

The Economics of Biodiversity: Some numbers and Sound-bites

About this Guide:

- Compilation of recent, relevant material regarding the economic valuation of biodiversity;
- Focus is on quantitative information, largely from academic literature and NGO/consultant reports;
- Not all documents are publicly available;
- This is a living document. It will be updated and edited from time to time as new information is released.

The SDGs and the Big Picture

- Achieving the SDGs opens up **US\$12 trillion of market opportunities** in four core economic sectors: food and agriculture, cities, energy and materials, and health and well-being. These sectors represent around 60% of the real economy. To capture these opportunities, businesses need to pursue social and environmental sustainability as strongly as economic sustainability. [[Business & Sustainable Development Commission, 2017](#)]
 - Implementing all the SDGs in all sectors and systems could increase the economic benefits by **2-3 times**
 - Of the market “hot-spots” with the most immediate economic value to businesses, those most directly related to biodiversity include ‘forest ecosystem services’, ‘dietary switch’, ‘sustainable aquaculture’, ‘micro-irrigation’, ‘restoring degraded land’, and ‘urban agriculture’
- **Over 9,000 companies** world-wide have already signed up to the 10 principles of the UN Global Compact. [[Business & Sustainable Development Commission, 2017](#)]
- Achieving the SDGs will create **380 million new jobs** by 2030 [[Business & Sustainable Development Commission, 2017](#)]
- A global food and agriculture system that is aligned with the SDGs will feed the world with nutritious and affordable food, generate higher incomes, help restore forests, freshwater ecosystems, and other ecosystems, and create new economic value of over **US\$2 trillion** by 2030 [[Business & Sustainable Development Commission, 2017](#)]

Markets, Consumers, and Financing

- The International Finance Corporation’s Performance Standard 6 on Biodiversity Conservation and Sustainable Management of Living Natural Resources, requires use of the IUNC Red List to inform project risks and encourages consultation with IUCN experts when managing high risks of biodiversity loss – this influence is leveraged to approximately **US\$2250 billion** (on top of the **US\$22 billion** the IFC lends each year) through voluntary use of PS6, including **83 signatories**

accounting for over **70% of international project finance debt** in emerging markets and 32 OECD export credit agencies [[Bennun et al., 2018](#)]

- On average, customers are willing to pay about **11% more** for products in downtown shopping areas with trees than in areas without trees, and are willing to pay more for parking on streets with trees; Willingness to pay for comparable goods and services differed between small cities (+9%) and large cities (+12%) [[Nesbitt, L. et al., 2017](#)]
- In the US alone, consumers spend **\$25 billion a year** on green products [[Khan and Mohsin, 2017](#)]
- **42%** of consumers are willing to pay premium prices for green products in the US [[Khan and Mohsin, 2017](#)]
- Businesses that act now towards achieving sustainable development will have a **5-15 year advantage** on the sustainable playing field [[Business & Sustainable Development Commission, 2017](#)]
- Four out of five (79%) of US citizens expect businesses to continue to improve their Corporate Social Responsibility efforts, and more than three out of five (63%) are hopeful that business will take a leading role to drive social and environmental change [[CONE Communications, 2017](#)]
 - Higher for Millennials! 71% are hopeful that business will take the lead to spark change
- 70% of US citizens believe companies have an obligation to take action to improve issues that may not be directly relevant to everyday business operations [[CONE Communications, 2017](#)]
- 87% of American consumers report that they will buy a product because the company advocated for an issue they care about; 76% report they will refuse to buy a product because a company supported an issue that is contrary to their own beliefs [[CONE Communications, 2017](#)]
- 86% of Americans expect companies to do more than just make a profit – they should also address social and environmental issues – this has either grown or remained steady over time!
 - Consumers report a more positive image to companies that support social and environmental issues (92% vs. 85% in 1993)
 - Consumers report they are more likely to trust companies that support social and environmental issues (87% vs. 66% in 1998)
 - Consumers report they are more loyal to companies that support social and environmental issues (88% vs. 90% in 2013)
- The environment is in the top three issues that American consumers would most like companies to address (15% report the environment as their number one issue) [[CONE Communications, 2017](#)]
- Institutional investors hold 1.04 trillion worth of infrastructure assets. Of these, 314 billion are identified as investments in green infrastructure [[OECD, 2021](#)].

