

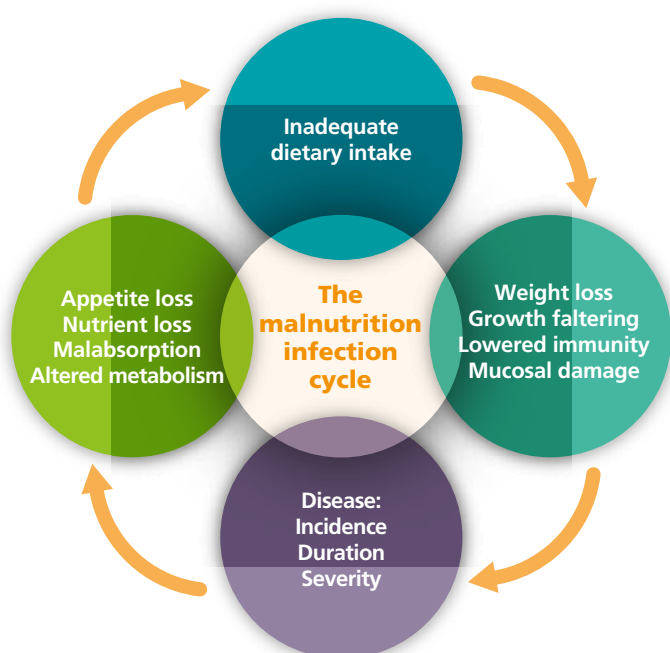


Forests for human health and well-being

Forests provide, directly or indirectly, important health benefits for all people – not only those whose lives are closely intertwined with forest ecosystems, but also people far from forests, including urban populations. Recognition of the importance of forests for food security and nutrition has significantly increased in recent years, but their role in human health has received less attention. Nutrition and health are intrinsically connected: Good nutrition cannot be achieved without good health and vice versa. Therefore, when addressing linkages with forests, it is essential to address health and nutrition at the same time. Yet forests also provide a wide range of benefits to human health and well-being beyond those generally associated with food security and nutrition. Recognizing that forests are essential for the well-being of all people, and creating an enabling environment in which people can benefit from them, can help transform people's interactions with forest ecosystems, especially in a rapidly urbanizing world.

WHO defines health as “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity”. Thus the concept of health includes not only treatment of illness, but also disease prevention and maintenance of health and well-being. Even more broadly, health can be considered not only in terms of the individual, but also in relation to the well-being of the community, which in turn depends on the well-being of the environment.

The vicious cycle of malnutrition and infection



HOW FORESTS CONTRIBUTE TO THE HEALTH OF PEOPLE LIVING IN OR NEAR FORESTS

Consumption of forest foods

Nutrient deficiency is a critical challenge to human health. Forests provide edible products that contribute macro- and micronutrients to a healthy diet, such as fruits, leaves, nuts and seeds, mushrooms, honey, wild meat and insects. While forest foods may have a small role in terms of calories, they form a critical part of diets commonly consumed by rural populations, which are often poor and food insecure. Forest foods also contribute to dietary diversity, which increases the diversity of the gut microbiome for improved health. Forest foods are of particular nutritional (and cultural) importance to Indigenous communities.

Facts and figures:

- Globally, an estimated 820 million people are undernourished and over 2 billion people are micronutrient deficient.



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- A study of data from 43 000 households across 27 countries in Africa found that the dietary diversity of children exposed to forests was at least 25 percent higher than that of children who were not.
- A study of 22 countries in Asia and Africa found that Indigenous communities use an average of 120 wild foods per community.
- In Central Africa, wild meat and fishery products account for 85 percent of the total protein intake of forest people.

Medicines from the forest

Diseases pose a particular challenge to the survival of forest people. Transmissible diseases are particularly diverse in forest ecosystems, especially moist and hot tropical ecosystems, and forest communities are often remote from health services. WHO estimates that at least 80 percent of the world's population depends on traditional medicine to meet primary health care needs. Local knowledge of medicinal plants constitutes a major part of traditional health care systems.

Facts and figures:

- Medicinal plants in forests have been used by humans for at least 5 000 years. The total number of plant species used for medicinal purposes could be as high as 50 000.
- Over 1 billion people worldwide use herbal and home remedies to treat children's diarrhoea.
- In India, forest plants are commonly used to treat snake-bite, asthma, jaundice, dropsy, gynaecological problems, piles, elephantiasis, bronchitis, rheumatism, leprosy, diabetes, cancer, pneumonia, paralysis, pharyngitis, ulcers, dysentery, cough, skin diseases, fever and lactation insufficiency.
- In China, almost 5 000 of over 26 000 native plant species (19 percent) are used as drugs.

