



Population Dynamics and Biodiversity: A PSN Briefing Paper PSN October 2012

Key Points:

- **The combination of increasing population growth and consumption levels is changing the planet's ecosystems at an unprecedented rate and scale, resulting in rates of biodiversity loss that pose a major threat to human well-being.**
- **Population dynamics, including population growth, density and migration, are important underlying causes of biodiversity loss, with human demands for food, energy, land and other natural resources placing ecosystems under increasing stress.**
- **Population growth and density are particularly high in areas where there is the greatest biodiversity and the threat of loss is most severe. In many of these 'biodiversity hotspots' women have a high unmet need for contraception.**
- **Future population growth, urbanization and expansion of human settlements will present further challenges to conservation of species-rich areas and overall biodiversity protection.**
- **Slowing population growth by addressing unmet need for contraception as part of reproductive health programmes that respect and protect human rights will help ease pressures on biodiversity while empowering women and their families.**
- **Climate change caused by human activity is compounding the impacts of the growing world population and increasing consumption levels upon biodiversity, making conservation efforts more challenging and urgent.**
- **Integrated Population Health Environment (PHE) approaches combining conservation with reproductive health provision offer scope to increase the effectiveness of biodiversity protection interventions and benefit both the health of local communities and the ecosystems upon which they depend.**
- **As human rights-based programmes can positively influence population dynamics by empowering women and advancing reproductive health, the conservation sector should take a stronger advocacy role in acknowledging and addressing population dynamics as a key driver of biodiversity loss, by working cross-sector to embrace integrated strategies that benefit both people and the environment.**

Introduction

Biodiversity is vital to human well-being because it underpins the functioning of ecosystems upon which human life depends.¹ Short for 'biological diversity', the term describes the genetic pool, extent and variety of species and ecosystems.² Human activity over the last century, and particularly since 1950 coinciding with unprecedented levels of human population growth, has placed ecosystems under considerable changes and stress.^{3,4} Important habitats are being lost and degraded, ecosystems are being destabilised through pollution, climate change and direct human impacts, and many species are declining to critical population levels.⁵ In 2002, the Convention on Biodiversity (CBD), an international agreement aimed at maintaining the planet's biodiversity and equitably sharing its benefits, adopted a target to "significantly reduce" the rate of biodiversity loss by 2010, but this target was not met.¹ New "Aichi" targets have been set,⁶ yet continuing at the current rate, there is a high risk of dramatic biodiversity loss and threats to crucial and life-supporting processes, including provision of food, materials, medicines and fresh water, crop pollination, pollutant filtration and protection from natural disasters.¹ Ultimately all societies and communities will suffer, but the earliest and most severely impacted will be the world's poorest who depend directly on plants and animals for their livelihoods and survival.⁷

Human population dynamics and accompanying consumption patterns influence the major direct drivers of biodiversity, and are the underlying, root causes of biodiversity loss.^{8,9} The ways that population and society interact with the natural environment to determine availability of natural and overall environmental sustainability was recognised by the 1992 UN Earth Summit. Agenda 21 focused on both consumption and population patterns, including a call for “programmes that promote demographic trends and factors towards sustainability.”¹⁰ In accord with the 1992 Summit and responding to the interrelationships between population, development and the environment, the 1994 International Conference on Population and Development (ICPD) placed human rights, including the right to health, at the centre of this approach. This resulted in the ICPD Programme of Action, a progressive vision of sexual and reproductive health programmes which recognised empowerment of women and realisation of universal reproductive health and rights as goals in their own right, as well as critical to achieving environmental sustainability and development.¹¹ Focusing on biodiversity, this briefing explores the interactions between population and the environment, and presents important policy considerations focusing on these linkages, which, perhaps due to the related sensitivities and complexities, are often overlooked by conventional conservation interventions.

Box 1: Key Facts on Consumption, Biodiversity Loss and Population

Humanity’s increasing ecological footprint and demands

- The influence of human activity on the earth since the Industrial Revolution, and particularly since 1950, coinciding with dramatic increases in the world population, has brought a new era where humanity is the dominant force affecting planetary processes. This new epoch has been termed ‘ the Anthropocene.’^{3,4}
- According to the Global Footprint Network’s Ecological Footprint Measure,ⁱ mankind is outstripping nature’s regenerative capacity by 50% and human demands on nature have doubled since 1966.¹²
- By 2030 humanity will need the capacity of two planets to absorb CO₂ waste and keep up with consumption, even with modest projections of population growth, consumption and climate change.¹²
- Due to unequal and unfair consumption patterns, if everyone in the world today lived as the average person in the USA does, we’d need the equivalent of over 4.5 planets to support us, compared with less than half the planet’s bio capacity if everyone lived as the average resident of India does.¹²
- 884 million people worldwide lack access to clean water.¹³ By 2025 1.8 billion people will be living in countries or regions with absolute water scarcity (where annual water supplies drop below 500 cubic metres per person), and two-thirds of the world population could be experiencing stress conditions (living in areas where annual water supplies drop below 1,700 m³ per person).¹⁴
- 925 million people are undernourished: almost 16% of the population of developing countries.¹⁵ To meet growing demand and achieve global food security global food production must increase by 70% by 2050.¹⁶

Biodiversity loss

- The International Union for Conservation of Nature estimates that the current species extinction rate is between 1,000 and 10,000 times higher than it would naturally be, leading some biologists to believe that the world is facing a sixth mass extinction.⁵
- Over 19,000 species of plants and animals known to be threatened with extinction, including 25% of mammals, 13% of birds and 41% of amphibians.⁵
- Since 1970, tropical species’ populations have fallen by 60%⁵ and the number of species facing extinction has increased every decade¹⁷ and is growing each day, particularly in developing countries.⁷
- WWF’s Living Planet Indexⁱⁱ measuring the health of the world’s ecosystems estimates there has been a decline of 30% since 1970.¹²
- Forests support 80% of terrestrial biodiversity, but 36 million acres of natural forest are lost annually.¹⁸
- Coral reefs provide food, storm protection, jobs, recreation and other income sources for more than 500 million people worldwide, yet 70% are threatened or destroyed.¹⁹
- Eighty-two per cent of global fish stocks are fully or overused. Most of the stocks of the top ten species for commercial marine fish stocks are overexploited.²⁰
- The world failed to meet the 2010 Convention on Biodiversity targets and target 7b of the Millennium

ⁱ The Global Footprint Network’s Ecological Footprint tracks the area of biologically productive land and water required to provide the renewable resources people use, and includes the space needed for infrastructure and vegetation to absorb waste carbon dioxide. Growth in humanity’s ecological footprint over recent decades is largely attributable to the carbon footprint, which has increased 11-fold since 1961.