Pollution, health, and amenity services

- The economic costs of air pollution from fossil fuels are estimated at **US\$2.9 trillion**, or **3.3% of global GDP** [[Centre for Research on Energy and Clean Air, 2020](#)].
- The pharmaceutical industry reliance on wild genetic resources: **26%** of all new approved drugs over the last 30 years to 2010 were either natural products or were derived from a natural product [[Pricewaterhouse Coopers, 2016](#)]
 - **65%** of all small molecule drugs approved to treat cancer were derived from or inspired by natural products [[World Health Organization, 2021](#)]
- **Half** our prescription drugs originate from plants [[Pricewaterhouse Coopers, 2016](#)]
 - Around **60,000** species – plants, animals, fungi, and microbes – are used for their medicinal, nutritional and aromatic properties [[World Health Organization, 2021](#)]

- Higher levels of biodiversity in natural ecosystems increases the chance of finding new natural compounds that could have medicinal uses [[World Health Organization, 2021](#)]
- More than **2/3rds** of people living in Sub-Saharan Africa use traditional herbal and plant medicines for primary health care [[Pricewaterhouse Coopers, 2016](#)]
- Children with ADHD who went for a 20-min walk in a park had **significantly better concentration** than children who walked downtown or in a neighbourhood. Browning et al. (2012) estimated that this would translate into potential annual savings on ADHD medications of **USD\$228million** if US children were able to walk in a park during the day; potential cost savings of between **USD\$383.5 million and USD\$1.9 billion** using average monthly expenditures across all ADHD medications, based on a range of 5–25% medication replacement [[Nesbitt, L. et al., 2017](#)]
- The economic cost of invasive insects: a minimum **US\$70.0 billion per year** globally (of which, US\$25.2 billion/year are from reproducible studies); health costs exceed **US\$6.9 billion per year** [[Bradshaw et al., 2016](#)]
- Increased exposure to green space has been associated with indicators of **good health** (such as lower cortisol and blood pressure) and **better self-reported health** [[World Health Organization, 2021](#)].
 - Spending time in nature has also been associated with a lower risk of specific health conditions (including pre-term birth, low birthweight, and type 2 diabetes) and reduced risk of death from all causes [[World Health Organization, 2021](#)].
- People who live in neighborhoods with higher densities of trees on their streets report significantly higher health perception and significantly less cardio-metabolic conditions [[Kardan et al. 2015](#)]
- Having 10 more trees in a city block will, on average, improve health perception in ways comparable to a **\$10,000 increase** in annual personal income. This is also on average equivalent to being 7 years younger [[Kardan et al. 2015](#)]

Agriculture, Soil, and Food

- As a result of pollinator loss, between **\$235 billion and \$577 billion** in annual global crop output is at risk [[IPBES, 2019](#)]
 - It is estimated that **5–8%** of current global crop production is directly attributable to animal pollination [[IPBES, 2016](#)]
- More than **three quarters** of the leading types of global food crops rely to some extent on animal pollination for yield and/or quality. Pollinator-dependent crops contribute to **35%** of global crop production volume. [[IPBES, 2016](#)]
 - More than **75% of global food crop types**, including fruits and vegetables and some of the most important cash crops, such as coffee, cocoa, and almonds, rely on animal pollination [[IPBES, 2019](#)]
- Beekeeping provides an **important source of income** for many rural livelihoods. The western honey bee is the most widespread managed pollinator in the world, and globally there are about **81 million hives** producing an estimated 1.6 million tonnes of honey annually [[IPBES, 2016](#)]
 - Local declines of insect populations such as wild bees have often been reported, and insect abundance has declined **very rapidly even without large-scale land-use change** [[IPBES, 2019](#)].
- Human actions threaten more species **with extinction** now than ever before [[IPBES, 2019](#)].

- An average of **25% of species** in assessed animal and plant groups **are currently considered threatened** [[IPBES, 2019](#)].
- Around **1 million** species are facing the prospect of extinction in the **coming decades** unless action is taken to reduce the intensity of drivers of biodiversity loss [[IPBES, 2019](#)].
- The volume of production of pollinator-dependent crops has **increased by 300%** over the last five decades, making livelihoods increasingly dependent on the provision of pollination [[IPBES, 2016](#)]
- About **30% of global land area has already experienced significant degradation**, which reduces the capacity of land to provide ecosystem service. The annual cost of land degradation is estimated to be about **US\$300 billion**, including losses to agricultural production and other ecosystem services [[WWF Living Planet Report, 2016](#)]
- Soil degradation has reduced the productivity of nearly a quarter of the global land surface, affected the well-being of about 3.2 billion people and **cost about 10% of annual global gross domestic product in lost ecosystem services** [[WWF, 2022](#)].
- Each year, the world loses approximately 36 billion metric tons of nutrient rich topsoil and 17 billion metric tons of cropland soil due to erosion, chemical inputs, and climate change. This land degradation costs **USD 300 billion** in lost agricultural production each year [[WWF, 2022](#)].

