GEO
GLOBAL ENVIRONMENT OUTLOOK

FOR YOUTH
ASIA AND THE PACIFIC

UN environment
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FOREWORD

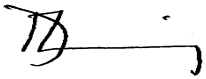
The future always belongs to the next generation. Without their engagement and leadership, that future cannot be sustainable. Fortunately, young people today are more passionate and involved in environmental issues than any who have come before them. Not only are they themselves taking action, they are mobilizing their families, communities and society at large to tackle the great environmental challenges of our time. Initiatives evolve into leadership. This is why youth empowerment is not just a slogan but a core tenet of environmental solutions.

In Asia and the Pacific particularly, we are all too familiar with the issues. Rapid economic growth, urbanization and lifestyle changes have been a boon to living standards. Yet this growth has been coupled with the unwise use of natural resources and a tendency to over consume. That means that environmental protection is not just the business of environmentalists, but everybody. Young people understand this intuitively more than most, and that is why, across the region, we see them disproportionately driving change.

UN Environment has recognized many of those young people working to make a difference. Through awards such as the Young Champions of the Earth and the Asia Pacific Low-Carbon Lifestyle Challenges, UN Environment is helping raise the profile and rights of youth to effect change. The stories of these winners reflect the creativity and lateral thinking that continue to inspire and influence others across the generations.

Knowledge, however, remains the prerequisite for solutions. That is the premise behind the *Global Environment Outlook for Youth : Asia and the Pacific*. This publication presents a clear and expansive picture of current environmental challenges for youth and young professionals with non-environmental backgrounds. It is a jumping-off point for those who want to do more for the planet and build their understanding of the environmental trends and challenges in Asia and the Pacific. Whereas conventional scientific publications can be technical and difficult to understand, this report is designed to be more interesting and accessible to a wider, younger audience.

I hope that this publication gives young people the chance to engage with environmental topics in a substantive way, build their knowledge and help spread an understanding of challenges that face us all. I also hope it encourages decision makers throughout Asia and the Pacific to support and empower young people. Ultimately, it is only with young people's efforts that we will deliver on the 2030 Agenda.



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PREAMBLE

The environmental landscape is changing rapidly, and the youth of today face a suite of both challenges and opportunities. As the human population increases, the decline in natural resources is accelerating at an unsustainable rate. At the same time, new frontiers are being explored to improve people's relationship with the environment and ambitious goals have been developed for transforming the world into a better place.

Figure 1: The Sustainable Development Goals (SDGs) formulated by the United Nations member countries in 2015

As a guiding principle in this journey towards sustainable development, 193 United Nations (UN) member countries agreed the 2030 Agenda for Sustainable Development in 2015. Recognizing that a healthy and well-functioning environment is critical to achieving social and economic development of humankind, this universal and ambitious global plan outlines a set of 17 goals, 169 targets and 230 indicators, the Sustainable Development Goals (SDGs). The UN, together with global leaders, governments, businesses and civil society are making every effort to achieve the 17 SDGs (Figure 1).

So, how can the youth of today be part of this global movement towards sustainable development? How are the SDGs relevant to the personal lives of young people?

Today's youth serve as vital agents of change in business and industry, science and technology, government and education. Vibrant, energetic and enthusiastic, young people are also a critical pool of change makers. They need to make the right choices to ensure prosperity, opportunities and well-being, as well as to secure a future for their families.

An environmental publication for youth in Asia and the Pacific

This publication aims to reach out to young people in Asia and the Pacific – tertiary students, young adults and early career professionals. It is intended to enhance their knowledge of three primary subjects – the natural environment, human health and the built environment – to promote a better understanding of the region's emerging environmental issues, their causes and effects.

Box 1: GEO for youth – Asia and the Pacific

- **Chapter 1** elaborates the context of the Asia-Pacific region and the crucial role of youth in addressing regional environmental challenges.
- **Chapter 2** presents the benefits derived from nature and demonstrates the critical role of healthy ecosystems in contributing to human survival and well-being.
- **Chapter 3** explores emerging issues of air and water pollution, food security and the effects of mismanaged waste on human well-being. This chapter advocates a balance between environmental wellbeing and economic development.
- **Chapter 4** addresses the natural and built environments, outlining options for a resilient and sustainable future.
- **Chapter 5** concludes the report by highlighting youth action for a better future, including a specific survey conducted for this report of youth, for youth and by youth.