Woodfuel: a source of health benefits as well as risks

Woodfuel is often the cheapest, most readily available and most easily accessible source of fuel for rural populations. Widely used for cooking, processing and preserving food and for sterilizing water, it plays a vital part in decreasing the occurrence of food- and water-borne diseases. Cooking is necessary for the utilization of some foods, improves nutritional quality and uptake, and increases the bioavailability of certain micronutrients, such as beta-carotene and lycopene. Untreated drinking-water may contain parasites and pathogens that cause diarrhoea, typhoid or dysentery. Around 20 percent of people in developing countries treat their drinking-water by boiling it. Smoke from improperly burned woodfuel can pose a serious human health risk, however, especially to women and children. Household air pollution is the single most important environmental

WOMEN, FORESTS AND HEALTH

It is not possible to address the forest–health–nutrition nexus without taking gender aspects into consideration. In developing countries, it is mainly women who control the use of natural resources for nutrition and health: It is women who collect and sterilize water, collect fuel, and provide food and medicine for their households. Women are custodians of traditional knowledge on local biodiversity, how to transform it into edible and medical products and how to manage it sustainably. Women's empowerment and rights over forest resources lead to improved nutrition and health outcomes, because women tend to use their income from forest activities to feed their families.



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health risk worldwide. Malnourished and nutrient-deficient people are more susceptible to diseases related to poor air quality.

Facts and figures:

- Over 75 percent of rural households (as well as 20 percent of urban households) depend primarily on woodfuel for cooking.
- In 2015, an estimated 663 million people globally had no access to clean, safe drinking-water and had to source water from unprotected wells, springs and surface water.
- Almost 1.4 billion people in developing countries treat drinking-water by boiling it, and about 765 million people (more than 10 percent of the global population) use woodfuel for this purpose.
- Smoke from solid fuels, including biomass, is associated with close to 4 million deaths each year from pulmonary diseases, strokes, lung cancer and ischaemic heart disease, and it can also cause blindness.

Cultural, spiritual and mental health

The forest often has a cultural significance that is key to the spiritual health of individuals and communities living in and near forest areas. Indigenous people often associate the well-being of the forest with enhanced collective and community well-being in a large sense, perceiving a link between healthy land and healthy people. In such cultures, forest degradation and deforestation have been observed to cause negative mental health effects.

ROLE OF FORESTS IN THE HEALTH OF URBAN POPULATIONS AND INDUSTRIALIZED SOCIETIES

Mitigating urban stresses

Urban and peri-urban forests provide green space for exercise and recreation, and assist in recovery from the stress of urban life. They buffer noise, reduce the urban heat island effect, which can be



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lethal during heat waves, and absorb pollution from traffic and industry, thus helping to shield against respiratory disease. Nature exposure appears to reduce income-related inequality in health status; it has been seen to provide greater benefits for groups with lower socio-economic status, perhaps because it may mitigate factors accounting for their generally higher rates of disease.

Facts and figures:

- More than half of the global population lives in urban areas, and this proportion is expected to increase to 68 percent by 2050.
- Rapid urban population growth and high poverty rates have been associated with increased risk of non-communicable diseases.
- Shade provided by urban forests and trees can reduce the urban heat island effect by 4 to 5 °C in some settings.

Forest products and healthy diets

Modernization, urbanization, economic development and increased wealth are associated with a nutrition transition – a shift from traditional diets based on basic commodities to an increased use of packaged and processed food and diets high in sugars, trans fat and animal-source food. This shift towards unhealthy diets, together with reduced physical exercise, is a major contributing factor to the global increase in overweight, obesity and associated non-communicable diseases such as heart and lung disease, stroke, cancer and type 2 diabetes. Traditional healthy whole-food diets based on diverse plant and animal resources gathered from woods and forests, which are mainly low in fat and high in protein and complex carbohydrates, show promise for reducing such diseases. Foods from forests, such as mushrooms and berries, have long contributed to diets even for populations of industrialized countries. Globalization is helping to expand the array of tropical forest foods reaching



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urban consumers. In recent years, consumption of insects as food has also become accepted in some countries where they have not been part of traditional diets, for example in Europe and North America.

Facts and figures:

- A survey of over 17 000 households in 28 European countries showed that almost 92 percent had consumed wild forest products (game, mushrooms, edible plants) in 2015; 82 percent of them purchased these products from a shop, while 25 percent were involved in direct gathering.