Invasive Species

- Ontario – municipalities and conservation authorities are estimated to spend **CAD 50.8 million** on invasive species in the province alone. This does not consider the expenditure of the provincial and federal governments to combat invasive species in Ontario [[Invasive Species Centre, 2021](#)].
 - Efforts to combat the invasive Emerald Ash Borer alone have costed municipalities and conservation authorities nearly **CAD 30 million** [[Invasive Species Centre, 2021](#)].
- Germany – economic costs of fighting invasive species in the country were estimated at **USD 9.8 billion** between 1960 and 2020, including 8.9 billion in potential costs [[Haubrock et al., 2021](#)].
- San Francisco Bay Area – removing the invasive *Spartina* costs about **\$300 per acre** [[Jardine and Sanchirico, 2018](#)]
- The economic cost of invasive insects: a minimum **US\$70.0 billion per year** globally (of which, US\$25.2 billion/year are from reproducible studies); health costs exceed **US\$6.9 billion per year** [[Bradshaw et al., 2016](#)]
 - Likely an underestimate, due to a lack of data!
 - This estimate excludes economic impacts on productivity, income, tourism, blood-supply system, personal protection, and quality of life
- Insect pests have been reported to reduce agriculture yields by **10-16%** before harvest, and consume a similar amount following harvest [[Bradshaw et al., 2016](#)]
- Globally, the total reported costs of invasions reached a **minimum of USD 1.288 trillion** between 1970-2017, with an **annual mean cost of 26.8 billion** [[Diagne et al., 2021](#)].
- Costs are likely to increase in the future as invasive insects expand their ranges in response to climate change, and due to increasing human mobility and international trade [[Bradshaw et al., 2016](#)].
 - Annual mean costs are on the rise, expected to surpass **\$160 billion** in the coming years [[Diagne et al., 2021](#)].
- Effective, early response and vigilant biosecurity are often cheaper than paying for damages (up to 10 times cheaper for mosquito-borne disease) [[Bradshaw et al., 2016](#)]

Marine and coastal ecosystems, fisheries

- About **one-sixth** of the world's population are employed in the fishery sector, or related sectors [[World Bank, 2017](#)]
 - More than **110 million workers** earn their livelihoods from the small-scale fisheries sector alone [[FAO, 2022](#)].
- Economic cost of overfishing: approximately **USD\$83 billion** in 2012 (“Sunken billions”) [[World Bank, 2017](#)]
- Restoring fisheries would yield significant economic benefits, while fish biomass would increase by a factor of **2.7** [[World Bank, 2017](#)]
- The economic value of coastal and oceanic environments based on tangible outputs such as fisheries production, shipping traffic and carbon absorption was recently calculated at **US\$2.5 trillion** each year [[Cavanagh et al., 2016](#)]
- Severe impacts to ocean ecosystems are illustrated by **33% of fish stocks being classified as overexploited** and greater than 55% of ocean area being subject to industrial fishing [[IPBES, 2019](#)].
- The conservation of fisheries alone could increase the annual profits of the seafood industry by \$53 billion [[UNESCO, 2021](#)].
 - Sustainable fisheries **increase the value of fisheries to the economy**, supports fishing communities, **and maintain healthy marine ecosystems** [[NOAA, 2020](#)].
- Conserving coastal wetlands could save the insurance industry \$52 billion annually by reducing storm flooding [[UNESCO, 2021](#)].
- A 2017 study estimates that temperate coastal wetlands reduced flood heights and thus **avoided over US\$625 million in flood damages** across 12 coastal states affected by Hurricane Sandy, from Maine to North Carolina - Wetlands **reduced flood damages by 11%** on average across the 12 states included in the study [[Narayan et al. 2017](#)]
 - Wetlands reduced flood heights and damages in 80% of the region and increased flood heights and damages in 20% of the region