Another ambitious goal of this publication is to empower young people to become involved in action and decision making to better protect the natural environment, improve human health, and create more sustainable and resilient cities and towns. And because all the Earth's systems are linked, these environmental challenges are also connected to one another. The report addresses how these issues are linked, why youth should care about the environment and why they should act right now.

"Only if we understand, can we care. Only if we care, we will help. Only if we help, we shall be saved."

Jane Goodall, UN Messenger of Peace, Primatologist and Anthropologist

CHAPTER 1

Our Earth, Our Story

Illustrations and story by Zheren Tang.

Since the appearance of humans on Earth, the young and loving Mother Earth has work diligently to nurture them. Over time, she witnessed the advancement of human intelligence, the progression of science and technology, as well as a deterioration of the environment.

Driven by the need to thrive and prosper, humans relentlessly took resources from her. As the years passed, Mother Earth gradually became old and wrinkled, and her hair turned from black to white. Eventually, her body could no longer take the beating of the humans' exploitation. Mother Earth fell ill – her lungs, the forests; blood, the oceans; and kidneys, wetlands became seriously damaged. She was in bad shape.

Seeing how sick Mother Earth had become, people young and old began to reflect on their poor behaviour, and, step by step, started to take positive action to save her. Slowly but surely, Mother Earth's health recovered. People reflected, "Mother Earth, you have raised and cared for us for so long; now it is our turn to protect you".

The stewardship of the environment requires long-term commitment. Everyone needs to take an active role at home, in their communities and workplaces to secure the future on this one planet, Earth.

Figure 2: Mother Earth and us

1.1 No time to wait, act now!

In many communities around the globe there is a lack of care or understanding of environmental issues that are essential to human existence. These include climate change bringing global warming and unpredictable weather patterns that in turn lead to food and water shortages, the deterioration of air quality as a result of urban pollution, and species extinctions and loss of biodiversity caused by human development since the Industrial Revolution that began 200 years ago. As a result of inaction, the issues are becoming more severe and the number of deaths attributable to a poor environmental conditions continue to increase.

In Asia and the Pacific, there are a number of threatening environmental issues – air and water pollution, deforestation and loss of biodiversity, rapid rural-to-urban migration, food shortages, increased frequency of extreme weather events and poor waste management. Environmental action and sustainable life choices have the potential to lessen the intensity of these issues. Young people have the capacity and have a responsibility to influence and promote environmentally positive outcomes, stimulating the social and political changes needed to mitigate these severe environmental issues.

1.2 Overcoming the challenges

Asia and the Pacific, comprising 41 countries (UNEP 2016), supports a vast diversity of cultures, people, landscapes and natural resources. It is the most populous region in the world, and although it occupies only 30 per cent of the world's land mass, the region supports 60 per cent of the global population (UNEP 2016). Over the past 50 years, the region's population has grown and gained economic momentum (IMF 2018), with many countries in the region considerably improving the standards of living of their citizens. This progress, however, has come at the expense of the region's natural resources and its vulnerable communities. Figure 3 provides an overview of the contemporary potential and challenges faced by Asia and the Pacific.

With almost half of the world's young people calling the Asia-Pacific region their home (UN-DESA 2017), the potential revolution they can bring about equates to an undeniable force in the race to address urgent environmental issues and drive sustainable development. Whatever their personal reality, the youth of the region are influential members in their own communities, have the ability to promote positive environmental outcomes through their daily lives, and be agents of change. Each and every young person must assume a mindset that promotes environmental stewardship to make both local and far-reaching changes that address the planet's environmental challenges. This will help to ensure that both their own and future generation's needs can be met (Brundtland 1987).