ⁱⁱ The World Wildlife Fund’s Living Planet Index reflects changes in the health of the planet’s ecosystems and biodiversity by tracking trends in nearly 8,000 populations of vertebrate species.

Development Goals to “significantly reduce” the rate of biodiversity loss by 2010.¹

Population dynamics and unmet need for family planning

- According to the UN medium term projection, the world’s population – currently 7 billion – will increase by over 30% to 9.3 billion by 2050, and surpass 10 billion by the end of the century.²¹
- While world population growth has declined to about 1.2% per year and birth rates are declining across countries, the pattern of decline is highly variable and in the least developed countries total fertility rates (TFR) remain very high, averaging over 4 children per woman.²¹
- Most population growth and the vast majority of projected growth is take place in the poorest, most-biodiversity rich regions of the world, often where access to family planning is low.^{8,22}
- Today 50.5% of the world’s population, some 3.5 billion, live in urban areas. By 2050 this will increase to 69% or 6.3 billion people.²³
- There are an estimated 222 million women in developing countries who say they are at risk of an unwanted pregnancy but are not using modern contraception, often because they do not have access to the necessary health services.²⁴ High fertility rates tend to correlate with high unmet need for family planning.
- Provision of voluntary family planning is known to facilitate fertility decline and offers potential to advance a range of development goals including: maternal and child health, gender equality, poverty reduction, food security and make a significant contribution towards environmental sustainability^{25,26, 27}

Human Threats to Biodiversity

WWF identifies five main threats and direct pressures on biodiversity causing current rates and patterns of biodiversity loss:¹²

- **Habitat loss, alteration and fragmentation**, through conversion of land for agriculture and industrial or urban land use, including deforestation, wetland drainage and coral reef destruction.
- **Over-exploitation of wild species populations**; the unsustainable harvesting of animals and plants for food, materials, or medicine, including over-hunting, over-fishing and logging.
- **Pollution**, including excessive use of pesticides and fertilizers and urban and industrial waste.
- **Human induced-climate change**, shifting geographical ranges and for example causing increasing coral bleaching.
- **Invasive species**, introduced deliberately or unintentionally as a result of human activity, resulting in competition with native species and emerging diseases.

These direct pressures stem from human demands for food, energy, materials and land for urban areas and infrastructure. The resulting human impact on the environment is determined by the number of consumers (population size), per capita consumption, and the efficiency with which natural resources are converted into goods and services.¹² Population dynamics, particularly population growth, but also migration and density, are therefore an important indirect driver and underlying cause of biodiversity loss, and play a particularly significant role in driving the most greatest direct cause of declining biodiversity, habitat loss. It is important to acknowledge that impacts of human activity on biodiversity are not driven solely by population dynamics. A complex mix of interacting factors can be involved, which in addition to population pressures, can include socio-economic factors such as; levels of development, poverty and social inequalities, economic activities, technology use, and policy failures leading to environmental degradation and lack of protection.^{8,28}

A recent study assessing progress toward the CBD target and Millennium Development Goal target 7b of significantly reducing the rate of biodiversity loss by 2010 found that most indicators used in the study for the state of biodiversity had declined, while pressures on biodiversity had increased.²⁹ Indicators demonstrating declining biodiversity included species’ population trends, extinction risk and habitat extent and condition. Increasing pressures on biodiversity included resource consumption, invasive alien species, nitrogen pollution, overexploitation of fish stocks, and climate change impacts. The study concluded therefore that it is highly unlikely that the 2010 target had been met; a finding confirmed by the Convention on Biodiversity.¹

Changes in the abundance and distribution of species will have serious consequences for human societies. There is a high risk of dramatic biodiversity loss and accompanying degradation of a broad range of ecosystem services if ecosystems are pushed beyond certain thresholds or tipping points.¹ The influential Planetary Boundaries concept by Rockström et al, identifies nine critical earth-system process boundaries which offer a safe operating space for

humanity, beyond which we risk dangerous, irreversible environmental change. According to the concept we have already crossed two of these; biodiversity loss and the nitrogen cycle element of the biogeochemical flow boundary.⁴ Climate change, one of the other critical boundaries, is projected to radically shift the geographical distribution of species and vegetation types, with ranges moving from hundreds to thousands of kilometres towards the poles by the end of this century. Ocean acidification and migration of marine species to cooler temperatures threaten to make tropical oceans less diverse and coral reefs collapse. Combined with the impacts of deforestation and fire, the Amazon could face widespread dieback (high incidence of tree decline and death) and shift to a savanna-like vegetation. These, and other impacts of climate change and biodiversity loss, will negatively impact on many industries including fishing and forestry, ultimately threatening the food security and livelihoods of millions of people, hitting the poorest the first and hardest.¹

