positively correlated with increases in ambient particulate matter.- Evidence -[1] From 1981-95, cardiovascular-related hospital admissions increased 4.8% for people 65+ when there was a 10 micro-g/m3 increase in black smoke (Prescott et al., 1998; n=450,000, Edinburgh).

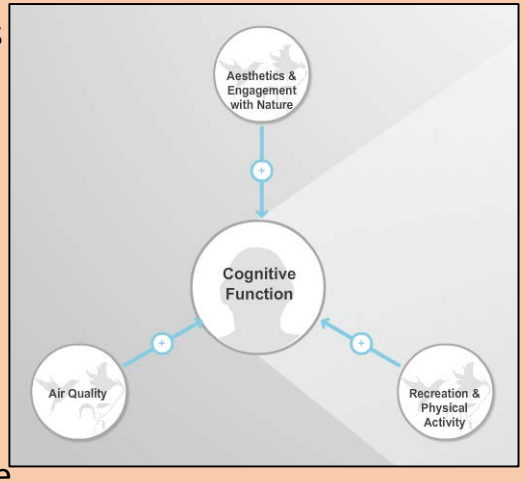
Cognitive Function

Definition: Cognitive function refers to a person's ability to process thoughts. Cognition primarily refers to things like memory, the ability to learn new information, speech, and reading comprehension. Cognitive function can become impaired as a result of aging, head trauma or the presence of disease such as Alzheimer's.

Organ System: Nervous

Trend in Incidence Rate: Cognitive function can become impaired as people grow older and may develop conditions such as dementia. Alzheimer's disease is the 5th leading cause of death among those 65 and older in the United States

Known Contributing Factors: Exercise, Diet, Sleep, Aging, Disease



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Cognitive Function: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

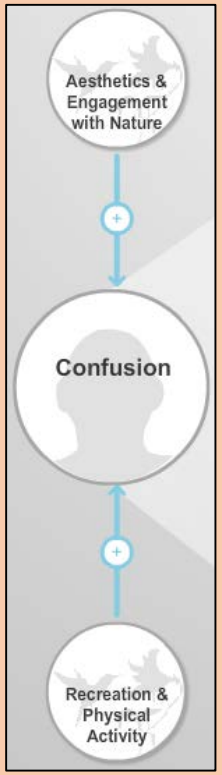
COGNITIVE FUNCTION / AESTHETICS & ENGAGEMENT WITH NATURE: A view of nature from a high school cafeteria window was found to be positively associated with student academic achievement (three measures). Cafeteria views explained 4-12% of the variance. Researchers also found landscapes composed primarily of trees and shrubs, and larger classroom windows, were positively associated with student performance (Matsuoka, 2010; n=101 schools, Michigan).

COGNITIVE FUNCTION / RECREATION & PHYSICAL ACTIVITY: School aged children who participated in a 12-week classroom-based physical activity program showed more than 8% improvement in on-task behavior during academic instruction (Mahar et al., 2006; n=243 children, North Carolina).

COGNITIVE FUNCTION / AIR QUALITY: [1] A study found that of children tested, 57% in a highly polluted city had brain lesions compared to only 8% from a less polluted city. When tested, children from the more polluted city overall performed at lower levels of psychometric intelligence, memory and executive functioning (Calderon-Garciduenas et al., 2008; n=18, Mexico). [2] An association was found between black carbon, a marker of traffic-related air pollution, and cognitive function in older men. An MMSE score was used to measure cognitive function, where the odds of having a score of less than 25 (considered low on a 30 pt. scale) was 1.3 times higher for each doubling in black carbon (Power et al., 2010; n=680, USA).

Confusion

Definition:	Confusion is the inability to think with one's usual speed or clarity. This includes difficulty in remembering, paying attention or making decisions.
Organ System:	Nervous
Demographic:	Confusion is more common in the elderly.
Known Contributing Factors:	Alcohol intoxication, Head Trauma, Brain Tumor, Low Blood Sugar, Infection, Drug Use



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Confusion: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

CONFUSION / AESTHETICS & ENGAGEMENT WITH NATURE:

Exercising/walking outdoors or while viewing outdoor scenes can reduce feelings of confusion by up to 8%.- Evidence -[1] Walking outdoors reduced confusion by nearly 8% (Peacock et al., 2007; n=20, UK).

[2] People who exercised while viewing urban scenes reported reduced feelings of confusion by 5% following the activity (Pretty et al., 2005; n=100, UK).

CONFUSION / RECREATION & PHYSICAL ACTIVITY:

Participating in physical activity can reduce feelings of confusion.- Evidence -[1] Across 10 green exercise case studies, participants reported reduced feelings of confusion by almost 5% after the physical activity (Pretty et al., 2005; n=263, UK).

[2] Across 36 studies investigating the linkage between physical activity and well-being in older adults, there was a significant reduction in confusion for those who participated in exercise as compared to those who participated in little or no exercise (Netz et al., 2005; n=36 studies, meta-analysis).

COPD

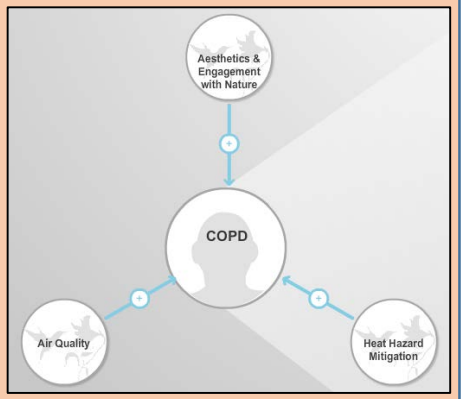
Definition: Chronic Obstructive Pulmonary Disease (COPD) is a disease of the lungs that makes it difficult for one to breathe. The term COPD most often includes two conditions: chronic bronchitis and emphysema. With chronic bronchitis, the lining of the lung airways becomes irritated, thickens, and produces large amounts of mucus. With emphysema, the walls between the lung's air sacs become damaged and deflate, reducing gas exchange in the lungs.

Organ System: Respiratory

Demographic: Worldwide, 64 million people have COPD. Typically, people between the ages of 65 - 84 develop COPD. Men and women are affected by the disease equally at present. Those who smoke are much more likely to develop the disease.

Trend in Incidence Rate: In 2012, more than 3 million people died of COPD and WHO predicts that by 2030 it will be the third leading cause of death worldwide. The number of women with COPD is increasing due to increased tobacco use in high-income countries and exposure to indoor air pollution in low-income countries.

Known Contributing Factors: Smoking, Exposure to Air Pollutants, Indoor Air Quality, Outdoor Air Quality



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COPD: Eco-Health Connections

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COPD / AESTHETICS & ENGAGEMENT WITH NATURE: In a randomized, controlled trial, senior women who walked around a forested area for an hour showed significant increases in mean values for two measures of pulmonary function: forced expiratory volume (FEV) in 1 second (12.3% increase), and FEV in 6 seconds (11.3% increase). Women in the control group who walked around an urban area for an hour did not show a significant change in either measurement (Lee & Lee 2013; n=62, Korea).

COPD / AIR QUALITY: Emergency room admissions for chronic bronchitis and emphysema increased by 31% with a 2.7-fold increase in sulfur dioxide (So_2) in the same day and by 39% after a 3 day lag period after the So_2 event for individuals less than 65 years old (Ponka & Virtanen 1994; n=2,807, Helsinki, Finland).

COPD / HEAT HAZARD MITIGATION: During a July, 2006 heat wave in Porto, Portugal, a 1° C increase in mean apparent temperature was associated with a 5.4% increase in hospitalizations due to chronic obstructive pulmonary disease for the entire population, with a 7.5% increase for women. For those older than 74 yrs., there was a 7.0% increase in these hospitalizations, with a 9.0% increase for senior women. The greatest number of excess hospitalizations occurred on the fourth consecutive day of extreme heat (Monteiro et al., 2013).

Diabetes

Definition:	Diabetes is a disease in which blood glucose levels are above normal. When people have diabetes, their bodies either do not make enough insulin or cannot use it as well as they should.
Organ System:	Diabetes can affect major organs, including heart, blood vessels, nerves, eyes, and kidneys.
Demographic:	Compared with non-Hispanic whites, members of racial and ethnic minority groups are more likely to have diagnosed diabetes. During their lifetime, half of all Hispanic men and women and non-Hispanic black women are predicted to develop the disease.
Trend in Incidence Rate:	Over the past 32 years, from 1980 through 2012, the number of adults with diagnosed diabetes in the United States nearly quadrupled, from 5.5 million to 21.3 million. Among adults, about 1.7 million new cases of diabetes are diagnosed each year.
Known Contributing Factors:	Obesity, Sedentary Lifestyle, Heredity, Hypertension (High Blood Pressure), Low levels of HDL and Elevated Levels of Triglycerides in the blood.

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Diabetes: Eco-Health Connections

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DIABETES / RECREATION & PHYSICAL ACTIVITY:

Exposure to green space was negatively associated with the rate of type 2 diabetes, where the strongest effect was found for neighborhoods containing 41-60% green space (Astell-Burt, et al., 2014; n=267,072, Australia).

Depression

Definition:	Depressive disorders are characterized by persistent low mood, loss of interest and enjoyment, and reduced energy, causing varying levels of social and occupational dysfunction.
Organ System:	Nervous
Demographic:	Women are affected twice as often as men. In patients with an affected first-degree relative, the lifetime risk of depression increases to 1.5 to 3.0 times average. First onset occurs most frequently in patients aged 12 to 24 years and in those older than 65 years.
Trend in Incidence Rate:	In people aged 18 to 44 years, depression is the leading cause of disability and premature death. Depression is predicted to be the second leading cause of disability in people of all ages by the year 2020.

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Depression: Eco-Health Connections

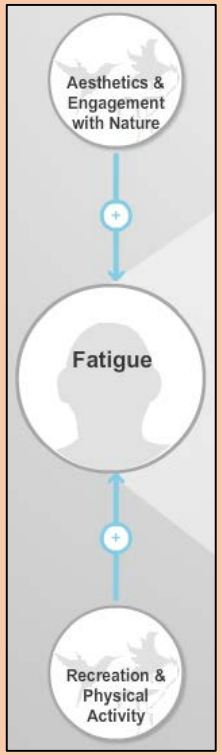
Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

DEPRESSION / AESTHETICS & ENGAGEMENT WITH NATURE: Exercising or participating in activities outdoors can reduce feelings of depression, sometimes significantly. In the case of running outdoors, an almost 85% reduction has been observed.- Evidence -[1] After running outdoors, subjects reported feeling significantly less depressed-an 85% reduction (Harte et al., 1995; n=10, Australia). [2] Taking a walk outdoors reduced depression by 6%, while walking indoors had little effect (Peacock et al., 2007; n=20, UK). [3] People who took part in green exercises reported reduced feelings of depression by 2% after the activity (Pretty et al., 2005; n=263, UK). [4] The presence of parks or recreation facilities in the neighborhood was significantly associated with a lower risk of depression (HR=0.80) (Gariepy, et al., 2014; n=9,025, Canada).

