Doctors for the Environment Australia

Policy

Biodiversity

Preamble

Natural ecosystems support our health by filtering our air, providing fresh water and food, regulating our climate, directly improving human health and protecting against the spread of disease and pests. They also foster our mental wellbeing and serve as places of recreation and sources of nature-based jobs in tourism and other vocations. Furthermore, with over one third of all medicines known to humans being derived from nature, protected ecosystems are a form of innovative capital for future medical advances. Ecosystems are the foundations of biodiversity, the infinite variation in life forms. Human resilience in the face of sudden and catastrophic shifts to the planet's life-support systems is strengthened by this variety of life on earth.

Doctors for the Environment Australia is focussed on the complex interaction between human health and our natural environment and is therefore interested in environmental degradation, particularly the loss of biodiversity and the impact this is having, and will continue to have, on human health and social stability. A global environment that supports biodiversity is better able to support human health. This is a topic of utmost urgency, and of great political and cultural complexity.

Background

Biodiversity (or biological diversity) is defined as the variability of living organisms, the 'diversity of life on Earth', and the complex relationships that make up ecosystems (MEA, 2005). People are an integral part of ecosystems and it is internationally recognised that biodiversity is intimately linked with human health with the UN Convention of Biological Diversity (1992) stating the importance of biodiversity in maintaining life-sustaining systems.

Biodiversity increases the resilience of ecosystems. The more biodiverse an ecosystem is, the more stability is has, and the more functions it provides. The services that ecosystems provide can be classified into four main categories, as described by the Millennium Ecosystem Assessment (2005). These are: provisioning, regulating, supporting and cultural.

Provisioning services are the easiest to appreciate. They offer us the products of nature and are the building blocks of primary industries like agriculture, fisheries, drinking water, timber, and fibre. Preservation of biodiversity strengthens these provisioning services, for example greater diversity in fisheries is associated with greater stability of yields.

Regulating services offer us benefits from the control of natural processes. These include regulation of macro-systems like the climate, crop pollination, air and water purification, waste management, and pest and disease spread. Forests, for example, regulate air quality, flow of water, soil fertility, and the climate itself. The regulating services of ecosystems also protect us from natural disasters. Vegetation helps buffer us from dust storms and landslides whilst coral reefs and mangrove swamps are natural barriers to coastal storms and tidal waves.

Supporting services of ecosystems facilitate the provision of all other ecosystem services including nutrient dispersal and cycling, soil formation, seed dispersal, and photosynthesis.

Cultural services of ecosystems offer us non-material benefits and foster positive mental health and cohesive communities. These services include the provision of recreational opportunities, a sense of

place and connection (especially to Indigenous people), a forum for aesthetic enjoyment, reflection, and spiritual fulfilment by direct interaction with nature.

Beyond these services, the intrinsic value we place on nature's role in our daily lives is incalculable. Modifying ecosystems to meet the exponential demand for food, fresh water, energy, and fibre has enabled material wealth and economic growth for some societies. The commoditisation of nature, however, does not make us any less reliant on ecosystem services. The cost of such human 'progress' is the direct loss of key ecosystem services such as clean water and air, protection from climate change and increasingly frequent and severe extreme weather events.

Most ecosystems provide human services that bridge all four domains. For example, the benefits that oceans provide range from the supply of food and sustenance of coastal livelihoods to the provision of recreational opportunities and storage of carbon.

The threats to biodiversity

Now more than ever, the diversity and sustainability of Earth's ecosystem services are at unprecedented risk.

Over the past century, humans have increased species extinction rates 100-1000 times the background rates that were typical over the Earth's history. Currently, between 10 per cent and 50 per cent of well-studied higher taxonomic groups (mammals, birds, amphibians, conifers, and cycads) are threatened with extinction. The main cause of biodiversity loss is habitat destruction. Other threats include pollution, climate change, over-harvesting, introduction of non-native species, and simplification of ecosystems. Less biodiverse ecosystems are less resilient and adaptable to ongoing and worsening threats like anthropogenic climate change.