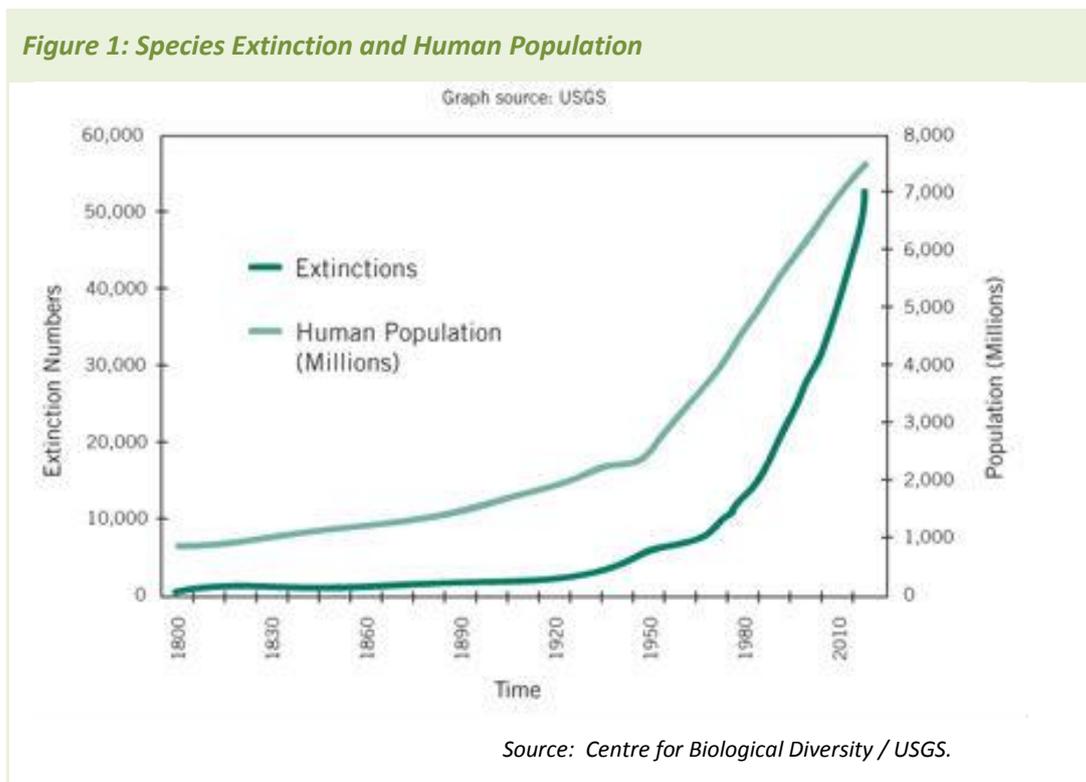
Demographic Variables and Influences on Biodiversity

In this section we examine the relationships between key population dynamics and biodiversity loss, focusing on the demographic variables population growth, density, urbanisation, household size and numbers and migration.

Population size and growth

Population size is a key factor determining the scale of humanity’s use of natural resources, and along with increasing per capita consumption, human population growth is driving degradation and destruction of natural ecosystems and loss of biodiversity.³⁰ As the world’s population grows, so does demand for food, water, land, timber and fossil fuels which places great pressures on ecosystems and drives biodiversity loss. More land was converted for cultivation between 1950 and 1980 than in the 150 years between 1700 and 1850, resulting in habitat loss, the greatest direct cause of biodiversity loss.³¹ The growth and expansion of the human population has long displaced other species and led to their extinction.³² Yet since the middle of the last century the extinction rate has increased dramatically, coinciding with the unprecedented growth of the world population.

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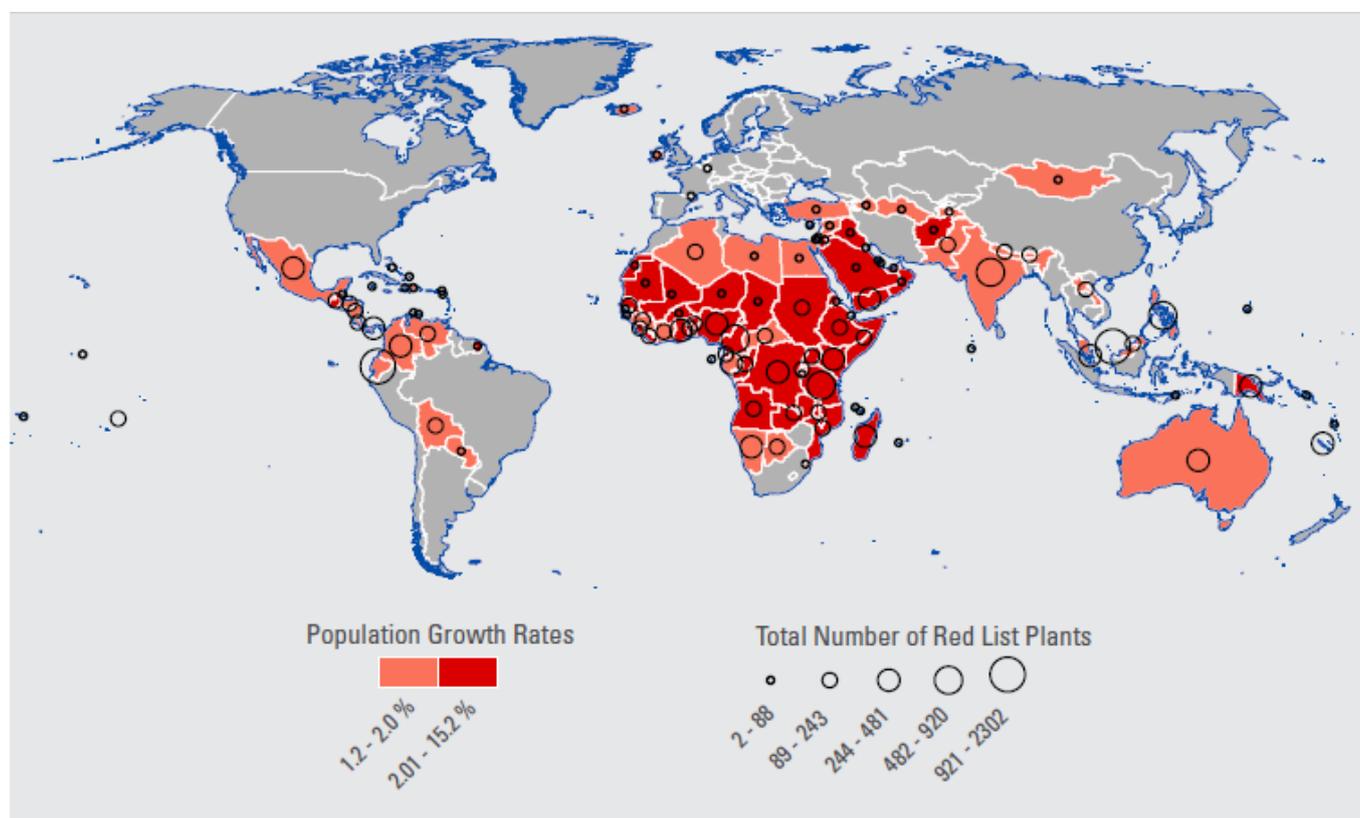