DEPRESSION / RECREATION & PHYSICAL ACTIVITY: Availability of parks or recreation areas and exercising in greenspace was shown to mitigate feelings of depression.- Evidence -[1] Across 10 green exercise case studies, participants reported reduced feelings of depression by over 2% after physical activity (Pretty et al., 2005; n=263, UK). [2] The presence of parks or recreation facilities in the neighborhood was significantly associated with a lower risk of depression (Gariepy, et al., 2014; n=9,025, Canada). [3] Individuals walking in a forest had improved self-reported mood states when compared to individuals walking in urban areas (Lee et al., 2014; n=48, Japan).

Fatigue

Definition:	Fatigue is a feeling of tiredness, weariness or lack of energy. It can be a normal response to physical or emotional stress among other factors but can also be a sign of more serious conditions.
Organ System:	Fatigue can affect the entire body or be localized in certain systems.
Demographic:	Any person from any race, ethnicity, gender, or age group can experience fatigue.
Known Contributing Factors:	Anemia, Depression, Certain Medications, Sleep Disorders, Malfunction of Thyroid Gland, Chronic Disease, Malnutrition, Exertion



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Fatigue: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

FATIGUE / AESTHETICS & ENGAGEMENT WITH NATURE: Walking or running outdoors can significantly reduce fatigue and increase vitality.- Evidence -[1] Those who engaged in physical activity while immersed in natural settings had increased energy levels when compared with sedentary individuals and those physically active in a laboratory setting (p less than 0.01) (Kinnafick and Thogersen-Ntoumani, 2014; n=40, United Kingdom). [2] Taking a walk outdoors reduced fatigue (nearly 15%) and increased feelings of vigor (3%), while walking indoors had only half the same effect for fatigue and decreased feelings of vigor (Peacock et al., 2007; n=20, UK). [3] Participants reported significantly increased energy after walking outdoors (condition effect 21.99) while exercising and viewing nature through virtual reality had little effect (Plante et al., 2006; n=112, US). [4] Running outdoors reduced fatigue by 26%, while subjects felt more fatigued after running indoors (Harte et al., 1995; n=10, Australia).

FATIGUE / RECREATION & PHYSICAL ACTIVITY: Those who engaged in physical activity while immersed in natural settings had increased energy levels when compared with sedentary individuals and those physically active in a laboratory setting (p less than 0.01) (Kinnafick and Thogersen-Ntoumani, 2014; n=40, United Kingdom).

Gastrointestinal Illness

Definition: Gastrointestinal infections (GIs) can be caused by a host of different parasites, viruses and bacteria and often result in diarrhea, nausea, cramping and vomiting. Bacterial gastroenteritis (food poisoning) is commonly caused by E.coli, Salmonella, and Staphylococcus. Enteric viral gastroenteritis, often called stomach flu, is caused by viruses such as adenovirus and rotavirus.

Organ System: Digestive

Demographic: Those with the highest risk for severe gastroenteritis include the young, the elderly, and people who have suppressed immune systems.

Trend in Incidence Rate: Each year in the US, foodborne illness causes 48 million gastrointestinal illnesses. Incidence rates for foodborne illnesses fluctuate yearly, although in the US, the general trend from 1996 - 2010 has shown a decrease in illnesses as a result of Campylobacter and Shigella, while there has been an increase in illnesses associated with Salmonella.

Known Contributing Factors: Tainted Food or Water, Contact with an Infected Person (viral)

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Gastrointestinal Illness: Eco-Health Connections

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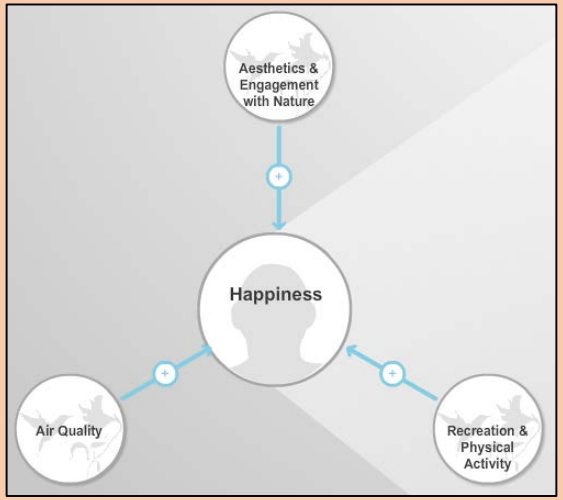
GASTROINTESTINAL ILLNESS / WATER HAZARD MITIGATION: The incidence of gastrointestinal illnesses, such as gastroenteritis and diarrhea, has been shown to increase during and following flood events.
- Evidence - While investigating the association of gastrointestinal illness and contact with flood water, researchers determined that during flooding, incidence was 29% higher than normal. This effect was more pronounced among people with potential sensitivity such as children, seniors, and those with a chronic gastrointestinal condition (Wade et al., 2004; n=1,100, Midwestern US).

GASTROINTESTINAL ILLNESS / WATER QUALITY: Drinking water contaminated with Copper has been linked to gastrointestinal symptoms such as vomiting, diarrhea and abdominal cramps. Diarrhea in rural African children has also been linked to reduced forest cover, suggesting impaired water purification services in degraded natural environments.- Evidence -[1] The risk of gastrointestinal symptoms increased with Copper exposure levels in drinking water. Risk was 53% higher for women with a concentration of 4 mg/L and 90% higher for men with a concentration of 6 mg/L (Araya et al., 2004; n=1,365 adults, Chile). [2] When looking at the relationship between gastrointestinal illness and copper exposure in drinking water, symptoms such as nausea, diarrhea, vomiting and abdominal cramps were reported as a result of elevated copper levels in drinking water. Findings suggest that drinking water containing copper levels above 1.3 mg/l may be a common cause for gastrointestinal upsets (Knobeloch et al., 1994; 5 case studies, Wisconsin).

Happiness

Definition:	Happiness is a specific emotion that people feel when good things happen and is considered by psychologists to be one of the few basic emotions (cannot be broken down further) that humans experience.
Organ System:	Nervous
Demographic:	Those who live in countries with higher incomes and less suffering typically have higher life satisfaction. A 2010 Gallup Poll found that European countries such as Denmark and Finland have high happiness ratings while many countries in Africa shared the lowest ratings.
Trend in Incidence Rate:	Up to a threshold point, people who gain wealth are happier. In 2007, a Pew study found that happiness in many countries globally was increasing largely due to economic growth. As of 2006, in the US, happiness inequality among demographic groups had decreased considerably since the 1970s.
Known Contributing Factors:	Quality of Life, Social Relationships, Income



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Happiness: Eco-Health Connections

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HAPPINESS / AESTHETICS & ENGAGEMENT WITH NATURE: Viewing photos of natural settings and/or walking outdoors are associated with higher levels of positive feelings. Those who live in greener areas have reported higher levels of happiness.- Evidence - In a study using a phone app to record happiness levels in different environments, participants reported being significantly happier outdoors in all green or natural habitat types than in urban settings (1.8 to 2.7 points happier on a 0-100 scale).

HAPPINESS / RECREATION & PHYSICAL ACTIVITY: Walking and other exercise in nature can positively affect self-esteem, emotional well-being and mood.- Evidence - In a multi-study analysis, researchers found that acute short-term exposures to green exercise improve both self-esteem (effect size=0.46) and mood (effect size=0.54). This improvement increases with the presence of water and is true regardless of duration or intensity of exercise (Barton & Pretty 2010; n=1,252, UK).

HAPPINESS / AIR QUALITY: On a scale from 1-4, Happiness increased in Belgium by 0.043 when nitrogen (N) and lead (Pb) air pollution decreased by 14% and 40%, respectively. Happiness in Denmark increased by 0.121 when N and Pb air pollution decreased by 11% and 90%, respectively. Happiness in France increased by 0.061 when N and Pb air pollution decreased by 9% and 75%, respectively. Happiness in Greece increased by 0.049 when N and Pb air pollution decreased by 12% and 60%. Happiness in Netherlands increased by 0.085 when N and Pb air pollution decreased by 9.2% and 80%, respectively (Welsch 2006).

Healing

Definition:

To heal is to mend or make better and includes recovery from injury and surgery. For the purpose of this browser, healing refers to physical and mental recovery.

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Healing: Eco-Health Connections

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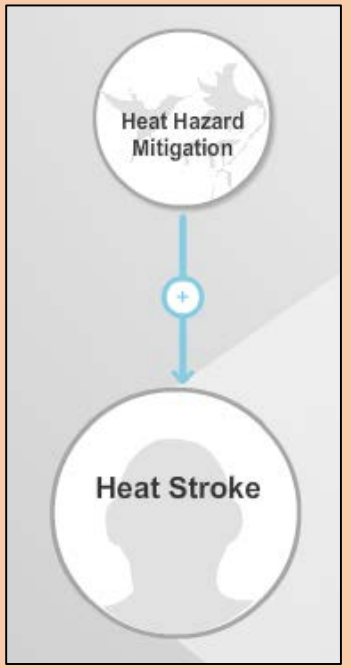
HEALING / AESTHETICS & ENGAGEMENT WITH NATURE:

Having a view of trees from a hospital window decreased in-patient recovery time from surgery and the amount of strong pain medications needed. Additionally, spending time in a forest has been found to increase cancer-fighting proteins and natural killer cell activity.

- Evidence -[1] Patients recovering from surgery who had a window view had an average hospital stay of 7.96 days compared to 8.70 days for patients with a brick wall window view. Those with a natural view also needed significantly fewer doses of painkillers and received fewer negative notes from nurses (Ulrich et al., 1984; n=46, Pennsylvania). [2] Spending 3 days/2 nights in the forest significantly increased Natural Killer (NK) cell activity and numbers. These NK cells kill tumor or virus-infected cells and may aid in fighting cancer. This effect was found to last more than 30 days following the trip and may result from phytoncides being released from trees (Li et al., 2010; n=12, Japan). [3] NK cell activity was found to have increased significantly (to a mean of 30.7 from a mean of 21.7, p less than 0.001) in post-treatment breast and lung cancer patients, following a 12-week integrated medicine program of forest and horticultural therapy, group therapy, and meditation in an urban park setting (Nakau et al., 2013; n=22, Japan).