Forest pharmaceuticals

Plant-based drugs have an important and growing role in modern medicine. Many commercial pharmaceutical products are derived from tropical forest species. Many of these medicines were identified as part of the traditional health systems of forest-dwelling peoples, while others have been discovered through pharmacological screening. Some of these products are now synthesized, but others are still collected from the wild. Developing countries provide two-thirds of the plants used in modern systems of medicine, but it is on the whole the developed countries that benefit economically from them. An improved ability to harness these resources could have a positive impact on health care delivery in developing countries.

Facts and figures:

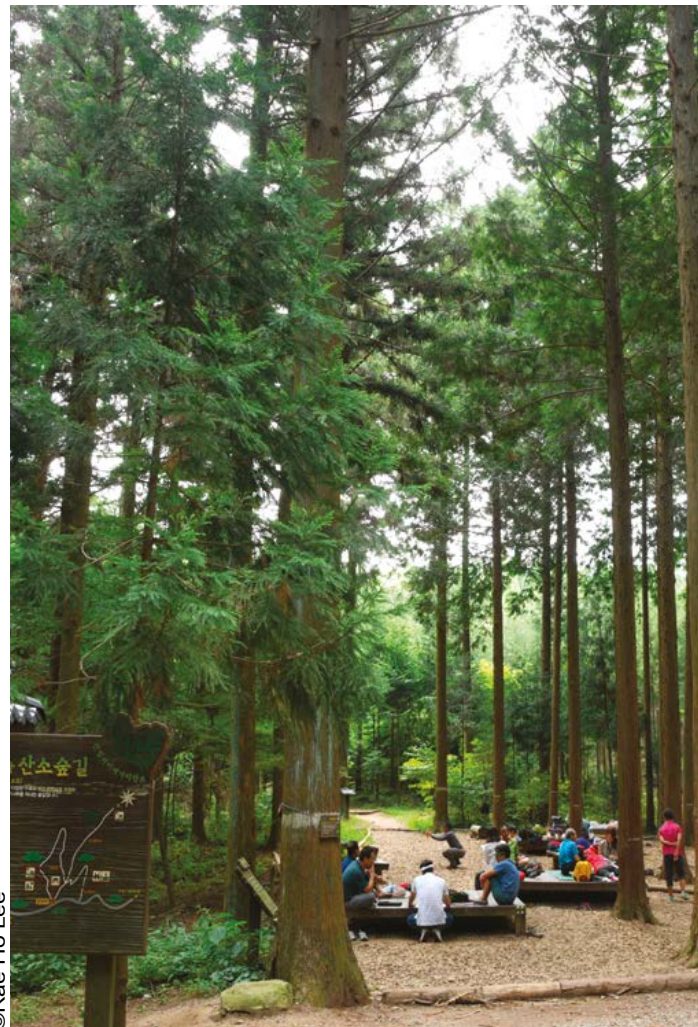
- Drugs derived from forest species include quinine from *Cinchona* spp., previously the most widely used antimalarial; cancer-treating drugs from rosy periwinkle (*Catharanthus roseus*); paclitaxel, an anticancer agent originally derived from the bark of the Pacific yew (*Taxus brevifolia*); treatments for enlarged prostate gland from *Prunus africana*; forskolin

from the root of *Coleus forskohlii*; and medicine for treating diabetes from *Dioscorea dumetorum* and *Harungana vismia*.

- In developed countries such as the United States, up to 25 percent of all drugs are plant based, while in fast-developing countries such as China and India, the contribution is as much as 80 percent.
- At least 60 percent of current medicinal plant products may be obtained from wild harvesting.

Mental, physiological, social and spiritual health benefits

Increasing evidence shows a positive relationship between exposure to forests and mental, physical, social and spiritual well-being – all interlinked cornerstones of good health. The benefits are likely greatest for those living in urban areas and whose basic health needs (e.g. nutrition, housing) are largely met. Parks and forested areas offer opportunities for outdoor physical activity, which has been shown to reduce the risk of both mental illnesses such as depression and non-communicable diseases. These health



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Interlinkages among mental, physiological and social health benefits of exposure to nature



problems often disproportionately affect socio-economically disadvantaged and vulnerable groups and are frequently linked with chronic stress and poor diet as well as insufficient physical activity.