The majority of future population growth is projected to take place in urban areas. The implications of this are discussed in the urbanisation section below. Yet while rural population growth rate trends vary considerably between countries and regions, the world's rural population is projected to continue increasing until peaking in 2020.²¹ Africa is the only region where the rural population is expected to continue to grow beyond that date, until 2040, and between 2010 and then Africa is projected to gain 147 million rural inhabitants.²³ Countries experiencing large increases in their rural populations will experience growing pressures on resources and are likely to experience further environmental degradation in rural areas.

Population growth, as well as density, is significantly higher in areas of the world with the highest biodiversity, posing a considerable threat to these species-rich regions; see Box 2 on population in the biodiversity hotspots.³³ As shown in Figure 2 below, there is considerable overlap between areas of the world with high rates of population growth and those with high numbers of threatened and vulnerable plant species, as determined by the IUCN Red List that tracks the average species extinction risk over time.⁵

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Figure 2: Population Growth and Threatened Plant Species



Sources: United Nations Population Division, 2011. *World Population Prospects: The 2010 Revision*. New York: UN Population Division; Vié, J. C., C. Hilton-Taylor and S. N. Stuart. *Wildlife in a Changing World—An Analysis of the 2008 IUCN Red List of Threatened Species*. Gland: International Union for Conservation of Nature (IUCN).

Source: Population Action International (2011).

This trend is likely to continue, because the majority of future population growth is projected to take place in the poorest countries in the global South, particularly in Sub-Saharan Africa and parts of Asia.²¹ In these countries factors that could lower fertility as well as prevent unplanned births, including reproductive health services, education, and economic opportunities for women, are extremely limited or lacking altogether.

Population density

High population density is a significant underlying cause of biodiversity loss. In heavily populated areas there is a close association between increasing population density and declining biodiversity, as growing numbers of people place increasing demands and strains on the natural resource base. Where people concentrate in urban and suburban areas, high population densities contribute to high concentrations of nitrogen and phosphorus in the air and water. Nitrogen and phosphorus-containing compounds are found in sewage and organic garbage, in industrial and automobile emissions, and in lawn fertilisers, and cause pollution that can have devastating impacts on surrounding ecosystems, and negative impacts on human health.⁸ The high population density in coastal areas worldwide poses a particular threat to the biodiversity of estuaries and coral reefs, with 44% of the world's population living within 150 km of the coast.³⁴ Population density has been found to be the most powerful determinant of river-borne nitrates, which cause algae to grow, reducing the amount of oxygen in the water and impairing aquatic life. Runoff pollution containing chemicals and excessive nutrient inputs, washed from urban areas and farmland, have been responsible for the development of around 50 coastal "dead zone" marine environments where sea life is nearly absent due to algae.⁸

Like high population growth, high population density correlates strongly with biologically-rich areas of the world²⁸ and with areas with high extinction rates, high rates of deforestation of tropical forests, and abundance of invasive species.³⁵ In areas rich in biodiversity, high population density poses a threat not only due to the associated increases in land transformation and introduction of exotic species, but also because the size of protected conservation areas tends to be smaller.²⁸

Box 2: Population and the Biodiversity Hotspots

There are 34 'biodiversity hotspots' in the world, which are areas identified as being exceptionally biodiversity-rich, yet particularly threatened by human activity and habitat loss. These areas are high in endemic species but low in pristine vegetation.^{33,36,37} The hotspots cover just 2.3% of the earth's surface but are home to 75% of the planet's most threatened mammals, birds and amphibians.³⁷ Due to the concentration of biodiversity in these areas, biologists have highlighted their importance for global conservation efforts in order to minimise further extinctions.³⁶

In 2000 Population Action International published a study using demographic data for 1995 to analyse rates of population growth in 25 hotspots (conducted prior to a 2004 analysis of hotspots that increased their number from 25 to the 34 recognised today). The study found that while the 25 hotspots covered around 12% of the earth's land surface, in 1995 they were home to nearly 20% of the world population – an estimated 1.1 billion.³³ According to an unpublished study based on 2010 population data, today the 25 original hotspots are estimated to be home to 21% of the world's population – 1.45 billion people.³⁸ In 1995 the population density in the 25 hotspots was 71% higher than other areas of the world (see Figure 3) and in all but one of the hotspots the population was still growing. In most hotspot areas in developing countries population growth rates were substantially higher than the average for developing countries.³³ Typically in these areas women have a high unmet need for contraception and other health services.²² Taking two biodiversity hotspots as examples, in the Philippines 20% of women of reproductive age in rural areas have an unmet need for contraception and 15% in urban areas, and in Madagascar 25% of women in rural areas and 19% in urban areas.³⁹

Rapid urbanization is taking place in the hotspots and presents a key threat to biodiversity and reductions in household size (the number of people per household) and the resultant increases in household numbers also pose a considerable threat. While circa to the year 2000 less than 1% of the 34 hotspot areas were urbanized, by 2030 new urban expansion is forecasted to take up an additional 1.8% of all hotspot areas.⁴⁰ Overall, the highest rates of urban growth projected by 2030 are forecasted to result in considerable loss of habitats in biodiversity hotspots, with the highest rates of urbanisation forecast to take place in regions that were relatively undisturbed before 2000: the Eastern Afromontane, the Guinean Forests of West Africa, and the Western Ghats and Sri Lanka hotspots.⁴⁰

A study analysing changes in population size and household numbers between 1985 and 2000 in hotspot countries found that the annual growth of rate in the number of households in hotspot countries (3.1%) was substantially

higher than the population growth rate (1.8%), contributing to urban sprawl and higher per capita resource consumption.⁴¹ With substantial human-induced environmental changes set to continue in the hotspots over coming decades, eroding ecosystems and driving extinctions, demographic change remains an important factor in global biodiversity conservation.