Heat Stroke

Definition:	Heat stroke is the most severe heat illness, and occurs when body temperature reaches 104° Fahrenheit. Heat stroke is typically preceded by other heat illnesses such as heat exhaustion and dehydration.
Organ System:	Multiple
Demographic:	Any person can suffer from heat stroke, though children, the elderly, those who work outdoors, and obese people are at higher risk of developing heat illness.
Trend in Incidence Rate:	Serious heat illnesses occur most often during the summer months and during heat wave events. As the global climate is expected to warm, it is likely that heat wave events and heat illnesses will increase in many areas.
Known Contributing Factors:	High temperatures, High humidity, Dehydration



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Heat Stroke: Eco-Health Connections

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HEAT STROKE / HEAT HAZARD MITIGATION:

Heat stroke incidence increases significantly during heat waves.- Evidence -[1] During a July 1980 heat wave in Missouri, incidence rates for heat stroke (per 100,000) were 26.5 for St. Louis and 17.6 for Kansas City compared to no heat stroke cases in July of the previous year. Heat stroke rates were 10 to 12x higher for people 65 or older than those younger than 65 (Jones et al., 1982). [2] During a Chicago heat wave in 1995, there were 11% more hospital admissions than average, of which 59% were for treatment of dehydration, heat stroke and heat exhaustion (Semenza et al., 1999).

High Blood Pressure

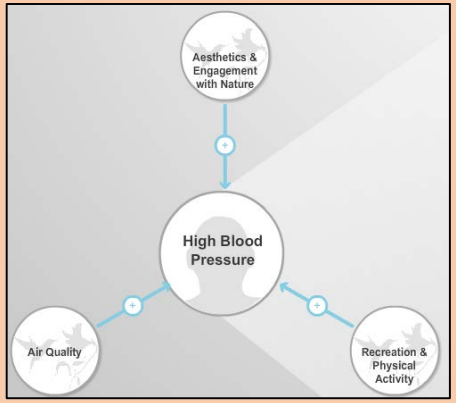
Definition: High blood pressure (HBP), also called hypertension, is when a person's blood pressure is at or above 140/90 mmHg most of the time. HBP is a serious condition and can lead to coronary heart disease, heart failure, stroke, and kidney failure, among other problems.

Organ System: Cardiovascular

Demographic: Risk of getting HBP increases with age as the blood vessels becomes stuffer. African Americans are particularly prone to HBP along with those who are overweight or obese. Hypertension affects approximately 30% of US adults.

Trend in Incidence Rate: In the US, hypertension increased from 23.9% (1988 - 94) to 28.5% (1999-2000). Though hypertension prevalence did not change between 2000 and 2008, hypertension control increased to roughly 50%. In 2000, the global number of adults with hypertension was estimated at 972 million with 2025 future projections reaching 1.56 billion.

Known Contributing Factors: Overweight, Smoking, High Salt Intake, Alcohol Consumption, Stress, Age, Genetics



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High Blood Pressure:
Eco-Health Connections

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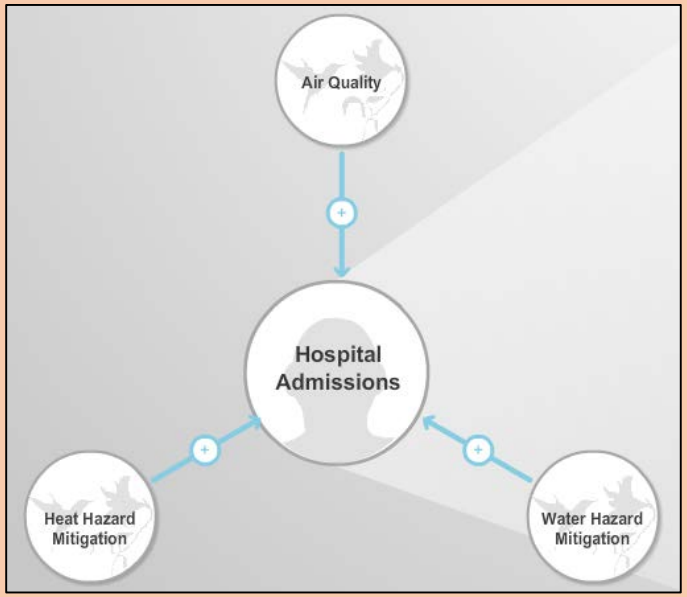
HIGH BLOOD PRESSURE / AESTHETICS & ENGAGEMENT WITH NATURE: Exercising in green environments or viewing natural scenes can reduce blood pressure.- Evidence - Participants who viewed pictures of pleasant rural scenes while exercising experienced an almost 9% reduction in mean arterial blood pressure while those who exercised without viewing nature saw a less than 2% reduction (Pretty et al., 2005; n=100 [20/group], UK).

HIGH BLOOD PRESSURE / RECREATION & PHYSICAL ACTIVITY: Exercise, including light or moderate activity, can reduce blood pressure by 3% to 7%. Exercising in green environments may enhance this reduction.- Evidence - Participating in 20 minutes of 'fairly light' exercise decreased mean arterial blood pressure by nearly 3%. Viewing a rural pleasant scene while exercising increased this effect by 6% (Pretty et al., 2005; n=100, UK).

HIGH BLOOD PRESSURE / AIR QUALITY: Exposure to PM2.5 and traffic-generated NO2 is strongly associated with increased blood pressure.- Evidence - When study subjects were exposed to fine particulate (PM2.5) at levels of 150 micro-g/m3 for 2 hours on 3 occasions, diastolic blood pressure significantly increased during all of the exposures by a range of 2.5 to 4.0 mm Hg in Ann Arbor, Michigan and 2.9 to 3.6 mmHg in Toronto, Canada. PM2.5 proved to be the important factor in this study; other pollutants, such as ozone, showed little effect (Brook et al., 2009; n=31-50, Toronto, Canada & Ann Arbor, Michigan).

Hospital Admissions

Definition: The "hospital admissions" portion refers to people who were admitted to a healthcare facility to receive illness diagnosis and/or treatment.



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Hospital Admissions:
Eco-Health Connections

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HOSPITAL ADMISSIONS / AIR QUALITY: During the lethal London fog of 1952, pollution levels were 5-19 times more than regulatory standards. Hospital admissions for respiratory disease grew by 163% and total hospital admissions increased by 48% (Bell & Davis 2001; London).

HOSPITAL ADMISSIONS / WATER HAZARD MITIGATION: Following Hurricane Katrina, Houston emergency departments received 8,427 hospital visits from Katrina evacuees (Mortensen and Dreyfuss 2008; n=875,750, Houston, Texas).

HOSPITAL ADMISSIONS / HEAT HAZARD MITIGATION: Hospital admissions increase significantly during heat wave events for cardiovascular, renal, and respiratory illnesses, as well as for dehydration, heat stroke, heat exhaustion, and mental health. These heat-related illnesses are often more pronounced in urban areas when compared to rural areas.

- Evidence -

[1] During a Chicago heat wave in 1995, there were 11% more hospital admissions than average, of which 59% were for treatment of dehydration, heat stroke and heat exhaustion (Semenza et al., 1999).

[2] During a 1980 heat wave event in Missouri, about 1 in every 1,000 residents of St. Louis and Kansas City were hospitalized for, or died of, a heat-related illness (Jones et al., 1982).

[3] An excess of 16,166 emergency department visits and 1,182 hospital admissions were reported for the state of California during a 2006 heat wave (Knowlton et al., 2009).

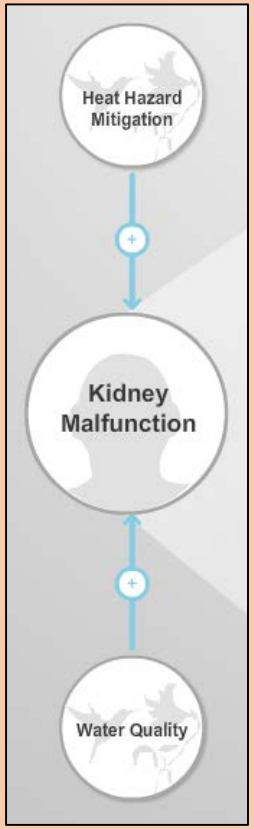
Kidney Malfunction

Definition: The kidneys are two small organs that are connected to the urinary bladder. Their main function is to remove waste products and excess water from the blood. The kidney plays a major role in regulating levels of various minerals in the body as well as producing some important hormones. Damage to the kidneys can be caused by a number of factors and if serious, can result in kidney failure.

Organ System: Urinary

Demographic: Issues with the kidneys become more common as people age. In the US, more than 10 percent of people, or more than 20 million, ages 20 years and older have chronic kidney disease.

Known Contributing Factors: Genetics, Diabetes, High Blood Pressure, Aging, Illness, Injury



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Kidney Malfunction:
Eco-Health Connections

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KIDNEY MALFUNCTION / HEAT HAZARD MITIGATION: Extreme heat events may lead to increased risks for kidney stones and increased hospitalizations for renal diseases.- Evidence -[1] One multi-city study in the United States found that extreme heat events were associated with a 15% increase in hospitalizations for renal diseases (Gronlound et al., 2014; n=114 cities, United States). [2] A California statewide and 6 sub-region study found that, on average, hospital admissions for acute renal failure increased by 7% on peak heat-wave days (Guirguis et al., 2014; n=2,510, California, United States). [3] The risk of developing kidney stones was almost one and a half times higher at a temperature of 30° C than at 10° C (Tasian et al., 2014; n=60,433, Atlanta, Chicago, Dallas, and Philadelphia).

KIDNEY MALFUNCTION / WATER QUALITY: Environmental and occupational exposure to cadmium has been related to renal tubular damage. One study showed that the prevalence of tubular proteinuria (early kidney damage) ranged from 5% among unexposed people to 50% in the most exposed group (Jarup et al., 2000; n=1,021, Sweden).