Australia's rich biodiversity, much of which is endemic, is being depleted at an alarming rate. In the past two hundred years at least 114 species of Australian animal and plant species have become extinct. Currently, more than 1500 species of animals and 3000 ecosystem types are facing the threat of extinction. In states like Victoria, some original vegetation types have been reduced by more than 99 per cent since European colonisation. Australia also has the dubious honour of being home to the world's most recent mammalian extinction – the Christmas Island pipistrelle bat in 2009.

Comparison of biodiversity values in native, undisturbed forests with that in secondary and plantation forests demonstrated that biodiversity values were substantially lower in secondary and plantation forests. Few truly undisturbed forests exist today and the rate at which forest degradation occurs with repeated logging and fires is rapidly expanding. This is true in the Tarkine region of Tasmania that contains the largest tract of temperate rainforest in the southern hemisphere. The Tarkine is home to rare and threatened species found nowhere else including the last disease free population of Tasmanian Devils. The fatal Devil Facial Tumour Disease is estimated to have killed 80 per cent of the Tasmanian Devil population. The Tarkine region is threatened by open-cut mining which, by destroying habitat and increasing road traffic and associated road kill, poses a direct threat to the Tasmanian Devil.

The impact of climate change on biodiversity is already evident, with changes in reproduction rates, migration and coral bleaching. Climate change alone is expected to render extinct 25 per cent or more of terrestrial species by mid-century. Projections for 2050 climate change scenarios range from minimal climate warming where 18 per cent of species are committed to extinction to maximal change scenarios where 35 per cent of species face extinction. (Thomas et al, 2004, Nature)

Of particular vulnerability in Australia are species unique to our iconic heritage sites such as the Great Barrier Reef, south-western Western Australia, the Australian Alps, the Queensland Wet tropics and the Kakadu wetlands (Steffen W et al, 2009).

Australia is one of the 17 'megadiverse' countries in the world which are home to more than 70 per cent of the Earth's species. Most of Australia's species are found nowhere else on earth- 85 per cent of our terrestrial mammals, 90 per cent of reptiles and frogs, and 91 per cent of flowering plants.

Therefore, Australia is in a unique position to gain from conserving its rich inheritance of biodiversity whilst particularly vulnerable to a devastating loss of endemic species if threats to this natural heritage are not addressed.

Marine case study: Great Barrier Reef

Overfishing, coastal urbanisation, and water pollution have undermined the capacity of marine ecosystems to support human wellbeing. At current estimates half of the world's coral reefs have suffered a measurable decline in the last few decades. Whilst 10-20 per cent of the world's reefs have 'died' or ceased to function. Reefs are being damaged by overexploitation of marine resources, inappropriate development of the adjacent coast and global phenomena (rising sea temperature and ocean acidification resulting from climate change).

Apart from providing healthy, long term jobs in tourism, opportunities for recreational activities and as nurseries for the commercial fishing industry, reefs protect the coast from large waves and associated coastal erosion. In these ways, human health and security is protected by the reef therefore protecting the reef is essential for the wellbeing of Australians.

Impacts of reef degradation on human health can include:

- Poor nutrition with associated diseases as diets change away from fresh fish
- Increased incidence of ciguatera poisoning of people from eating affected fish
- Loss of employment in the reef and coastal tourism and fishing industries and the associated health and social implications of unemployment

Hatcher and Hatcher (2004); Skinner MP et al (2011)

Biodiversity and health – how they are linked together

Biodiversity is a key foundation for human health and wellbeing. Protecting biodiversity and ecosystems preserves the essential services (such as clean air, clean water) that they provide.