Figure 3: Population Density in the Biodiversity Hotspots

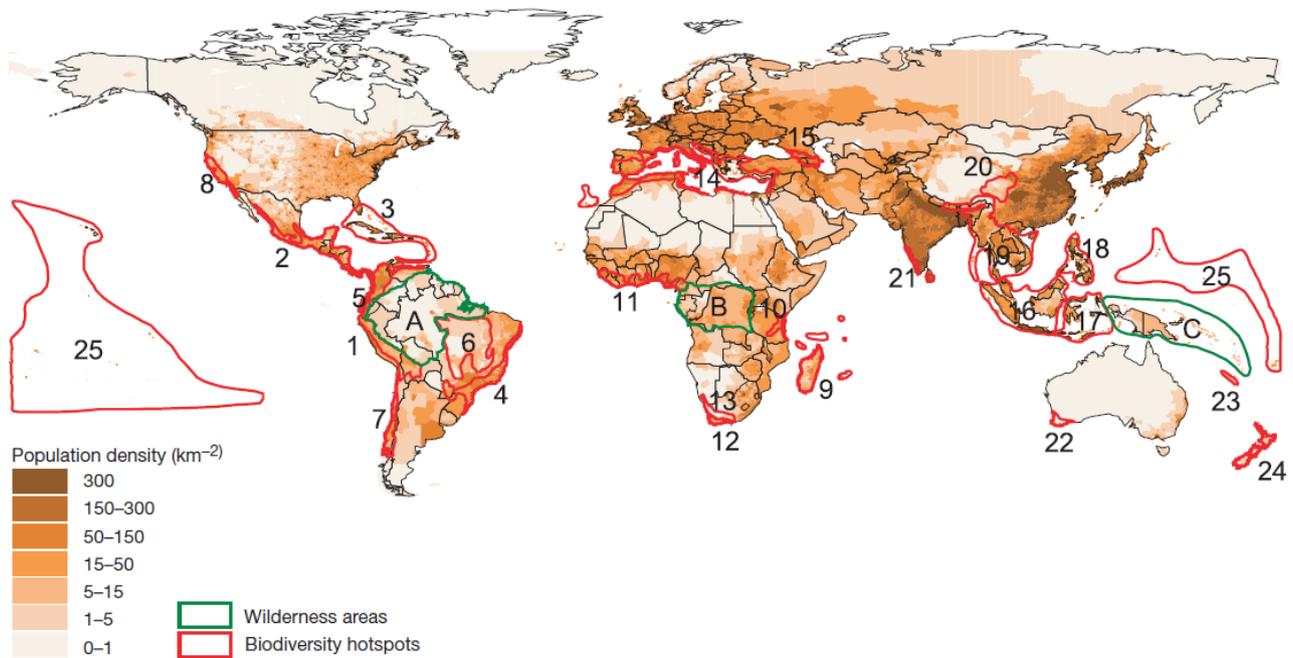


Figure 1 World population density (1995) and the 25 biodiversity hotspots (outlined in red, numbered), and three major tropical wilderness areas (outlined in green, lettered). Hotspots: (1) Tropical Andes; (2) Mesoamerica; (3) Caribbean; (4) Atlantic Forest Region; (5) Chocó-Darién-Western Ecuador; (6) Brazilian Cerrado; (7) Central Chile; (8) California Floristic Province; (9) Madagascar; (10) Eastern Arc Mountains and Coastal Forests of Tanzania and Kenya; (11) West African Forests; (12) Cape Floristic Region; (13) Succulent

Karoo; (14) Mediterranean Basin; (15) Caucasus; (16) Sundaland; (17) Wallacea; (18) Philippines; (19) Indo-Burma; (20) Mountains of South-Central China; (21) Western Ghats and Sri Lanka; (22) Southwest Australia; (23) New Caledonia; (24) New Zealand; and (25) Polynesia and Micronesia. Major tropical wilderness areas: (A) Upper Amazonia and Guyana Shield; (B) Congo River Basin; and (C) New Guinea and Melanesian Islands.

Source: Cincotta, R.P., Wisniewski, J. and Engelman, R. (2000).

Note: This analysis was undertaken prior to the 2004 analysis of biodiversity hotspots that identified 34 hotspots, increased from the 25 analysed here. It also examines population density in the three 'major tropical wilderness areas', a complementary concept to 'biodiversity hotspots' which identifies the most pristine of all terrestrial ecoregions.