Longevity

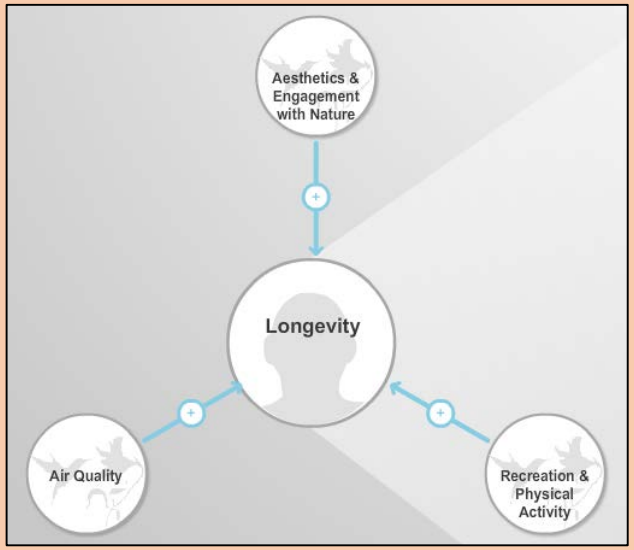
Definition: Life expectancy is the average number of years a person is expected to live from birth and is often used as a measure of overall quality of life in a country.

Organ System: Life expectancy is affected by all organ systems.

Demographic: Life expectancy varies among countries and regions. In 2009, the lowest average life expectancy was 47 years for those who live in Malawi and the highest was 83 years for those from Japan. The United States' average life expectancy is 79 years. Low income countries generally have lower life expectancies.

Trend in Incidence Rate: Life expectancy has increased globally by four years since 1990. However, in many African countries it has actually decreased, largely due to HIV/AIDS.

Known Contributing Factors: Access to Medical Treatment, Quality of Life, Chronic Disease, Infectious Disease, Nutrition, Lifestyle



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Longevity: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

LONGEVITY / AESTHETICS & ENGAGEMENT WITH NATURE: Populations that are exposed to the greenest environments also have the lowest levels of health inequality related to income deprivation. Thus, despite the evidence of increased mortality risk associated with income deprivation, the authors found that this risk was decreased for those who live in greener areas. The incidence rate ratio (IRR) for all-cause mortality for the most income deprived quartile compared with the least deprived was 1.93 (95% CI 1.86-2.01) in the least green areas, whereas it was 1.43 (1.34-1.53) in the most green (Mitchell and Popham 2008; n=4.8 million +, England).

LONGEVITY / RECREATION & PHYSICAL ACTIVITY: The probability of five-year survival of senior citizens studied increased from 56% when space for taking a stroll near the residence was not available to 74% when enough space was available. Also, the five-year survival increased from 66% when participants had very few parks and tree lined streets near the residence to 74% when there were plenty of both (Takano et al., 2002; n=3,144, Tokyo).

LONGEVITY / AIR QUALITY: For constant 1990 pollution levels, statistical life expectancy is reduced by approximately 500 days. By 2010, the control measures presently decided for emissions of primary particles and the precursors of secondary aerosols were expected to reduce these losses to about 280 days, while the theoretical maximum technically feasible emissions reductions could bring reduced life expectancy below 200 days (Mechler et al., 2002; n=700 million, Europe).

Low Birth Weight

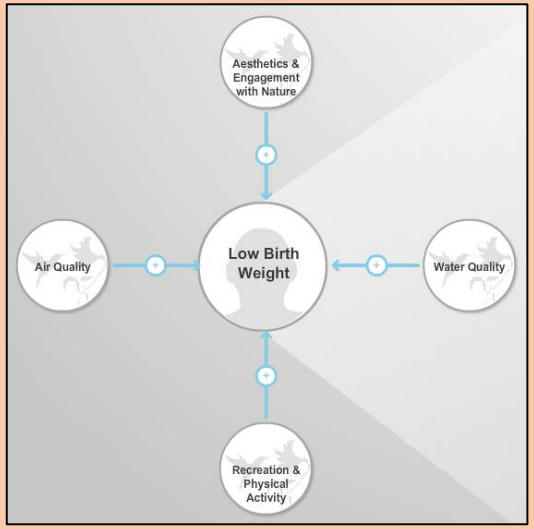
Definition: An infant is considered to have a low birth weight if it weighs less than 5lbs 8 oz. (2500 grams) at birth.

Organ System: Reproductive

Demographic: Roughly 30 million babies are born with low birth weight annually. Low income or developing countries have higher numbers of low-weight births than higher income countries.

Trend in Incidence Rate: Globally, prevalence of low-weight births is slowly decreasing.

Known Contributing Factors: Multiple Pregnancy (twins+), Previous Chronic Conditions, Smoking, Drug and Alcohol Use, Uterine or Cervical Issues



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Low Birth Weight: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

LOW BIRTH WEIGHT / AESTHETICS & ENGAGEMENT WITH NATURE: Increasing tree canopy by 10% within 50 meters of a mother's home was associated with a marginal decrease of 1.42 per 1,000 in the number of small for gestational age (SGA) births. (SGA births are often defined as those below the tenth percentile.) Potential causal mechanisms for this finding include stress reduction as a result of contact with green space, improved social contacts, and increased physical activity-all of which have been proven to affect infant birth weight (Donovan et al., 2011; n=5,696, Oregon).

LOW BIRTH WEIGHT / WATER QUALITY: Atrazine is an herbicide with a seasonal pattern of peak contamination in drinking water from May to September. There was a 37% increased risk of small gestational age in births where the third trimester overlapped whole or in part with the May-September period, compared with those in which the third trimester occurred entirely from October to April. If the entire third trimester took place from May to September there was a 54% increased risk of small gestational age (Villaneuva et al., 2005; n=3,510 births, France).

LOW BIRTH WEIGHT / RECREATION & PHYSICAL ACTIVITY: Increasing tree canopy by 10% within 50 meters of a mother's home was associated with a marginal decrease of 1.42 per 1,000 in the number of small for gestational age (SGA) births. (SGA births are often defined as those below the tenth percentile.) Potential causal mechanisms for this finding include increased physical activity, stress reduction as a result of contact with green space, and improved social contacts-all of which have been proven to affect infant birth weight (Donovan et al., 2011; n=5,696, Oregon).

LOW BIRTH WEIGHT / AIR QUALITY: Increasing total greenness at maternal residences has been linked to small gains in birth weight and slightly reduced odds of pre-term birth. The authors explored reduced air pollution as a potential mechanism, also acknowledging the potential of green space to reduce heat, noise and maternal stress (Laurent et al., 2013, n=80,000; Los Angeles and Orange Counties, CA).

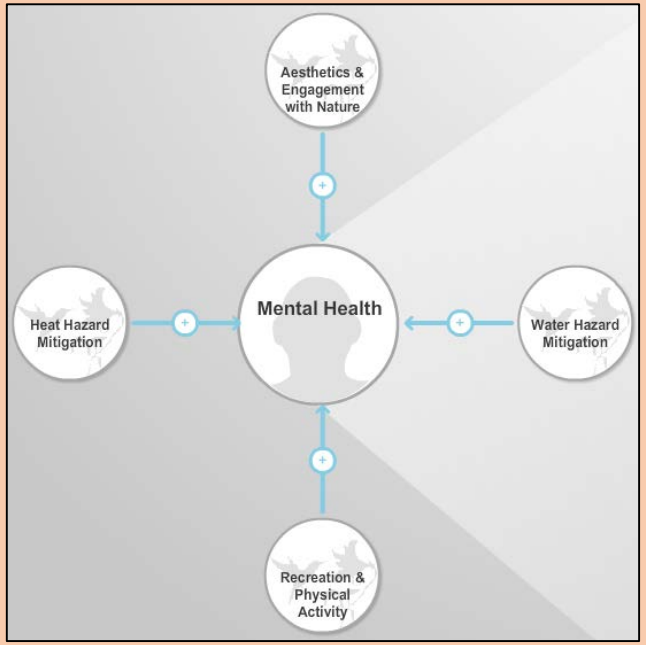
Mental Health

Definition: Mental health is a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community.

Organ System: Nervous

Demographic: Mental and behavioral disorders are estimated to account for 12% of the global burden of disease. Mental and behavioral disorders are common, affecting more than 25% of all people at some time during their lives. Around 20% of all patients seen by primary health care professionals have one or more mental disorders.

Known Contributing Factors: Social Relations, Social Support, Spirituality/Religion, Physical Health, Substance Abuse, Trauma, Stress



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Mental Health: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

MENTAL HEALTH / AESTHETICS & ENGAGEMENT WITH NATURE: Those who reported the highest degree of neighborhood greenness had almost twice the odds of being in the better mental health category, compared with those who perceived little greenness in their neighborhood (OR=1.60). Recreational walking, as evidenced when added to the model, may be the mediator for this relationship (Sugiyama et al., 2008; n=1,845, Australia).

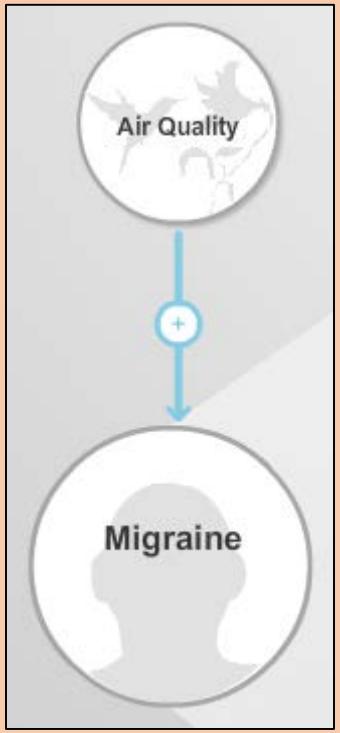
MENTAL HEALTH / WATER HAZARD MITIGATION: While investigating the health effects associated with flooded households, researchers found that 48% of adults in flooded households experienced moderate to severe psychological problems in the nine months following the flood, compared to only 12% of adults in non-flooded households (Reacher et al., 2004; n=467, Lewes, England).

MENTAL HEALTH / RECREATION & PHYSICAL ACTIVITY: Study subjects who engaged in physical activity while immersed in natural settings had a more positive affect when compared with sedentary individuals and subjects who were physically active in a laboratory setting (p less than 0.01) (Kinnafick and Thogersen-Ntoumani, 2014; n=40, United Kingdom).

MENTAL HEALTH / HEAT HAZARD MITIGATION: Compared to non-heat wave periods, there was a 17.4% increase in hospital admissions for dementia and a greater than 2-fold increase in hospital admissions for senility during heat waves (temperatures above 26.7° Celsius) (Hansen et al., 2008; n=1.16 million, Adelaide, Australia).