- Higher wetland cover resulted in proportionally greater damage reduction; among the four states with the greatest wetland cover, wetlands are estimated to have reduced flood damages between 20-30%
- Wetlands only cover 2% of the land area in New York, yet they are estimated to have saved nearly **US\$140 million (0.4%** of the state's total losses)
- Wetlands cover 10% of the floodplain in New Jersey, and are estimated to have reduced damages by an average 27%, approximately **US\$430 million (3%** of total losses)
- Some locations that have very little wetlands saw damage reduction benefits up to **139%** due to wetlands in adjacent, downstream locations
- The loss of a hectare of wetlands costs society **more than \$8,000** in flood damages per year in developed areas [[Taylor and Druckenmiller, 2022](#)].
- Properties behind a salt marsh save **16%** on average in flood losses every year, compared to properties where marshes have been lost [[Narayan et al. 2017](#)]
 - Salt marsh presence reduces maximum annual flood losses across all elevations, varying from 18-70%
- On average, **coastal habitats reduce wave heights between 35% and 71%**. Coral reefs reduce wave heights by 70%, salt-marshes by 72%, mangroves by 31% and seagrass/kelp beds by 36% - **coral reefs have the greatest potential for coastal protection** as they are very effective at reducing wave heights and are often exposed to higher, more powerful, waves [[Narayan et al. 2016](#)]
 - Coral Reefs are particularly vulnerable to climate change, and are projected to **decline to 10 to 30 per cent of former cover at 1.5°C** warming and to **less than 1 per cent of former cover at 2°C** warming [[IPBES, 2019](#)].
- Over 3 billion people depend on marine and coastal biodiversity for their livelihoods [[World Bank, 2021](#)]
- Around 60 million people worldwide are employed in fishing and fish-farming [[World Bank, 2021](#)]

Forest ecosystems, forestry

- Forests and trees provide vital resources to 1.3 billion people worldwide [[World Bank, 2021](#)]
- The value of biodiversity in maintaining commercial forest productivity is estimated at **US\$166 – 490 billion per year** (more than twice the cost of implementing effective global conservation, which is estimated at US\$76.1 billion annually) [[Liang et al. 2016](#)]
- Globally, a 10% decrease in tree species richness, from 100% to 90%, would result in a **2-3% decline in productivity**, which would equate to **US\$13-23 billion per year** (in 2015 US\$) [[Liang et al. 2016](#)]
- A decrease in species richness from the current level to one species would lead to a **26-66% reduction in commercial forest productivity** in biomes that substantially contribute to global commercial forestry (even if other factors remained constant, including the number of trees and forest stocking) – equivalent to **US\$166-490 billion per year** [[Liang et al. 2016](#)]

- An estimated 1.6 billion people depend on forests for their livelihood [[Pricewaterhouse Coopers, 2016](#)]
 - The forestry industry alone provides about **13.2 million jobs** [[IPBES, 2019](#)].
- Seeing and being in the presence of trees can reduce stress, improve emotional health, and enhance quality of life [[Nesbitt, L. et al., 2017](#)]
- Access to a window where workers can view nature can improve workplace satisfaction and job performance; quality of a worker's view can explain **10%** of the variation in sick days taken, and access to greenery in the workplace can lower stress and increase positive attitudes. Employee absenteeism and presenteeism (workers present but mentally disengaged) account for about **4%** of a company's costs, equaling about **US\$2000 per employee per year** in office costs: access to nature=happier employees=reduced costs [[Nesbitt, L. et al., 2017](#)]
- People who live in neighborhoods with higher densities of trees on their streets report significantly higher health perception and significantly less cardio-metabolic conditions [[Kardan et al. 2015](#)] – study done in Toronto, Canada
- Having 10 more trees in a city block will, on average, improve health perception in ways comparable to a **\$10,000** increase in annual personal income. This is also on average equivalent to being 7 years younger [[Kardan et al. 2015](#)]– study done in Toronto, Canada
- An estimated 45 million jobs are provided by the formal forest sector [[World Bank, 2021](#)]

The Arctic

- Cultural benefit of hunting a polar bear in the Canadian Arctic = **US\$6,298 per adult per year** (foregone income from not selling the hunting rights to trophy hunters) – almost **one third of the per capita income** for Arctic populations [[O'Garra, 2017](#)]
- A **30% decline** of polar bear populations will result in an annual loss of at least **\$96 per capita per year** [[O'Garra, 2017](#)]
- Existence values found to be **substantial and comparable** to the economic value of present-day mining in the Arctic [[O'Garra, 2017](#)]
- Highest per capita values are found within Indigenous communities – huge benefits from subsistence food and cultural services [[O'Garra, 2017](#)]
- At current rates, air-pollution mortality in Arctic Council countries is projected to result in high welfare costs, exceeding USD 750 billion per year by 2050 [[OECD, 2021](#)]

Genetic resources

- Annual revenues in the United States alone from genetically engineered plants and microbes are estimated at more than **\$300 billion**, or about **2% of gross US domestic product** – and less than 0.1% of estimated species of terrestrial plants and animals have had their DNA thoroughly sequenced to understand their potential value. [[Carlson, 2016](#)]

Freshwater and Water Security

- Nearly a **third** of the largest cities globally are reliant on protected habitats for clean water [[Pricewaterhouse Coopers, 2016](#)]