Extensive research demonstrates that use of forests contributes to reducing stress and promoting more positive moods and feelings. In relatively high-income countries, long-term exposure of urban populations to residential parks, gardens and forests has shown beneficial effects related to general health, obesity, birth weight, childhood behavioural development and mortality. Breathing in fresh air and volatile organic compounds (phytoncides) emitted by trees is also believed to strengthen human immune function and to promote both physical and mental health; this concept underlies the increasing popularity of forest-based therapies and “forest bathing”, as the practice of peaceful walks in forests is called in Japan. Growing evidence suggests that direct contact with nature contributes to a healthier composition of the human commensal microbiota – micro-organisms living mostly in the human gut but

also on skin and in other parts of the body, which help their human hosts by providing essential nutrients, metabolizing indigestible compounds and defending against pathogens. Experiencing the solitude, beauty, silence, grandeur and harmony of nature can also be a means of meeting spiritual needs.

Facts and figures:

- Non-communicable diseases are responsible for almost three-quarters of all deaths globally, the majority of which occur in low- and middle-income countries. Six non-communicable diseases are included in the top 10 global causes of mortality.
- Studies from China, Japan and the Republic of Korea have shown that a visit to a forest environment lowers blood pressure and pulse rate, reduces cortisol level, suppresses activity of the sympathetic nervous system (which controls the “fight, flight or freeze” response during potential danger) and enhances activity of the parasympathetic nervous system (which inhibits the body from overworking and restores it to a calm and composed state).

OBSERVED MENTAL HEALTH BENEFITS OF CONTACT WITH FOREST

- Increased positive emotions and decreased stress, depression, fatigue, general anxiety, uncertainty and tension
- Improved psychological stability in patients with depression and alcoholism
- Raised self-esteem
- Renewed vitality and directed attention capacity
- Healthy mental and social development of children
- Improved emotional well-being and alertness for cancer patients

HEALTH CONSEQUENCES WHEN FORESTS AND TRADITIONAL FOREST COMMUNITIES BECOME ALTERED

Urbanization is taking place considerably faster in developing than in developed regions; in 2018, 3.2 billion people lived in cities in developing regions, compared with 1 billion in developed regions. Urbanization, combined with overall population growth, could add another 2.5 billion people to urban areas by 2050, with close to 90 percent of this increase expected to take place in Asia and Africa. With increasing globalization, urbanization and land-use change, forest boundaries are increasingly becoming fragmented, and traditional forest communities are becoming less remote from urban areas. These changes also have a role in human health.

Health issues associated with a changing way of life for forest dwellers

Industrialization and urbanization, which generally follow economic growth in tropical forests, bring in their wake changes to a population's diet and nutritional status. Deforestation, decreased access to land and the shift to a more sedentary way of life affect food availability and distribution and dietary diversity, leading to a dietary transition, especially in children: a tendency towards excess intake of energy-dense foods that are rich in fat and free sugars but low in complex carbohydrates, which have been linked with obesity and risk of degenerative chronic diseases in middle and later adult life. Where high rates of infectious illness persist and undernutrition and overnutrition coexist, communicable and non-communicable diseases create a double burden.

Facts and figures:

- Studies of former hunter-gatherers show increased nutritional disorders, such as anaemia, obesity, hypertension, elevated cholesterol levels and diabetes, and loss of physical fitness as a result of their decreased dietary diversity and physical activity.

Transmissible diseases

Some infectious diseases are spread through forest pest vectors, for example Lyme disease and encephalitis borne by ticks. Other forest-associated diseases include malaria, Chagas disease, African trypanosomiasis (sleeping sickness), leishmaniasis and lymphatic filariasis. As settlements near forests become larger and more densely concentrated, exposure to these and other transmissible diseases (e.g. smallpox, measles, cholera, diphtheria, influenza) increases. Environmental changes, including alteration of forests, wildlife population structure and biodiversity, may modify the abundance or dispersal of particular hosts, vectors and/or pathogens. Landscape alterations such as the building of roads and agricultural conversion have led to outbreaks of malaria, for example. Evidence about the effects of forest biodiversity loss and conversely of forest management on the transmission of infectious diseases is contradictory. Areas of naturally high biodiversity may have increased abundance of vectors and serve as a source pool for new pathogens. However, mounting evidence suggests that biodiversity loss frequently increases disease transmission. Preserving intact ecosystems and their endemic biodiversity should generally reduce the prevalence of infectious diseases.