1.3 Youth in Asia and the Pacific matter!

The concerns and responsibilities of youth play a vital role in the health of the planet and are influenced by the environmental conditions they have inherited from their parents. With their life expectancy forecast to be longer than their parents, today's young people face the very real threat that the environment they will live in will be unhealthy and so damaged that their

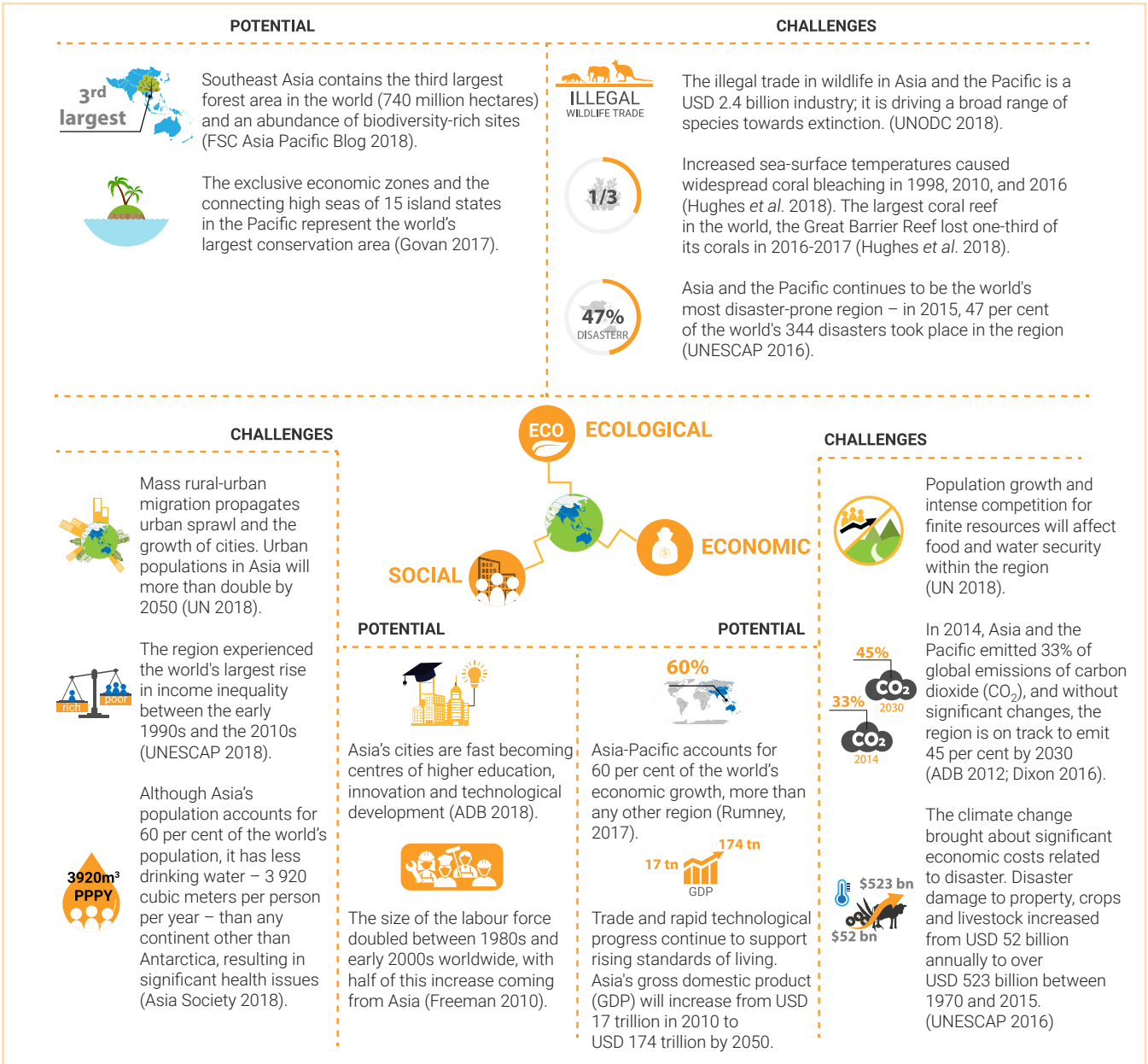


Figure 3: Summary of the economic, social and environmental potential and challenges in Asia and the Pacific

quality of life will be reduced. Fortunately, young people have a special talent for innovation and the development of new forms of action and activism. This will allow them to generate more effective responses to environmental issues and create stronger opportunities for change.