Migraine

Definition:	A migraine is a type of severe headache caused by abnormal brain activity that is often accompanied by nausea, vomiting or sensitivity in light.
Organ System:	Nervous
Demographic:	Migraine afflicts 28 million Americans, with females suffering more frequently (17%) than males (6%). This trend, where roughly 6% of men and 15-18% of women are affected by migraines is also seen in Europe and Central and South America. Migraines affect women 2 - 3 times more than men in most countries that have been studied.
Known Contributing Factors:	Stress, Alcohol Use, Allergic Reactions, Certain Foods, Environmental Factors (these are thought to have an effect on migraines)



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Migraine: Eco-Health Connections

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MIGRAINE / AIR QUALITY:

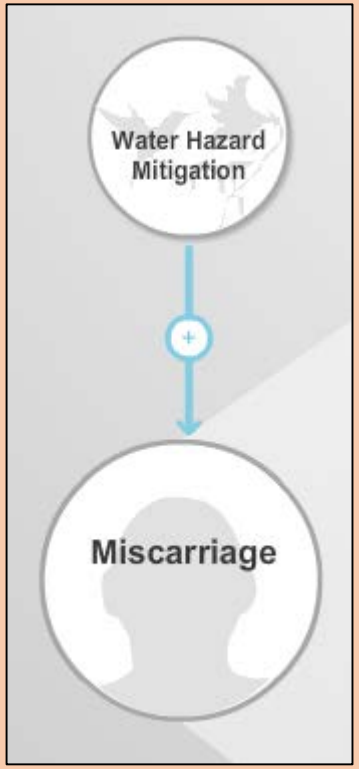
Air pollutant exposure is linked to hospital visits for migraines and headaches.

- Evidence –

[1] A time series analysis conducted for the years 2001-2005 found increased risks for migraine associated with increases in specific air pollutants in Chile: 11% for a 1.15 ppm increase in CO; 11% for a 28.97 micro-g/m^3 increase in NO_2; 10% for a 6.20 ppb increase in SO_2; 17% for a 69.51 ppb increase in Ozone; 11% for a 21.51 micro-g/m^3 increase in PM2.5; and 10% for a 37.79 micro-g/m^3 increase in PM10 (Dales et al., 2009; n=5.37 million, Chile). [2] For female emergency room visits for migraine, positive associations were observed during the warm season for sulfur dioxide (SO_2), and in the cold season for particulate matter (PM2.5) exposures lagged by 2 days. The % increase in daily visits was 4.0% for SO_2 mean level change of 4.6 ppb, and 4.6% for PM2.5 mean level change of 8.3 micro-g/m^3. For male emergency room visits for headache, the largest association was obtained during the warm season for nitrogen dioxide (NO_2), which was 13.5% for same day exposure (Szyszkowicz et al., 2009; n=64,839, Canada).

Miscarriage

Definition:	A miscarriage is the spontaneous loss of a fetus before the 20th week of pregnancy.
Organ System:	Reproductive
Demographic:	Miscarriages occur in women who are pregnant and increase in likelihood as women age. Women over the age of 30 and those who have previously had a miscarriage are at greater risk of having a miscarriage.
Trend in Incidence Rate:	Studies show that about 8 to 20 percent of women who know they are pregnant have a miscarriage some time before 20 weeks of pregnancy; 80 percent of these occur in the first 12 weeks (Regan 2000).
Known Contributing Factors:	Diabetes, Chromosomal abnormalities, Drug and alcohol abuse, Exposure to environmental toxins, Hormone problems, Infection, Obesity (potential contributing factors)



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Miscarriage: Eco-Health Connections

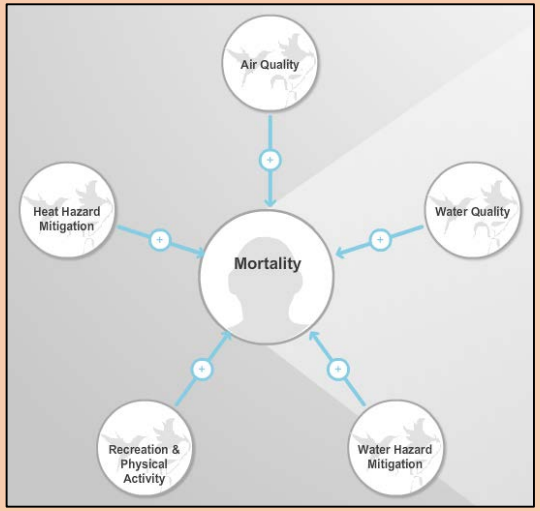
Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

MISCARRIAGE / WATER HAZARD MITIGATION:

While investigating the connection between floods resulting from Hurricane Agnes (1972) and incidences of spontaneous abortions, researchers found that in the year after the flood (1973), there was a significant increase in the number of spontaneous abortions in the four-county region affected by the flood when compared to the rest of upstate New York. There were 60.9 spontaneous abortions per 1000 live births in the four-county region and 54.4 per 1000 live births in the rest of upstate New York (Janerich et al., 1981; n=10 million+, New York).

Mortality

Definition:	Put simply, mortality means death. Infant mortality rate is often used an indicator for the health level in a country.
Organ System:	Multiple
Demographic:	Mortality rates vary among countries depending on a number of factors. Infant mortality rates range from 2.60 to 144 deaths/1,000 live births. Developing countries typically have higher mortality rates than those in developed countries.
Trend in Incidence Rate:	In the United States, the death rate for 10 out of the 15 leading causes of death has been declining in the past several years. For the U.S., the death rate in 2007 was 803/100,000 compared to 2009's rate of 741/100,000.
Known Contributing Factors:	Heart Disease, Stroke, Cancer, Infectious Disease, Malnutrition, Diet, Chronic Disease, Violent Crimes



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Mortality: Eco-Health Connections

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MORTALITY / AIR QUALITY: A study of six cities found that an average of 3% fewer people died for every reduction of one micro-g/m3 in the average levels of PM2.5 fine particulate matter. This decreased death rate is approximate to saving 75,000 people per year in the U.S. (Laden et al., 2006; n=8,096, 6 U.S. cities).

MORTALITY / WATER QUALITY: Among a population in Greece where an aquifer was contaminated with Chromium, observed deaths were 98 times what were expected for that region based on age and gender (Linos et al., 2011; n=131,000, Viotia, Greece).

MORTALITY / WATER HAZARD MITIGATION: In the 12 months following the Bristol Floods of 1968, there were 87 deaths among the 209 households affected, compared to 58 deaths in those same households in the 12 months prior to flooding-a rise of 50%. No significant difference was found in the non-flooded homes (Bennet 1970; n=770, Bristol, England).

MORTALITY / RECREATION & PHYSICAL ACTIVITY: In a study of men aged 25-74, those whose energy output in walking, climbing stairs, and playing sports totaled 2000 or more kilocalories per week had a 28 percent lower death rate (from all causes) than less active men (Paffenbarger et al., 1986; n=12,936 men aged 25-74; USA).

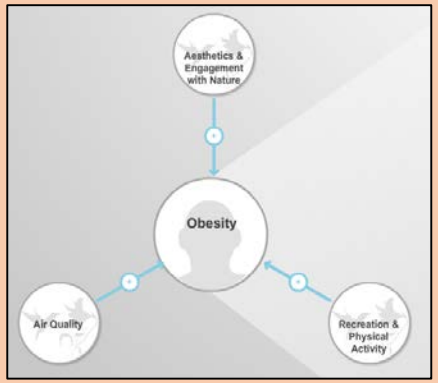
MORTALITY / HEAT HAZARD MITIGATION: During a 1995 summer heat wave event in Chicago, there were 514 heat-related deaths and 696 excess deaths during the month of July (Whitman et al., 1997).

Obesity

Definition: Obesity is a preventable disease characterized by being extremely overweight and having a high percentage of body fat or a body mass index (BMI) of 30 or greater. BMI is a calculated weight to height ratio used to determine a person's relative body fat amount and is typically accepted as a good indicator of fat content. A BMI between 18.5 and 25 is considered normal and healthy.

Organ System: Multiple

Demographic: In 2008, 1.5 billion adults (age 20 and older) worldwide were deemed overweight. Of those, over 500 million were obese. In 2010, around 43 million children under five were overweight, of whom 81% were in developing countries. In the United States, roughly one third of adults (33.8%) are obese. In the U.S. more women than men are obese and non-Hispanic blacks have the highest rate of obesity (44.1%) compared to non-Hispanic whites who have the lowest rate of obesity (32.6%) of the reported groups.



Trend in Incidence Rate: Worldwide, obesity has more than doubled since 1980 and along with being overweight is the fifth leading risk for global deaths.

Known Contributing Factors: Lack of Exercise, High Calorie Intake, Genetics, Drug Usage

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Obesity: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

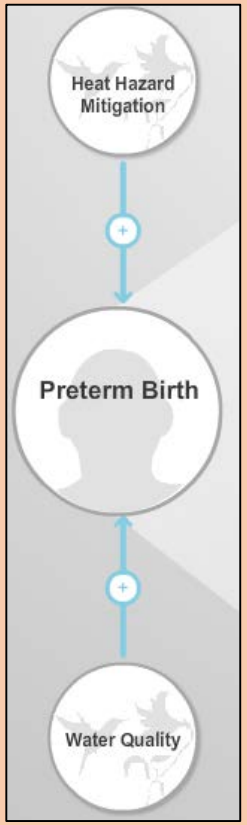
OBESITY / AESTHETICS & ENGAGEMENT WITH NATURE: Living in a residence surrounded by at a buffer of at least 100 m of greenspace was associated with 17% reduced odds of being overweight or obese (Dadvand et al., 2014; n=3,178, Sabadell, Spain

OBESITY / RECREATION & PHYSICAL ACTIVITY: In 2005-2006, U.S. adults spent approximately 56.8% of the waking day in sedentary activity, 23.7% in low-intensity, 16.7% in light-intensity and less than 3% in moderate- to vigorous-intensity activity. As the amount of physical activity increased, BMI scores decreased. People with a normal BMI (less than 25 kg/m2) spent 33 min/day doing moderate to vigorous physical activity, while those who were overweight (BMI between 25 and 30) spent roughly 28.6 minutes in moderate to vigorous activity. Those who were obese (BMI greater than 30) spent only 20.5 min/day doing moderate to vigorous activity (Tudor-Locke et al., 2010; n=5,000 adults, USA).

OBESITY / AIR QUALITY: Children may be at greater risk for childhood obesity if their mothers are exposed to polycyclic aromatic hydrocarbons (PAH) during pregnancy. In this study, it was found that higher prenatal PAH exposure was significantly associated with higher childhood body size. At age 5 years, 21% of the children were obese as were 25% of those followed to age 7 years. Children of mothers with the highest PAH exposure had a 0.39-unit higher body mass index z-score and a relative risk of 1.79 at age 5 years (0.30 BMI z-score and 2.26 RR at age 7) (Rundle et al., 2011; n=702, New York).