Food

Good nutrition, and thus good health, depends on biodiversity. Fundamentally, the food and water we consume are services of nature. Biodiversity in agriculture and fisheries is important for productivity and resilience to environmental threats like pests, diseases, and climate change. Insects such as bees, wasps and beetles are essential for pollination, and it is well recognised that biodiversity in food production is key to food security. Balanced diets that are sourced from diverse food species promote human health and protect against a range of specific micronutrient deficiencies.

Water

Healthy intact forests surrounding catchment areas provide essential services, including improving water quality and thus drastically reduce the cost of expensive water treatment. Sydney's Catchment Authority recognises the importance of preserving forest quality, and manages a buffer zone of forest around the storage area in order to protect water quality and reduce pollutants. In Melbourne, there is good evidence that the forested catchment area regulates water flow, maintaining a more constant supply in times of drought (Stolton and Dudley, 2007).

Land degradation, pollution and loss of biodiversity around waterways can have direct health consequences, for example causing outbreaks of blue-green algae. The toxins produced by some species of blue-green algae have a number of health effects, causing liver damage, gastroenteritis, skin irritation, and increased incidence of fatal neurodegenerative disease such as the motor neuron disease amyotrophic lateral sclerosis (Dunlop R, 2013; DPI, 2009).

Medications and research

The wealth of diversity in nature is behind much advancement in medical research particularly in enhancing the understanding of diseases and development of medications. Over 50 per cent of commercially available medications are sourced from nature, for example digoxin, warfarin and morphine.
Traditional medicines, from plants and animals, are used as primary healthcare for many people in developing countries (Chivian and Bernstein, 2010).

The study of cone snails, a genus of predatory sea snails living on or near coral reefs, has lead to breakthroughs in neuroscience and drug development (Aguirre, AA et al, 2012). Ziconitide, a new pain medication 1000 times more potent than morphine, was developed from cone snail venom and is used to treat chronic severe pain (Carey M, 2011). Beyond pharmacological applications, the study of animals and plants contributes to further understanding of our anatomy, physiology, and biochemistry. Biodiversity remains an important resource for future medical research and development.

Biodiversity and infectious diseases

Preserving ecosystems and biodiversity can reduce the prevalence of some infectious diseases. Around half of the new diseases spreading from animals to humans since the 1940s have resulted from changes in land use e.g. from forest to agriculture, and from wildlife hunting (Keesing et al, 2010). In the case of malaria transmission, deforestation reduces forest mosquito diversity, and the species that survive and become dominant often transmit disease better than the species formally abundant in the intact forest. This same effect of deforestation increasing transmission of disease has been noted with Lyme disease (Keesing et al, 2010; Chivian and Bernstein, 2010).

The recent outbreaks of Hendra virus in Queensland, a virus transmitted from flying foxes to horses to humans, have been partly attributed to loss of habitat that drives them closer to human settlement and also stresses the flying foxes, making them more likely to excrete the virus (Carey M, 2011; ABC, 2011).

Climate change, with changes in rainfall and temperature, is expected to expand the range of mosquito-borne diseases such as Dengue and Ross River Virus further south into NSW (Steffen and Hughes, 2013). However, keeping ecosystems intact and preserving biodiversity may reduce the incidence of these infectious diseases.

Biodiversity and Allergies

Research is beginning to explore contributory links between the rapid loss of global biodiversity and increasingly common immunological conditions in urban populations where green space and contact with nature is declining swiftly. The ‘biodiversity hypothesis’ has long proposed that people who have reduced contact with the natural environment may be more likely to develop allergies or ‘atopy’. Testing the hypothesis on adolescents in 2012, Hanski et al (PNAS) found environmental biodiversity in the surrounding of adolescents’ homes influenced the composition of types of normal bacteria on their skin. Individuals with an allergic disposition had lower biodiversity in the surroundings of their homes and lower diversity of bacteria on their skin compared with healthy individuals. In vitro studies have found that the abundance of certain types of skin bacteria positively correlates with the blood levels of Interleukin-10, an anti-inflammatory cytokine which regulates immune tolerance or allergic disposition. This raises potential, and hitherto little known, consequences to human health from loss of biodiversity.