The power of youth

Today's young people form the backbone that supports communities and civil society. They are best placed to notice new problems quickly, blaze trails at the grassroots, and bring about urgent societal change that will be of tremendous value to local communities. Civic education and voting are other priorities, as they instil common values and a sense of social and civic rights and obligations (Shaw *et al*. 2014; World Bank 2007). Remember, the voice of youth matters. Young people should be heard – through activism, volunteerism, engagement and civic participation, everyone can be an active member of their own community (UN-DESA 2016). Passionate young people will drive the shift towards environmental sustainability in Asia and the Pacific.

Getting involved

Youth can offer new perceptions and pioneering solutions in policy dialogues or as representatives in local or national decision-making bodies (UNDP 2013). Getting involved in democratic processes upholds young people's rights and allows opportunities to steer development towards environmental sustainability (World Bank 2007). Today's young people are better informed than ever before and are capable of creating ingenious solutions and applying technology, such as social media and crowdsourcing platforms (UN-DESA 2016). Indeed, the proactive participation of youth in the deliberations around the United Nations Agenda 2030 for Sustainable Development is now supporting its implementation. As prospective leaders of Asia and the Pacific, their skills and capacities are crucial to the transformational change that is required in the region (Palanivel *et al*. 2016).

Championing leaders of change

Young people can make development more environmentally sustainable and inclusive. It makes sound economic sense for governments across Asia and the Pacific to develop national youth policies and commit themselves to investing more in youth (UNICEF 2013). This may involve strengthening environmental sustainability education, supporting initiatives that promote youth empowerment, creating opportunities for young people to contribute to the development process or advancing the role of youth leaders in decision making. The bottom line is that governments can start building the next generation of responsible leaders, who will act as positive agents of change and partners in achieving the SDGs (Billimoria 2016).

Taking the next step...

So, imagine a world in which everyone wakes up in the morning, has access to safe drinking water, cooks meals with fresh vegetables and takes deep breaths of clean air on the commute to work. We can all enjoy this fundamental quality of life by making conscious decisions in our everyday lives that support positive environmental and health outcomes. The youth of

today are key actors in shaping the future environment and can still change our future towards happy and healthy lives. The Earth is at risk and waiting for us to take action; collectively we can help to give Mother Earth a fighting chance.

CHAPTER 2

Circle of Life

2.1 Nature's gifts

The Asia-Pacific region contains exceptionally rich biodiversity. The tropical rainforests of Southeast Asia, the reefs of the Coral Triangle, temperate forests and the large Mekong river basin are all found in the region and are regarded as among the most biodiverse and valuable on Earth. The region also encompasses many different ecoregions and biomes that harbour dramatically distinct assemblages of plants and animals. Sadly, the Asia-Pacific region is facing unprecedented declines in biodiversity and natural environments. Protecting and conserving these natural resources that contribute to human wellbeing is urgent.

This chapter highlights the social, economic and biological values of Earth systems to human wellbeing. It presents the reasoning on how people reap abundant benefits from nature and showcases four systems: land, freshwater, coastal and marine, and urban (Figure 4). Through featuring real-life examples, the chapter also aims to show how nature is vital to human wellbeing.

2.2 Land systems: seeds of life

Our society, culture and way of life are intertwined with the land systems – forests, trees, plants and soil. The increasing recognition of their value in Asia and the Pacific is due to the invaluable ecosystem goods and services they provide, upon which people depend. Land systems in the region can be grouped according to such functions as production, recreation, conservation and protected areas or landscapes. Each provides various benefits to people and are vital to the achievement of the SDGs, contributing to food security, eradicating poverty, improving rural livelihoods, conserving biological diversity and the overall functioning of ecosystems, and increasing the planet's resilience to anthropogenic changes.

Forests are reservoirs for wildlife and people

Forests are one of the most biologically rich terrestrial systems. Tropical, temperate and boreal forests provide diverse habitats for plants, animals and microorganisms, and host the vast majority of the world's terrestrial species (ACB 2011). Due to abundant rainfall and warm temperatures, the vast tropical forests of Southeast Asia (Box 2), for instance, support ecologically, economically and scientifically valuable diverse plants and animals.