Preterm Birth

Definition:	A baby is considered preterm, or premature, if it is born at least three weeks before its due date - or 37 weeks. Of all neonatal deaths, 28% are due to preterm birth.
Organ System:	Reproductive
Demographic:	Pregnant women worldwide have premature births. In the United States, 1 in 8 babies is born premature.
Trend in Incidence Rate:	In countries where data is available, such as the U.S. and UK among others, preterm birth rates have risen dramatically over the past 20 years due to a number of factors.
Known Contributing Factors:	Carrying More than One Child, Previous Preterm Birth, Uterine or Cervical Issues, Previous Chronic Health Problems; Cigarette Smoking, Alcohol Use, or Drug Use During Pregnancy



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Preterm Birth: Eco-Health Connections

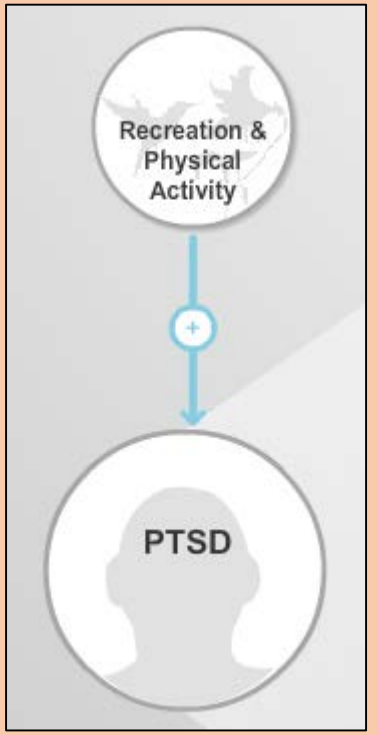
Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

PRETERM BIRTH / HEAT HAZARD MITIGATION: Preterm births increase significantly during extreme heat events.- Evidence - Heat waves were associated with 32.4% higher preterm births (Kent et al., 2014; n=60,466, Alabama, United States).

PRETERM BIRTH / WATER QUALITY: Researchers found that significant decreases in gestational duration are associated with in-utero organophosphate pesticide exposure, especially increased exposure in the latter part of pregnancy. For every log10 unit increase in pesticide exposure there was a 0.41 week (2.9 days) decrease in gestation (Eskenazi et al., 2004; n=601 low-income, Latina women, California).

PTSD

Definition:	Post-Traumatic Stress Disorder (PTSD) is an anxiety disorder that some people get after seeing or living through a dangerous or traumatic event. People who have PTSD may feel stressed or frightened even when they're no longer in danger.
Organ System:	Nervous
Demographic:	Anyone can get PTSD at any age. Roughly 7 or 8 out of every 100 people will experience PTSD at some point in their lives.
Trend in Incidence Rate:	About 8 million adults have PTSD during a given year. This is only a small portion of those who have gone through a trauma. Women are more likely to develop PTSD than men.
Known Contributing Factors:	Traumatic Event, Prior Trauma, History of Mental Illness, Mental Illness in the Family, Genetics, Alcohol Abuse, Education Level



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PTSD: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

PTSD / RECREATION & PHYSICAL ACTIVITY: The study sought to evaluate the effectiveness of a fly-fishing program (3-day overnight trip) in reducing multiple measures related to Post Traumatic Stress Disorder (PTSD) in a sample of veterans with PTSD. Paired t-tests showed a significant reduction in overall PCLM-M scores (PTSD indicator) between the baseline and follow-up periods (p less than 0.001) and on all 3 subscales (p less than 0.001). Bonferroni post hoc analyses of Brief Symptom Inventory scores revealed the trip to be linked to significant and sustained reductions on all measures of distress, comparing baseline levels to 6 wk. follow-up assessments (p less than 0.001). The trip was also found to be linked to significant and sustained reductions for negative affect (guilt, hostility, fear, sadness) from the last day of the fly-fishing trip to the 6 wk. follow up assessment relative to the baseline period (p less than 0.001). Analyses also indicated significant acute effects for increases on positive affect (self-assuredness, joviality, serenity) (p less than 0.001) on the last day relative to the baseline period, and sustained increases in serenity (p less than 0.05) when comparing the baseline to the 6 wk. follow-up period. Paired sample t-tests evaluated hypothesized improvements in sleep quality between baseline and follow-up periods (last day of trip, 6 weeks after), indicating significant effects: Pittsburgh Sleep Quality Inventory (PSQI), $t(73) = 2.23$, p less than 0.001 (Vella et al., 2013; n=74, United States).

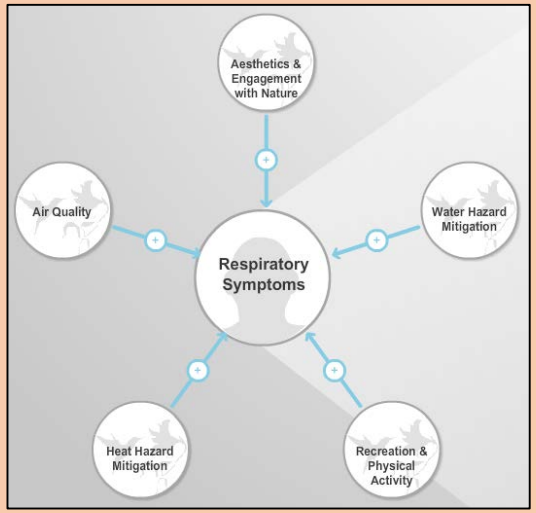
Respiratory Symptoms

Definition: Common respiratory symptoms include coughing and wheezing. There are a number of respiratory symptoms that are associated with serious respiratory illnesses. These symptoms include the following: difficulty breathing, rapid breathing, shallow or deep breathing, and absence of breathing.

Organ System: Respiratory

Demographic: Respiratory symptoms can affect any person regardless of age, race or gender, though women are more likely than men to develop a chronic cough.

Known Contributing Factors: COPD, Infection, Inflammation, Smoking, Heart Conditions, Irritants, Allergens



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Respiratory Symptoms: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

RESPIRATORY SYMPTOMS / AESTHETICS & ENGAGEMENT WITH NATURE: Children who used city parks less than 5 hours per week were 52% more likely to be rated in "poor health" (wheezing and allergies) by their parents (Grazuleviciene et al., 2014; n=1,489, Lithuania).

RESPIRATORY SYMPTOMS / WATER HAZARD MITIGATION: Respiratory tract infections accounted for 17.4% of treatment visits for displaced persons during the devastating 1988 flooding in Bangladesh (Siddique et al., 1991; n=46,740, Bangladesh).

RESPIRATORY SYMPTOMS / RECREATION & PHYSICAL ACTIVITY: Children who used city parks less than 5 hours per week were 52% more likely to be rated in "poor health" (wheezing and allergies) by their parents (Grazuleviciene et al., 2014; n=1,489, Lithuania).

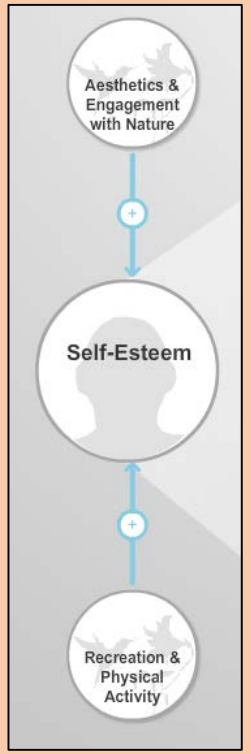
RESPIRATORY SYMPTOMS / HEAT HAZARD MITIGATION: During a July, 2006, heat wave in Porto, Portugal, a 1°C increase in mean apparent temperature was associated with a 1.7% increase in hospitalizations due to respiratory distress (2.2% for women). For those older than 74 yrs., there was a 3.3% increase in these hospitalizations, with a 3.9% increase for senior women. The greatest number of excess hospitalizations occurred on the fourth consecutive day of extreme heat (Monteiro et al., 2013).

RESPIRATORY SYMPTOMS / AIR QUALITY: The risk of admission to the hospital for respiratory disease in the spring and summer months increased 4.2%-5% with a 30 ppb increase in daily high hour ozone concentrations in the previous day (Burnett et al., 1997; n=16 cities, Canada).

Self-Esteem

Definition: Self-esteem is used to describe one's overall sense of self-worth or personal value. Many experts think self-esteem is a major component of human existence and plays an important role in one's construct of identity.

Organ System: Nervous



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Self-Esteem: Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

SELF-ESTEEM / AESTHETICS & ENGAGEMENT WITH NATURE: Exercising and walking outdoors, and even viewing pictures of nature, can significantly improve self-esteem.- Evidence -[1] Both meditative and athletic walking in a forested environment increased reported self-esteem more than either of these activities in an indoor environment. In both settings, meditative walking was found to increase self-esteem more than athletic walking (Shin et al., 2013; n=139 young women, Korea). [2] Taking a walk outdoors improved self-esteem by 25% (Peacock et al., 2007; n=20, UK). [3] People who took part in green exercise reported a 9% improvement in self-esteem after the activity (Pretty et al., 2005; n=263, UK).

SELF-ESTEEM / RECREATION & PHYSICAL ACTIVITY: Participating in physical activity can improve self-esteem.- Evidence -[1] Study participants reported an almost 9% improvement in self-esteem after physical activity (Pretty et al., 2005; n=263, UK). [2] Older adults who participated in exercise experienced a significant increase in self-esteem (Netz et al., 2005; n=36 studies, meta-analysis). [3] In a multi-study analysis, researchers found that acute short-term exposures to green exercise improved both self-esteem (effect size=0.46) and mood (effect size=0.54). This improvement increased with the presence of water and was true regardless of duration or intensity of exercise (Barton and Pretty 2010; n=1,252, UK). [4] Researchers found that self-esteem scores improved more following exercise when compared to spending time in social activities. Out of the three study groups, those in the green exercise group had the greatest improvement in self-esteem (2.6 out of 40) (Barton et al., 2012, n=53, UK).

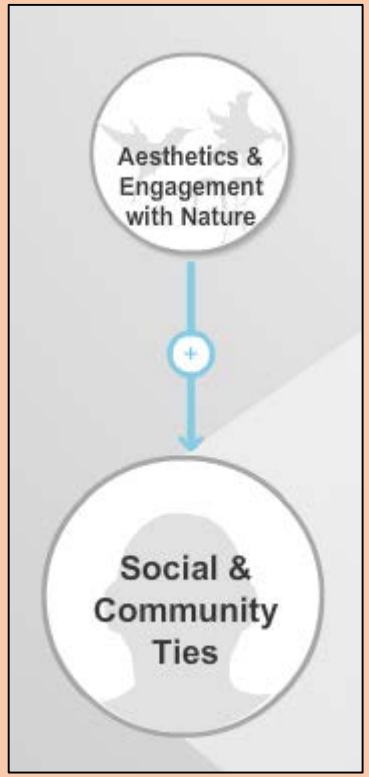
Social and Community Ties

Definition: Social relations, which are often referred to as social interactions, include the relationships that individuals have with one or more people. The term includes long-term relationships and everyday social interactions with others.