Biodiversity and climate change

Ocean acidification, extreme weather events like drought, cyclones, storm surges, bushfires and flooding, and shifts in the distribution of plants, animals, and pathogens affect ecosystem health and productivity. Climate change limits the availability of ecosystems goods and services for human use and affects the viability and health of human-ecosystem interactions. Biodiversity also provides natural buffers to increasingly frequent and severe extreme weather events occurring due to climate change.

The mental health and cultural values of biodiversity

The cultural value of biodiversity is harder to define, however no less important. For Indigenous Australians, it is well recognised that the connection to land and country is essential to well-being and physical health (Sangha et al, 2011). There is also a growing body of evidence that spending time in nature has tangible health benefits, for example reducing social dysfunction, alleviating anxiety and depression, and improving physical health by promoting physical activity which improves blood glucose control in diabetics (Kuo FE, 2010). Time in nature has been shown to alleviate symptoms of children with Attention Hyperactivity Disorder and enhance the restoration of attention and focus (Bagot, KL, 2004), (Martin, K, 2011).

Biodiversity and global health

The health burden of biodiversity loss primarily affects the poor and the developing nations, as the poor are more directly reliant on ecosystem services and less able to adapt to their destruction. Biodiversity loss thus threatens the achievements made in the Millennium Development Goals of eradicating extreme poverty and hunger (MEA, 2005).

The Millennium Ecosystem Assessment identified credible threats to human wellbeing: depleted global fish stocks, worsening pollution, climate change, and precipitous species extinction. Investment to conserve nature is far cheaper and more effective than the cost of measures engineered as alternatives to the declining services of nature. The loss of such services in poorer regions of the world will increase financial and geopolitical strain on the international community, with greater need for aid and emergency relief.

DEA Policy

Due to the complex interplay between biodiversity and other threats to natural ecosystems, policy on biodiversity involves other areas of DEA's work. Our policies on climate change, unconventional gas, the coal industry and forests all support the protection of ecosystems for the preservation of biodiversity due to its relevance to human health.

With regard to forests, DEA recommends the protection of all intact ecosystems and their unique biodiversity and the sustainable management of plantation forests to meet forestry demands. Some highly biodiverse regions will need great protection as will water catchments whereas other areas will be amenable to access for recreational activities.

For marine parks the co-benefits of enhancing ecological resilience include overlapping improvements to both human health and ocean health. Intact coastal ecosystems serve as carbon storage, coastal protection, promote a sense of place, provide opportunities for tourism, support local economies as well as support biodiversity. DEA supports improved management of farms and ports, protecting and restoring mangroves, salt marshes, coral reefs, and seagrass beds and thereby seeks to reverse the adverse impact of human activity on the health of marine ecosystems. Future human development should be informed by factors affecting the sustainability and health of marine ecosystems, on which human health and wellbeing is so reliant. For development in and adjacent to these areas detailed and transparent health and environmental impact assessments are required and they need to examine the cumulative impact of multiple projects.

DEA calls for the protection of biodiversity hotspots and threatened species. Protection for threatened species can be improved by legislative change such as streamlining the processes for listing threatened species on the Environmental Protection and Biodiversity Conservation Act and the adaptation of the Recovery Act for these species- both of which are currently drawn out, expensive and ineffective. DEA recommends these processes be replaced by a national strategic planning process that avoids duplication and is quick to identify conservation priorities, obtain funding and implement short actions designed for each species to meet specific objectives.