Also, tropical forests in the Asia-Pacific region contribute significantly to the global food supply through the production of fruit and vegetables pollinated by bees (Box 3), birds and bats. These pollinators shape 35 per cent of the world's crop production and affect production of 87 of the leading food crops worldwide, as well as many plant-derived medicines. However, the sustainability of this food supply is being threatened due to the decline in populations of pollinator species. In 2016, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) reported that 16.5 per cent of vertebrate pollinators globally are threatened with extinction due to land-use change, intensive agricultural management and pesticide use, environmental pollution, invasive alien species, pathogens and climate change (IPBES 2016). It has been shown that pristine forests provide greater availability of food

Figure 4: Earth's natural systems have provided people with huge numbers of resources, which, in turn, support human health and well-being. The four systems – land, freshwater, coastal and marine, and urban – are important foundations supporting sustainable communities, providing natural resource security, mitigating climate change, and delivering bountiful ecological benefits

Box 2: Forest gardeners

In Southeast Asia, the Sumatran orangutan (*Pongo abelii*) is an important species that lives in the tropical rainforests of Sumatra, Indonesia. They eat fruit from the trees and spread the seeds as they travel considerable distances through the forests, helping to maintain the rainforests' biodiversity (Campbell-Smith *et al*. 2011). These orangutans also are of great cultural importance and are considered iconic in Southeast Asia.

Across Southeast Asia, governments have protected 18 per cent of the remaining tropical moist forest. Nonetheless the forests and their wildlife are increasingly threatened by conversion to agriculture, increasing global demand for palm oil and other anthropogenic factors. On the Indonesian islands of Borneo and Sumatra, the expansion of oil palm plantations is a huge challenge as it brings about forest, land and soil degradation.

Orangutan Rehab Centre, Sumatra
Source: Dave59, UNEP

Box 3: Bees, give me honey!

Bees are more than pollinators, they make honey – a highly nutritious food and in some communities a valuable medicine. But bees can also contribute to local social and economic interactions. Beekeeping can be a major source of income for those who have limited options for making money, such as the farmers from high altitude areas in Jumla District of Nepal, high in the Himalayas. These farmers do not have enough productive land for growing rice so they barter honey for rice, other food and household items, and renting farmland in lower altitude areas (Partap *et al*. 2014).

Beekeeper
Source: Kaipara Flats, unsplash

products than secondary or degraded forests, as well as the vital link between biodiversity and pollination service (Hicks *et al.* 2014).

Soaking up carbon dioxide and water

Plants absorb carbon dioxide (CO_2), the main greenhouse gas, from the air, then store the carbon (C) in soil and release the oxygen (O) to create the air that humans breathe. It has been shown that by conserving forests in the tropics, total global CO_2 emissions can be reduced by 8 per cent, helping to mitigate the impact of climate (Figure 5).

Feeling down? Go forest bathing!

Forests are important areas for recreation, aesthetic appreciation and stress relief, all of which are of great importance to the health and well-being of people. The experience of forest bathing reduces the possibility of mental illness and depression (Bratman *et al*. 2015), as well as improving the quality of life and stress (Yu *et al*. 2016). In Japan, a study showed that forest bathing trips significantly improve human immunity functions in both male and female subjects (Li 2010). These all shows that forests provide intangible or immaterial values to human health, and this connection to nature has been termed biophilia.