Box 3: Case Study: Madagascar – Population growth, poverty and poor reproductive health

Madagascar, the fourth largest island in the world is one of the “hottest” global biodiversity hotspots, with exceptional concentrations of endemic species.^{42,43} The island is home to 5% of global biodiversity, including 10,000 plant species, 316 reptile species, and 71 primate species.^{44,45} Madagascar has one of the world’s fastest growing populations, with a growth rate of 2.9% a year, an average fertility rate of almost 5 births per woman (2010 data),²¹ and high unmet need for family planning with only 29% of married women having access to modern contraception.⁴³ Classified as a least developed country, Madagascar is extremely poor and the livelihoods of over 50% of the rapidly increasing population directly depend on forests and other natural resources.⁴³ Low access to family planning and other reproductive health services, high fertility rates, poverty and minimal education combine to place increasing pressures on natural resources.^{46,47} As a result, the biodiversity of this unique island is threatened by a devastating loss of habitat, with only 10% of the country’s original vegetation remaining.³⁶ This threat is likely to increase over coming decades, with the island’s population set to more than double between now and 2050, from today’s 21,000 to over 53,000 according to

UN medium-term projections.²¹

Madagascar's Spiny Forest Region is an ecologically unique area covering 66,000 square kilometres in Southern and South West Madagascar recognised as a high global priority for conservation.⁴⁷ The area has the highest concentration of baobab species in the world and is the habitat of some of the endemic lemur species for which the island is best known,⁴⁸ fifteen of which have been driven to extinction since humans arrived on the island.⁴⁶ Deforestation is a key threat to the Spiny Forest, and the combination of a lack of alternative economic practices and demographic pressures are key driving forces of habitat loss. Farmers use slash-and-burn techniques to convert forest to land for subsistence agriculture and cash crops, the supply of charcoal and fuel for urban areas, and uncontrolled cattle grazing. Population growth pushes migrants to the area in search of agricultural land and employment opportunities. Migration places further pressures as people migrate seasonally and permanently in response to natural and climatic features including longer periods of drought, decreasing soil fertility and pest invasions.⁴⁸ Urbanisation is also threatening the forests, by increasing demand for forest resources for construction and fuel.⁴⁷

Madagascar's marine environments are another important source of Madagascar's biodiversity threatened by demographic trends. Box 5 describes an innovative integrated Population Health and Environment programme in South West Madagascar responding to these pressures by successfully integrating marine conservation, reproductive health and community development.

Urbanisation

The rapid urbanisation that has taken place over the last century, and the accompanying construction of housing and infrastructure (including water, energy and waste disposal), has contributed to biodiversity loss in a number of ways.⁸ Although patterns of urban concentrations and suburban sprawl vary considerably between countries, worldwide the growth of towns and cities has taken place as a result of population growth and migration to towns and cities from rural areas as people go in search of work and more prosperous lifestyles, in part driven by economic change. While considering the stress placed on natural resources and biodiversity from urbanisation, it is important to consider the role that urbanisation and cities could play in reducing ecological footprints and promoting sustainable development and solutions, through urban planning and innovation as well as capitalizing on the potential for economies of scale.¹² Furthermore rural population growth and rural-rural migration also contribute significantly to biodiversity loss.

As urban areas expand and require more land and resources, urbanisation contributes to declining biodiversity in several ways. Rural areas are taken over and in the process habitats are changed and lost. Ecosystems are further damaged by the extraction of natural resources to provide building and energy supplies, and from other activities associated with urbanisation, including infrastructure and industry. Rapid urbanisation and urban migration puts stress on natural resources and leads to deforestation, as forests are destroyed to provide wood for fuel and building supplies.²² A recent study in Tanzania found that the expansion of Dar es Salaam between 1991 and 2005 resulted in "waves" of deforestation and biodiversity loss, with deforestation spreading 9 km a year from the city as people needed to travel further from the city to find resources such as timber and charcoal.⁴⁹ As discussed in relation to high population density, waste, effluent and other pollutants associated with urban areas result in air and water pollution which can dramatically affect ecosystems.⁸

Additionally, urbanisation is associated with increasing affluence and increasing demands for energy. This tends to result in increased per capita consumption rates,⁹ although urbanisation can be associated with energy efficiencies related to economies of scale.⁵⁰ Cities currently account for almost 80 per cent of global CO₂ emissions; a figure that is set to rise with increased urbanisation in the future.¹² A study forecasting global urban expansion by 2030 and impacts on biodiversity found that if current trends in population density continue and all areas with high probabilities of urban expansion undergo change, then by urban land cover will increase by almost 1.2 million km², nearly tripling the global urban land cover circa to the year 2000. This, the study warns, will result in considerable habitat loss in the biodiversity hotspots and poses a major threat to biodiversity.⁴⁰ With this projected land-coverage change, the world's urban population projected to increase by 2.8 billion between now and 2050²³ and the majority of future world population growth expected to take place in urban areas, management of urban areas to ensure biodiversity protection will become all the more critical.^{28,40}

Box 4 Case Study: California Floristic Province- Population and consumption pressures

Most of the US state of California lies within a biodiversity hotspot called the California Floristic Province, an area of diverse vegetation with landscapes including deserts, mountain ranges, wetlands, woodlands, and 1,100 miles of coastline.⁵¹ Of nearly 3,500 species of vascular plants in the hotspot, 61% are found nowhere else in the world.⁵² Known as 'the wildlife state,' California has more species than any other US state, but rapid population growth and other human pressures are placing great stress on biodiversity.⁵³

In recent decades California has witnessed some of the most rapid growth in the industrial world.⁸ State-wide, California's population almost doubled between 1970 and 1990, and between 1990 and 2000 the population grew by another 14%, adding over 4 million more residents to the population.⁵³ Increasing needs for housing, services, transportation, and other infrastructure have placed ever-greater demands on the state's land, water, and other natural resources.⁵¹ California's economy would rank it among the top seven countries in the world, and it is the most populated (estimated at 35 million people in 2002) and fastest growing state in the US.⁵² Direct pressures on ecosystems include: urbanization, pollution, habitat encroachment, expansion of large-scale agriculture, strip mining and oil extraction, invasive alien species, road construction, livestock grazing and logging.⁵²

Migration to the hotspot has contributed to rapid population growth in the area, including internal migration of people relocating from elsewhere in the US drawn by the state's warm coastal areas, and international migration from Latin America and Asia of migrants drawn by the area's growing economy.⁸ Urbanization has accompanied the population growth, and crowded and costly areas in the central coast have forced developments inland, taking over land previously dominated by agriculture and large ranches. Development and urban sprawl has destroyed habitat directly, as well as fragmenting the remaining landscapes and degrading adjacent habitats.⁵³ Sewage and other pollutants from urban coastal areas threaten marine life. In the Los Angeles Metropolitan area which has one of the highest population densities in the state, sanitation systems release around 800 million gallons of minimally treated sewage directly into the Pacific Ocean each day.⁸