Organ System: Nervous

Demographic: In general, humans feel the need for contact with other human beings and interact with others on a regular basis. Demographic factors that may affect a person's social connectedness include: age, marital status, church attendance, home ownership, education and income.

Known Contributing Factors: Environment, Development of Social Skills



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Social and Community Ties:
Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

SOCIAL & COMMUNITY TIES / AESTHETICS & ENGAGEMENT WITH NATURE: In urban areas, including public housing developments, access to common green spaces and the greenness of those areas are positively linked to neighborly activities and social and community ties across age groups.- Evidence -[1] With every unit increase of greenness in common space, residents of an urban public housing community saw a 1/3-unit increase in neighborhood social ties. With every unit increase of use of common space, there was a 1/5-unit increase in neighborhood social ties (Kuo et al., 1998; n=145, Chicago). [2] The presence of trees was significantly associated with the presence of people in outdoor public spaces in an urban housing community. The mean number of people in areas with no trees was 1.32; the mean number of people in areas with trees was 4.45, 237% higher (Coley et al., 1997; observational, Chicago). [3] Social capital, defined as social connection or association, was positively correlated with tree canopy (measured as percentage of tree canopy per block group). Also, a linear regression found that tree canopy density was positively related to social capital (Holtan et al., 2014; n=361, Baltimore, Maryland, United States). [4] Urban residents who reported visiting a local park for more than 30 minutes, versus those who did not, were three times as likely to have four or more good friends in the area. People who reported engaging in social activities in a local park versus those who did not were almost four times as likely to have 14 or more acquaintances in the area (Kazmierczak 2013; n=236, England).

Stress

Definition:	Stress is a normal feeling that can manifest as a result of an event or thought that makes people frustrated, upset or nervous. While some stress can be healthy, chronic and/or prolonged stress can have negative health effects. Stress affects people differently and can bring about headaches, muscle pain, and rapid breathing, among other symptoms.
Organ System:	Nervous System
Demographic:	Stress can affect people of all ages, regardless of sex or ethnicity. However, one study in the United States found that women, individuals with lower income, and those who have less education reported higher levels of stress.
Trend in Incidence Rate:	Studies in the US indicate that stress decreases with age and education level.
Known Contributing Factors:	Emotional or Important Life Events; Injury or Illness in Yourself, a Friend, or Loved One; Depression

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Stress: Eco-Health Connections

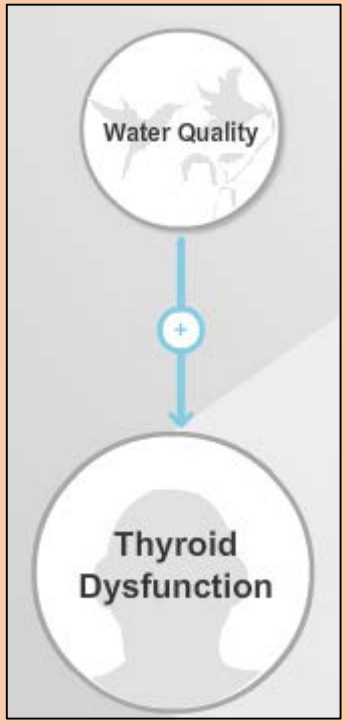
Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

STRESS / AESTHETICS & ENGAGEMENT WITH NATURE: [1] Two related studies in economically deprived communities found inverse relationships between neighborhood green space and both self-reported stress and objective markers of stress as measured by levels and patterns of cortisol secretion (Roe et al., 2013; n =106; Ward Thompson et al., 2012; n=25, Scotland). The larger study also found significant gender differences--women in less green neighborhoods showed higher levels of stress than men, and the relationship of cortisol measures to perceived stress was dissimilar between genders. [2] People who visited urban green spaces more often reported lower levels of stress (includes fatigue and irritation). Additionally, those who reported wishing to be outdoors in green spaces more often suffered from higher levels of stress (Grahn and Stigsdotter 2003; n=953, Sweden).

STRESS / RECREATION & PHYSICAL ACTIVITY: [1] Study participants reported an 87% stress recovery ratio following their visit to a forest or park. Those who practiced sports while at the green space experienced greater reductions in stress than those who relaxed or walked (Hansmann et al., 2007, n=164, Switzerland). [2] The study sought to evaluate the effectiveness of a fly-fishing program (3-day overnight trip) in reducing psychological distress and other factors in a sample of veterans with PTSD. Paired sample t-tests evaluated hypothesized reductions in perceptual stress between baseline and follow-up periods (last day of trip, 6 weeks after), indicating significant effects: Perceived Stress Scale (PSS), t(73) = 5.56, p less than 0.001 (Vella et al., 2013; n=74, United States).

Thyroid Dysfunction

Definition:	The thyroid gland is located in the neck and is a hormone-producing endocrine gland. When the thyroid gland malfunctions, it may cause too much or not enough hormone to be produced. A thyroid gland that is not active enough (hypothyroidism) may cause weight gain and fatigue.
Organ System:	Endocrine
Demographic:	People over the age of 50 and females are at higher risk of hypothyroidism (most common thyroid dysfunction).
Known Contributing Factors:	Inflammation of the thyroid gland, birth defects



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Thyroid Dysfunction:
Eco-Health Connections

Note: these are not all-inclusive. Some studies may have been left off due to space constraints.

THYROID DYSFUNCTION / WATER QUALITY:

Nitrate, a chemical that has numerous health effects including inhibiting iodine accumulation in the thyroid gland, is commonly found in groundwater aquifers and thus in drinking water supplies. This study compared 26 pregnant women in a village with high (93 mg/L) nitrate concentrations in the drinking water to 22 pregnant women in a village with low (8 mg/L) nitrate concentrations. Women living in the high-nitrate village were 429% more likely to have thyroid dysfunction than those in the low-concentration village, thus demonstrating that high nitrate levels are a risk factor for thyroid dysfunction (Gatseva et al., 2008; n=48 pregnant women, Bulgaria).

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Aesthetics & Engagement with Nature

People enjoy recreating, relaxing, and spending time outdoors. **Scientific studies show that exposure to nature is positively associated with numerous aspects of health and good social relations.** Causal mechanisms for some of these associations have been demonstrated in the laboratory: faster recovery from neurological fatigue appears to be responsible for the observed effects that greenness has on mental concentration and the alleviation of ADHD symptoms in children. **Exposure to natural scenery, even through a window or a photograph, slows the heart rate and calms anxiety. Humans' innate affinity for nature may be responsible for observations that people are preferentially drawn to community green space, where they are more inclined to interact with neighbors while relaxing or recreating. Access to nature, including urban green space, allows for engagement with the natural world and seems to have health benefits that extend beyond those derived from outdoor exercise. Gardens have long been components of hospital grounds and urban settings for their perceived benefits to well-being. Engagement with less cultivated outdoor environments is believed to facilitate exploration, creativity, and self-esteem in children (Louv 2005).** The notion that humans, as natural creatures that evolved within ecological settings, have an innate affinity for nature has been dubbed biophilia (Wilson 1984). This concept is one explanation for observed improvements in many aspects of human health with increased exposure to features, even representations, of the natural world.

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Aesthetics & Engagement with Nature

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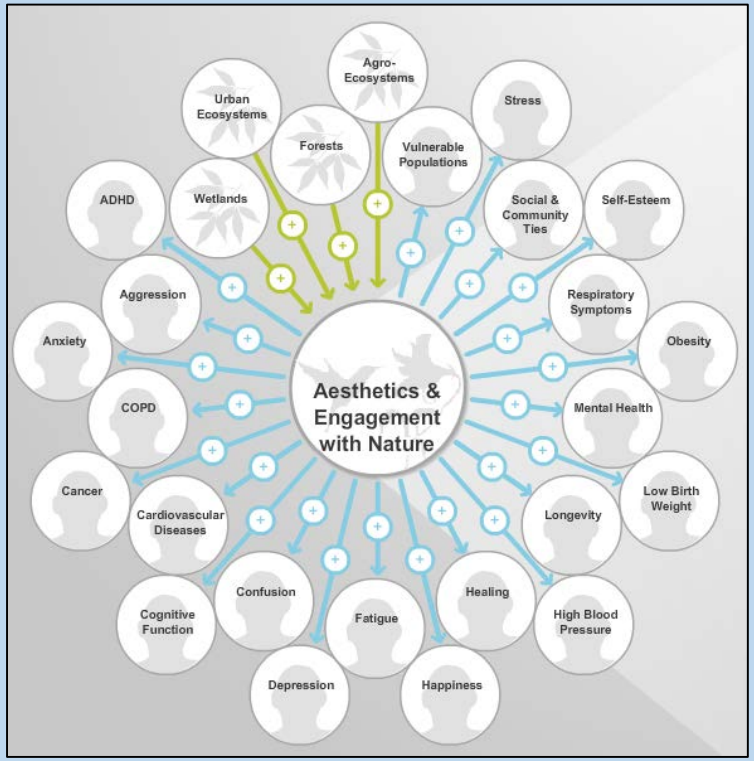

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Air Quality

As industry, urbanization, and use of motor vehicles have increased, so too has the concentration of pollutants in the atmosphere. **Forests and other green spaces can reduce the atmospheric concentrations of many of these pollutants, including** those regulated under the U.S. Clean Air Act: particulate matter (PM 10 and PM 2.5), **carbon monoxide, sulfur dioxide, nitrogen dioxide and ozone. Due to their significant negative health effects, their natural removal, dilution, or displacement can protect public health.** In heavily populated areas, even small air-quality improvements from tree cover are estimated to significantly reduce incidence and severity of respiratory and related illnesses, as well as reduce health-care costs and days missed from work and school. Vegetation can also increase air pollution through the production of pollen, fungal spores, and volatile organic compounds, which contribute to ozone formation.