EROSION OF TRADITIONAL KNOWLEDGE

Traditional knowledge of edible and medicinal forest plants and their associated benefits is disappearing, with negative consequences for food security, nutrition and disease prevention. Preserving and maintaining traditional knowledge associated with forest biodiversity, and protecting the rights of rural people to share the benefits from the use of their knowledge and resources, is extremely important for the health and well-being of local communities as well as for the global community.

Facts and figures:

- In 2017, malaria was estimated to affect 219 million people, with almost half a million deaths, 90 percent in sub-Saharan Africa.
- A study of 700 municipalities in the Brazilian Amazon found that malaria, acute respiratory infection and diarrhoea incidence were significantly less prevalent in areas under strict environmental protection.

Emerging zoonoses

Global changes, including land-use change, encroachment of humans into forests and other wild landscapes, deforestation and habitat erosion, and globalization of wildlife trade with inadequate regulation, have increased the opportunities for pathogens to jump from wild and domestic animals to people. A number of zoonotic diseases that have had dire health and socio-economic consequences, such as malaria, dengue fever, Lyme disease, HIV and Ebola, are almost certainly connected with the loss and fragmentation of forest habitats, expansion of human populations into forest areas and increased contact of humans with wild animal products. The exponential rise in volume and speed of trade and travel has transformed the epidemiology of emerging infectious diseases,

CLIMATE CHANGE EFFECTS ON THE FOREST-HEALTH NEXUS

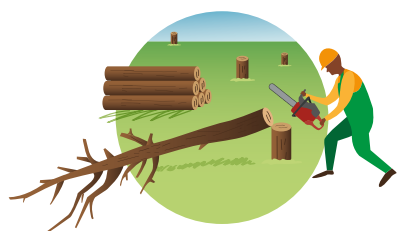
Human-induced climate change is a major factor for disease emergence. It influences the environmental conditions that can affect the survival, reproduction, abundance and distribution of pathogens, vectors and hosts, as well as allergen-producing forest species. Growing evidence suggests that disease outbreaks or epidemics may become more frequent as climate continues to change. Yet forests can also help to mitigate some of the human health related effects of climate change, by mitigating heat and mediating water flows.

giving them global rather than local importance – as the current outbreak of COVID-19 dramatically illustrates.

Facts and figures:

- Around 60 percent of all infectious diseases in humans, and 75 percent of all emerging infectious diseases, originate in animals.

Factors in emergence of zoonotics



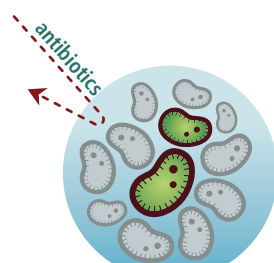
Deforestation and other land use changes



Intensified agriculture and livestock production



Illegal and poorly regulated wildlife trade



Antimicrobial resistance



Unsafe handling of wild meat



Climate change

WAYS FORWARD

Promote a One Health approach to bring together professionals and policy-makers in forestry, natural resources, agriculture, livestock and public health and nutrition for health solutions at the interface between humans, animals and their various environments.

Promote best practices of sustainable forest management to prevent the loss of forests and trees and maintain their integrity.

Ensure secure land tenure rights and forest access for local people to support their livelihoods and their access to health-giving products while providing a strong incentive to conserve forest resources.

Harmonize conservation with livelihoods and human health. Promote livelihood and income generation opportunities for forest communities, including the sale of sustainably harvested forest products and nature-based tourism enterprises, and undertake reforestation and greening initiatives in urban and peri-urban areas.

Manage wildlife sustainably, and promote safe handling of wild meat. Take into account the role of hunting and trade of wild animals in local livelihoods, nutrition and traditional medicine, on the one hand, and in the transmission of zoonotic diseases, on the other.

Include health and nutrition aspects in forest management planning, not only for rural areas but also for peri-urban and urban areas, in both developed and developing countries. Encourage a cross-sectoral approach, public participation and inclusivity.

Develop methods for measuring the health benefits of forests, which would also assist in obtaining resource allocation for initiatives linking forests and human health.

Collect disaggregated data on topics such as forest cover; health and nutritional status of the population, particularly in forested and urban areas; nutrient composition of local forest foods; collection and consumption of wild forest products used for food, feed and medicine; wildlife monitoring of likely disease vectors; and indigenous medical knowledge with wider application potential.

Encourage partnership among governmental and intergovernmental agencies, the private sector, civil society organizations and research institutions to promote innovative approaches and the sharing of best practices, knowledge, data and information.

Encourage behaviours that support human and ecosystem health, based on a vision of humans as part of nature and nature as linked to human well-being.

One Health approach