- An estimated **US\$25 billion** was invested in green infrastructure for water worldwide in 2015, with an estimated **annual increase in investment of more than 11%** over the previous year [[Bennett and Ruef, 2016](#)]
- Investment in watersheds is predominantly done locally, with nearly 90% of those investments coming via government programmes to subsidize landholders directly with payments to take actions for watershed protection [[Bennett and Ruef, 2016](#)]
- By investing money into protecting source water sheds, one in six cities (approximately 690 cities serving over 433 million people globally) has the potential to **fully offset conservation costs** through water treatment savings alone [[Abell et al., 2017](#)]
- For half of the world's cities, source water protection could cost only **US\$2** or less per person per year [[Abell et al., 2017](#)]
- The economic life expectancy of the Itaipu Hydropower Dam in Brazil/Paraguay, one of the world's largest, **was increased six-fold** by applying improved landscape management and farming practices in the catchment to reduce sedimentation in the reservoir, whilst simultaneously improving farm productivity and farmer's incomes [[UNWater, 2018](#)] (p33)
- Average global economic loss from floods and droughts is over US\$40 billion per year across all economic sectors. Storms add another US\$46 billion in economic losses annually, on average. These numbers are projected to increase to US\$200–400 billion by 2030, according to various estimates. Such losses strongly affect water, food and energy security and consume most of the current total development aid flow [[UNWater, 2018](#)] (pp 64) [OECD, 2015]
- three protected watersheds provide New York City with the largest unfiltered water supply in the USA, saving the city more than US\$300 million per year on water treatment operation and maintenance costs. The programme also serves as an alternative to building a water treatment plant which would have cost between an estimated US\$8 and 10 billion [[UNWater, 2018](#)] (pp 82) [[Abell et al., 2017](#)]

Tourism

- The world's terrestrial protected areas receive approximately **8 billion visits in a typical year** [[World Bank, 2021](#)]
- Annual visits to terrestrial protected areas generate approximately **US\$600 billion per year** in direct in-country expenditure, and **US\$250 billion per year** in consumer surplus [[Balmford, A. et al., 2015](#)]
- Central Park, in New York City, attracts about **42 million visitors per year**, while Stanley Park, in Vancouver, BC, receives about **8 million visitors annually**, a number almost **14 times** the city's population [[Nesbitt, L. et al., 2017](#)]
- Washington DC: The Cherry Blossom Festival has been found to generate **USD\$98.5 million** in direct economic output and **USD\$135.81 million** when indirect and induced economic effects are considered [[Nesbitt, L. et al., 2017](#)]
- Australia: the total annual direct expenditure by shark divers in Australia are estimated conservatively at **\$25.5 M** in 2014; Additional expenditure provided by the white-shark and

whaleshark-diving industries totaled \$8.1 and \$12.5 M for the Port Lincoln and Ningaloo Reef regions respectively [[Huveneers et al., 2017](#)]

- International tourists diving with white sharks also expended another **\$0.9 M** in airfares and other activities while in Australia – tourism benefits are not isolated to the diving industry, but are spread across the region [[Huveneers et al., 2017](#)]
- Australia's Great Barrier Reef has been valued at about USD 40 billion, contributing AUD 4.5 billion per year to the economy and supporting 64,000 jobs [[World Bank, 2021](#)]
- Nature-based tourism makes up **1/3rd** of all tourism in Australia, and contributes **\$30-40 billion** to the economy annually [[Huveneers et al., 2017](#)]
- The whale-shark-diving industry on the barrier reef of Belize (with a six-week season) generates tourist expenditures of **US\$5.0 M** (US\$3.7 M nominal value) including US\$1.8 M (US\$1.3 M nominal value) in five stakeholder communities [[Huveneers et al., 2017](#)]
- Contributions as high as a **US\$206 M** (US\$150 M nominal value) have been estimated for whale-shark tourism in Thailand [[Huveneers et al., 2017](#)]
- Galapagos: tourism contributed to a 78% growth in income over 6 years, creating the fastest growing economy in the world [[World Bank, 2021](#)]
- Rwanda: mountain gorilla trekking in the Volcanos Natural Park is now the country's largest source of foreign exchange, generating USD 200 million annually [[World Bank, 2021](#)]
- Global coral reef tourism is valued at USD 36 billion per year [[World Bank, 2021](#)]
- United States: invests USD 3 billion per year in its national park system, which contributes up to USD 20 billion to GDP via visitor spending and gateway communities [[World Bank, 2021](#)]
- Wildlife tourism contributed USD 120 billion in GDP to the global economy while sustaining 21.8 million jobs [[World Bank, 2021](#)].

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