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Air Quality

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Water Quality

When a contaminant is introduced into water, it does not always remain suspended in the water but can be taken up by plants, animals, or soil before it reaches a major water body. **Ecological features, whether natural or man-made, with the appropriate plant species and soil types, can remove up to 100% of certain contaminants from various landscapes including urban and agricultural areas. This process can reduce contamination of aquatic habitats, drinking-water supplies, and recreational waters. The absence of adequate natural water filtration due to habitat removal or the inability of the filtering environment to cope with the volume of pollution can lead to significant public-health threats.** These threats can be reduced with water treatment systems; however, this solution is not always an option due to expense or technology limitations. One well known example of promoting natural removal of contaminants as opposed to a water treatment system is that of the Catskills watershed. Faced with building a water filtration plant that would cost at least $6 billion to build and $300 million a year to operate, New York City opted to protect the Catskills watershed which provides their water supply. An investment of $1 to $1.5 billion to purchase and restore the watershed allowed for continued purification and filtration of the City's water resources without having to invest in a filtration plant.

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Water Quality

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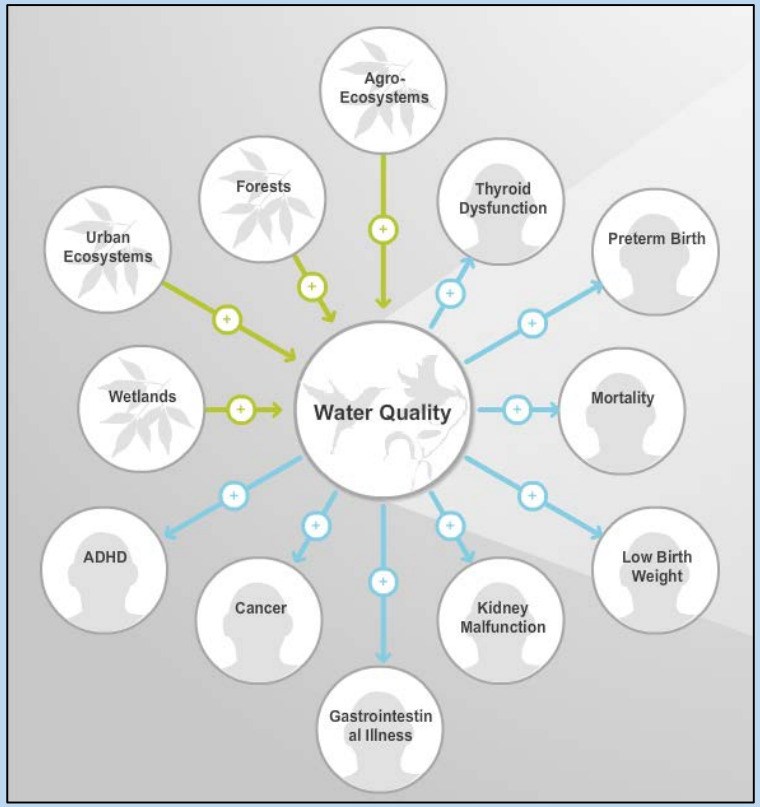

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Heat Hazard Mitigation

The Urban Heat Island (UHI) effect is a heating phenomenon that occurs in urban centers and their surrounding suburban areas. With the UHI effect, metropolitan areas do not cool down at night due to the release of heat from dark surfaces that absorb heat throughout the day. In UHIs, temperatures can be 6 to 8 degrees higher in urban centers than in nearby woodlands. This fact is especially important during heat wave events, where those who reside in urban areas are often most effected due to exposure to higher maximum temperatures and less nighttime reprieve from heat. In urban systems, green spaces such as parks, urban forests and green roofs, can reduce urban temperatures and mitigate the effects of heat wave events through evapotranspiration and shading. The cooling effects of these green spaces may be especially important during heat waves, where temperatures directly outside the homes in which people are confined (elderly, infirm) have an effect on mortality.

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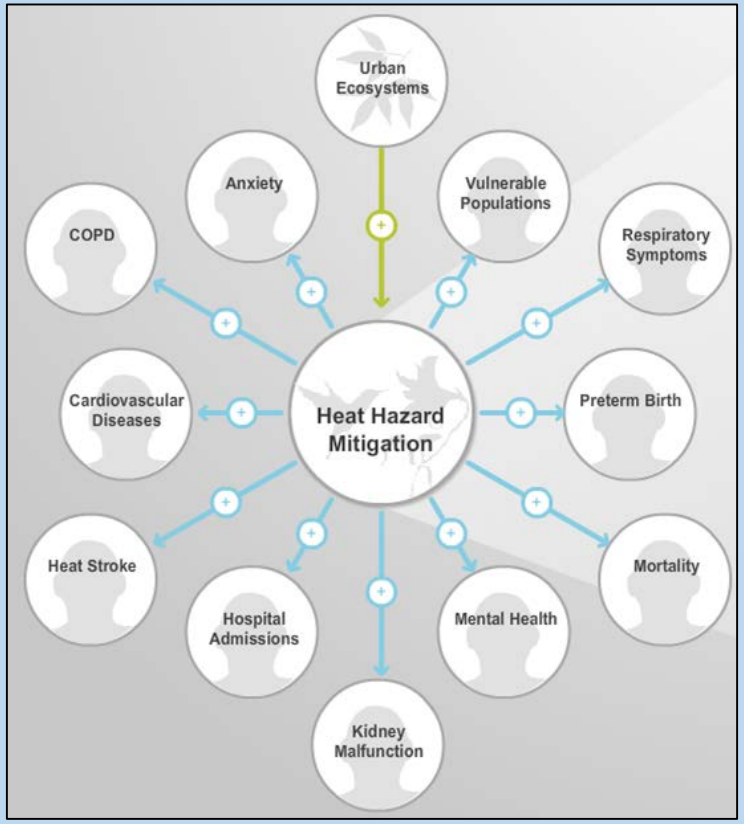
Heat Hazard Mitigation



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Recreation & Physical Activity

Regular physical activity is essential to a healthy lifestyle. Outdoor areas such as parks, forests, and urban green spaces promote a variety of physical activities such as walking, biking and exploration. Bodies of water also provide opportunities for activities like canoeing, fishing, and water skiing. Though there are numerous opportunities for indoor exercise at fitness centers, these options are often costly in terms of time and money and are not available to everyone. **Studies show that many people prefer exercising outdoors and outdoor exercise has been shown to have more positive mental and physical health effects than indoor exercise. The presence of outdoor green spaces provides more opportunities for people to recreate and participate in physical activities outdoors.** This planned exercise, combined with the incidental exercise that comes from walking and biking from place to place, contributes to overall well-being.

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Recreation & Physical Activity

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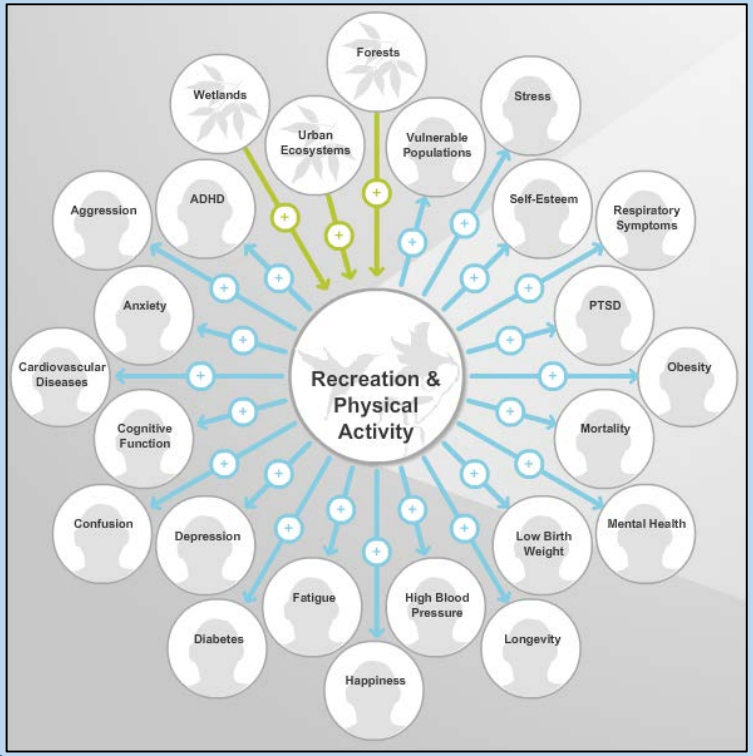

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Water Hazard Mitigation

Various ecosystems, whether natural or man-made, can buffer the negative effects that extreme precipitation and weather events have on surrounding areas. For instance, wetlands moderate the effects of floods by taking in and holding floodwaters and protect coastlines from storm events like hurricanes and tsunamis. Forested ecosystems have also been shown to reduce flooding and help regulate water flow in-between precipitation events by intercepting, absorbing, and slowly releasing water. In urban areas, these forests also reduce the impacts of stormwater runoff. This water regulation reduces flooding events and their negative health effects while also mitigating potential droughts through water storage. The absence of ecosystems such as wetlands and forests, which are capable of regulating water, may result in increased incidence of extreme events such as flooding, as well as exacerbate the effects of events such as hurricanes due to the lack of a proper buffer from human settlements.

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Water Hazard Mitigation

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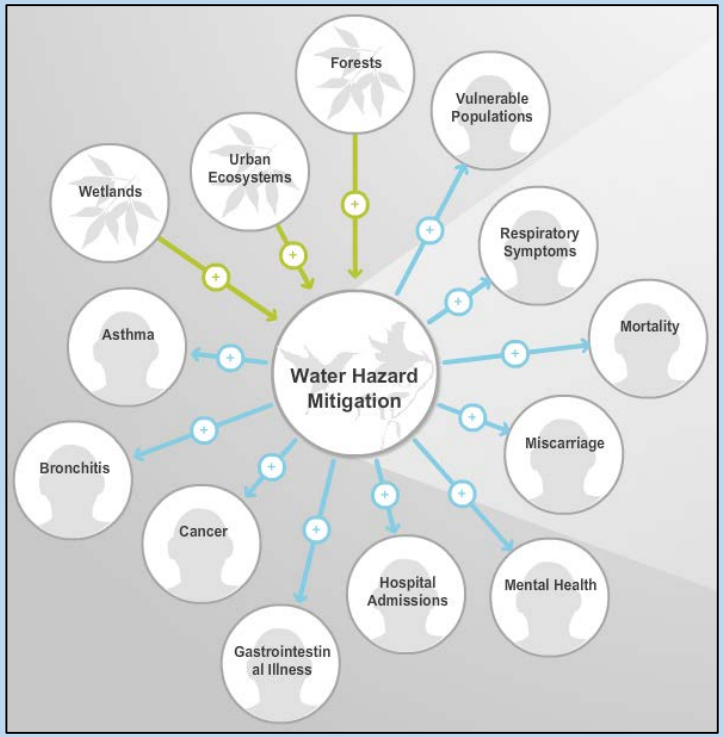

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