The result of these population and human pressures is that California is one of the four most ecologically degraded states in the US. Only about 25% of the hotspot's original vegetation remains in more or less pristine condition⁵² and over 800 species are at risk.⁵¹ Climate change will pose an increasing threat to biodiversity, with rising temperatures and altered precipitation patterns expected to change plant communities and reduced habitat suitability for some wildlife species.⁵¹

Household size and composition

The number of people per household (household size) and the total number of households influence per capita consumption rates and effect biodiversity in a number of ways. Globally household numbers are growing, due to both population increase and a shift towards fewer people per household, meaning that growth in the number of households is more rapid than aggregate population growth.⁴¹ This results in a type of *housing momentum*, with per capita housing needs increasing even while population growth slows.

Industrialised countries currently account for a disproportionately large share of housing, yet requirements for shelter in developing countries are projected to more than double between 1995 and the middle of this century,⁵⁴ because of population growth in the global South and declining household size. In industrialised countries the proportion of single-person households is greater, and the trend of increasing single-person households is expected to also occur in developing countries as family size becomes smaller and economies industrialise. Reductions in household size places a double burden on biodiversity. Firstly, contributing to loss of natural habitat by increasing the amount of land and materials needed for household construction. Secondly, because smaller households have lower efficiency of consumption use per capita.⁴¹

Migration

Migration has impacted biodiversity and natural resource management by local residents for centuries, as people move between and within countries in search of land, economic opportunities, better living conditions and security. Rural-to-rural migration, including movement to remote areas, forest frontiers and coastal areas, is often associated with more adverse impacts on biodiversity.⁴⁸ However, as discussed above, rural-urban migration is a driver of urbanisation which also places pressures on biodiversity.

Migration to small, fragile areas of high biodiversity poses risks to the long-term health and vitality of ecosystems, and is recognised as a critical concern for conservation worldwide. A number of complex factors drive migration at the local, national and international levels, often interacting with other population dynamics and involving the poorest and most marginalised groups in society. Common push factors for migrants include poverty, lack of employment opportunities, population pressures, scarcity of natural resources, environmental degradation or natural disaster, and insecurity, including displacement of people by civil conflict or natural disaster.²²

Many forms of migration to marginal or fragile lands are linked to population growth, causing increased competition for natural resources, including prime agricultural land and fresh water supplies, thereby degrading the natural resource base and pushing migrants to move elsewhere, often in search of land or employment opportunities. Migration to tropical forests where land can be cleared for subsistence farming, to frontier lands for employment in farming or resource extraction, and to coasts where migrants can undertake small-scale fishing as a form of livelihood, are common migration trends that can contribute to pressures on biodiversity.⁹ Due to the high biodiversity value of these lands, clearing can result in widespread habitat loss and even species extinction, and often these areas do not have sufficient protection. In addition to the areas to which migrants relocate, it is common for degradation to take place along migration routes, and areas of origin can also be adversely affected, for example when traditional natural resource management practices are lost.⁴⁸

In some areas the natural beauty and habitats of the area is itself a pull factor for migration. As exemplified in Box 4, the domestic migration in the US placing pressure on biodiversity in California is a phenomenon that is also taking place in the Southwest Australia and New Zealand hotspots, where relocation to coastal areas is popular.⁸ In the Galapagos Islands in Ecuador, employment opportunities in the growing tourism economy have been a major factor driving the six-fold increase in the population since 1974, resulting in severe threats to native species from over-fishing, non-native species and other human impacts.⁵⁵

Population growth and the large population movements that are expected to take place as a result of climate change will contribute to drive migration-related biodiversity loss in the future.⁴⁸ Conservation policies are therefore required that not only seek directly to protect biodiversity-rich areas, but are based on principles of equality and fairness and also respond to the underlying factors, including social inequalities, which drive migration.

Box 5: Population Health Environment (PHE) Approaches

What is PHE?

Integrated population, health and environment (PHE) programmes acknowledge and address the complex interactions between humans, their health and wellbeing, and the environment.⁵⁶ Over the last decade or so, a number of conservation projects in areas of high biodiversity have incorporated reproductive health, and sometimes additional health, livelihood and development interventions. Experience from these projects has shown that integrated programmes provide multiple benefits. Synergies can be generated that can achieve not only the primary project goals such as environmental protection and improved reproductive health, but also poverty alleviation, food security, increased gender equality and greater community participation.^{57,58}

Responding to the local health needs of underserved communities is a goal in its own right, and contributes to overall success of the projects by generating community good will and trust, and by facilitating greater local participation in conservation.⁵⁸ Addressing interactions between people, health and the environment therefore

makes conservation programmes more effective and sustainable than traditional vertical programmes, as well as cost effective.⁵⁷ Evidence from Madagascar and the Philippines shows that efforts to scale-up programmes has been successful, demonstrating the scope for wider replication of PHE programmes in other priority areas for biodiversity conservation and community development.⁵⁹

PHE in Madagascar: Integrating family planning and marine conservation

The case study in Box 3 examines the ways that population growth and other demographic pressures are threatening the biodiversity hotspot of Madagascar. Responding directly to these pressures in an area where local communities themselves were identifying the links between population growth, unsustainable resource use and environmental degradation, the conservation organisation Blue Ventures is undertaking a PHE marine conservation programme.