The cost of stopping biodiversity loss is low but the existing conservation budget is inadequate to prevent extinction of all species. A wiser and more efficient allocation of resources would ensure that a

relatively modest increase in funding achieves real gains. For instance annual spending to protect threatened Australian birds is $3 million – less than 1 per cent of the weekly defence budget. Raising the budget to $10 million would slash extinction numbers to nearly zero in 80 years and threatened species numbers by 15 per cent. (Senate Submission – Possingham H, McCarthy M)

Protected areas alone cannot meet targets without species-specific management outside reserves. Even within protected areas there is evidence of species decline whilst 13 per cent of threatened species are found outside protected areas and 80 per cent of species have insufficient habitat protected for their survival. DEA supports efforts to protect species outside reserves, which need not compete with existing land uses with conservation brings co-benefits to farmland productivity, tourism, and livelihoods. (Senate Submission – Possingham H, McCarthy M)

DEA calls for urgent mitigation of climate change as this can protect against further biodiversity loss, and thus protect humanity from the health impacts of a changing climate. Climate change mitigation where emissions peak in 2016 would reduce biodiversity losses by 60 per cent. Although contractions would occur even amongst common and widespread species that contribute to ecosystem services, immediate and rigorous mitigation would buy humanity, via the preservation of biodiversity, up to four decades of adaptation to climate change. Adaptation to and mitigation of climate change are crucial priorities for managing the threats to human wellbeing, economic resilience, and integrity of ecosystem services worldwide.

People displaced by the effects of conflict, biodiversity loss, and natural disasters are more susceptible to ill health *and* more reliant on their natural habitat for food, water, and shelter. To aid in relief and recovery efforts post-disaster, sustainable management of existing biodiversity in disaster-prone regions is vital.

DEA supports changes to agriculture with a move away from environmentally destructive farming methods and a move towards methods to increase soil integrity, decrease erosion and salinity. These changes also include protecting bees and other pollinators, who are essential to food production; by moving away from pesticides that have harmful effects on them.

DEA supports ensuring continuing diversity in food species by preserving and utilising heirloom varieties.

As mining poses both direct and indirect threats to biodiversity, DEA supports thorough and independent health and environmental impact assessments prior to the approval of any new mine. These assessments need to look at the cumulative impact of multiple mines within a region, their impact on water flows through the region, air quality and the impact of transport both to and from the mine, including shipping's impact on the marine environment.

DEA recognises that restoration of biodiversity of mining sites is rarely successful and promise of restoration should never be a bargaining point in favour of mining approval (Bowman, D. 2013). Similarly the use of "offsets" as a trade off in development approvals is not supported for these fail to provide adequate habitat. (Regnery, B., Couvet, D. & Kerbiriou, C. (2013).

DEA supports moves to recognise and promote Indigenous peoples' cultural connection to biodiversity, including involving Indigenous people on conservation and development issues.

DEA supports the preservation of marine parks as invaluable fish nurseries for both the recreational and commercial fishing industries. DEA supports the protection of all threatened marine species, especially those made more vulnerable by climate change and calls for greater transparency in the labelling of fish for consumption as to its threatened status. DEA supports greater research into the wellbeing of marine and other aquatic environments in the face of expanding commercial development. The risks posed to human health by algal blooms in river and lake systems require greater oversight by regulatory bodies and DEA supports this.

DEA calls for greater research and education of the importance and interconnectedness between biodiversity, natural systems and human health.

DEA calls for the prioritising of funding to research and conservation efforts through a biodiversity fund.

DEA encourages medical schools to incorporate this interconnectedness between biodiversity and health into medical student teaching and to highlight biodiversity loss as an important threat to public health.

Summary

Doctors for the Environment Australia seeks to raise awareness of both the general public and policy makers of the risks to local and global health, both present and future, from environmentally damaging and disruptive technological choices and related short-term economic priorities. Biodiversity loss, through the destruction of ecosystems, has profound impacts on human health and wellbeing.

DEA calls for the importance of biodiversity to be reflected in all policy areas and associated budgetary commitments of our governments. The absolute dependence of our health and wellbeing on natural systems, as outlined above, is critical with our future survival completely dependent on the restoration of balance within and between these systems.

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