Velondriake is a locally managed marine area encompassing approximately 40 villages covering 40km of coast line in South West Madagascar, home to the fourth largest continuous coral reef system in the world. The reef stretches for almost 500 km along the remote coast, which fringes the arid Spiny Forest found further inland.⁴⁵ While population growth is high across Madagascar, the coastal population is growing particularly rapidly, and in the project area where communities previously had no or little access to family planning it is not uncommon for women to have 10 or more children.⁴⁵ Population growth was being identified by fishing communities in the area as a root cause of resource degradation, by placing pressures on coastal resources and contributing to overfishing.⁴³

Responding to the community-expressed need for reproductive health services, in 2007 Blue Ventures began integrating reproductive health programmes with existing conservation initiatives by opening a family planning clinic. By 2012 service provision had been dramatically expanded, serving all 40 villages in the marine conservation area and into the adjacent spiny forest.⁴³ The project includes a comprehensive programme of community education and social marketing activities focusing on the links between the projects health, environmental and alternative livelihood aspects. As a result of the project, contraceptive prevalence has risen significantly in the area and the crude birth rate has dropped in comparison with the region as a whole.⁴⁵ Conservative estimates of the outcomes estimate that contraceptive provision has averted over 355 unwanted pregnancies resulting in cost savings of at least USD 51,000.⁴³

“This pioneering, integrated approach to conservation and sexual and reproductive health offers opportunities for these different interventions to work synergistically, enabling far more achievement of the projects’ objectives than could be achieved if these projects were carried out in isolation” says Blue Ventures.⁶⁰

PHE in action elsewhere

Another widely acclaimed PHE Programme is The Integrated Population and Coastal Resources Management (IPOPCORM) Project in **the Philippines** undertaken by PATH Foundation Philippines Inc, combining coastal resource management with reproductive health interventions in fragile coastal regions, including a focus on livelihoods and food security.⁶⁰ A comparative study of the programme found that integrated delivery of coastal resource management and reproductive health services generated higher impacts on ecosystem and health, respectively, than delivering either in isolation.⁶¹

In **Ethiopia**, PHE Ethiopia Consortium is working to promote integrated PHE programming with the aim of ensuring “a healthy population, sustainable resource use, improved livelihood and resilient ecosystems.”⁶² Member association the Ethio Wetlands and Natural Resource Association (EWNRA), located in Ethiopia’s Wichi watershed, uses a combination of techniques to restore the watershed, create alternative livelihoods, strengthen health systems, and improve reproductive health. In an area where rapid population growth is exacerbating the impacts of climate change, the project is working to improve farm productivity and livelihoods, restore forests and wetlands and help achieve desired family size by addressing unmet need for contraception.⁶³

A number of successful PHE projects have shown that increasing access to health services while simultaneously helping communities manage the natural resources and environments upon which their health, livelihoods and wellbeing depends is beneficial for both people and the environment. For details of further PHE Programmes across the world see the [Population Health and Environment Project Map](#) compiled by Population Reference Bureau.

Key Policy Recommendations:

- **Addressing the root causes of rapid population growth and consumption:** For conservation strategies to be successful in the long-term, human-rights based policies are required that address both the role of human population growth and dynamics *and* unsustainable patterns of consumption as underlying drivers of biodiversity loss. With regard to consumption, developed countries must take the lead responsibility for addressing inequitable and unsustainable patterns of consumption, as a matter of social justice. There must also be increased focus on use of technology and other means to increase the efficiency of resource utilisation. With regard to population dynamics, working collaboratively with other sectors environmental organisations should increase focus on the relationships between population dynamics and consumption, and the ways in which these factors influence biodiversity loss. Awareness of these linkages must be increased across disciplines and amongst politicians, decision-makers, donors and NGOs.
- **Increased investment in family planning:** Family planning is a highly cost-effective intervention, empowering couples to achieve smaller, healthier families while reducing population growth and pressures on natural resources and biodiversity. Policies that will contribute to stabilization of the human population are often missing from conservation policies but may be among the most important in the long-term. To meet the needs of the 222 million women in developing countries with an unmet need for contraception, there must be increased investment in family planning, delivered as part of comprehensive reproductive health programmes that respect and protect rights. Funding for family planning must be increased to meet the estimated USD 8.1 billion necessary a year, requiring an additional USD 4.1 billion a year and subsequent increases to meet demand.²⁴
- **An integrated policy approach:** Voluntary family planning programmes and other social investments should be integrated into environmental programmes. Innovative Population Health Environment projects provide successful models for this approach, offering opportunities to increase the effectiveness of conservation interventions while advancing reproductive health and contributing to poverty alleviation. Biodiversity hotspots in particular should be priority areas for wider replication of these projects. Further research is required to strengthen the evidence base for integrated approaches and to support 'scaling-up'.⁵⁹
- **Effective leadership and funding:** Urgent action and strong leadership is required on a global scale to reverse the overexploitation and destruction of life-supporting ecosystems, requiring increased awareness of the role of biodiversity and its importance for human wellbeing. If new targets established at the 2010 Convention for Biological Diversity in Nagoya are to be achieved, funding for biodiversity protection must be substantially increased. Governments and donors should embrace integrated approaches addressing the interrelationships between people and the environment, requiring flexible funding mechanisms and support for cross-sector collaboration.
- **Multi-sector collaboration and environmental planning and policy making:** An integrated approach requires greater cooperation between environment, health and development organisations, including collaborative mechanisms at the international level. At the national level, population dynamics and trends must be effectively integrated into environmental planning and policies, and seen as a priority for both health and environmental departments. Sustainable development, environmental and urban planning requires consideration of population dynamics and trends including population growth and density, urbanisation and migration, and related impacts on biodiversity.
- **Women's empowerment, education and participation:** Initiatives to promote women's empowerment, including a focus on education will support women to exercise reproductive choices and reduce fertility rates. Recognising that women are key agents of change, often bear responsibility for management of natural resources, and are particularly vulnerable to the impacts of biodiversity loss, the full and equal participation of women in conservation interventions and decision making must be ensured.

This briefing is one of a series of briefings from PSN outlining the significance of population dynamics for a range of development priorities, including climate change, poverty alleviation and fragile states. See: www.populationandsustainability.org

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