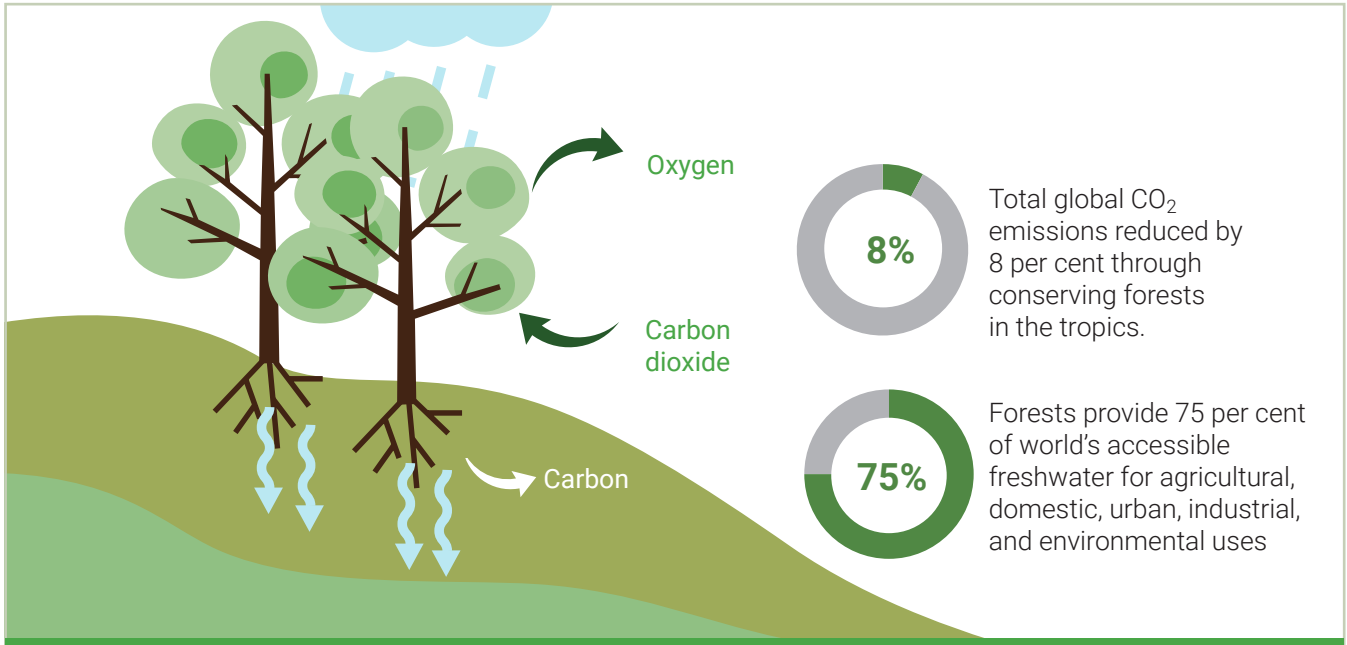


Figure 5: Planting and growing trees is one of the cheapest and most effective ways of soaking up excess CO_2 from the atmosphere and is key to achieving sustainable and secure water supplies

Box 4: Reafforestation in the Kubuqi Desert

About a third of the Kubuqi Desert, the seventh largest in China, has been transformed into viable green oasis by a public-private-local community partnership. Over 30 years, Elion Resources Group and its partners have reforested more than 6 200 square kilometres (km^2) the desert, helping more than 100 000 farmers and herdsmen out of poverty, and creating more than USD 74 billion of ecological wealth and natural capital (UNEP 2017).

Kubuqi Desert
Source: Elion Group

Biophilia *– the urge to affiliate with other forms of life.*

The biophilia hypothesis suggests that humans have the innate tendency to seek out connections with nature and other forms of life, to satisfy the human craving for aesthetic, intellectual, cognitive and even spiritual meaning and satisfaction (Wilson 1984)

Watch a talk by Ming Kuo on Vitamin N (nature)!

A video link

https://www.youtube.com/watch?v=JGh8CqS4HLk

As the demands of economic development rise, forest areas in Asia and the Pacific are increasingly threatened (Box 2). One way to combat forest loss and degradation is the establishment of policy instruments and initiatives that protect them. According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), between 1990 and 2015 forest cover in Northeast Asia rose by 12.9 per cent and by 5.8 per cent in South Asia as a result of joint participatory management, payment for ecosystem services and restoration of degraded forests. Programmes such as the Payment for Ecosystem Services (PES) mechanism allow governments and the private sector to allocate money to land owners and local communities living in and around forest landscapes to restore and protect their forests. As a result, farmers in China, for example, are paid by the government to restore forest lands (Yang and Lu 2018).

Satoyama - Yes, in my backyard!

Terrestrial areas of high conservation value provide a myriad of benefits to local communities. Some

protected areas in the region, such as a number of the Association of Southeast Asian Nations (ASEAN) Heritage Sites, consist of pristine forests and other terrestrial landscapes, distinct from human-modified habitats. However, this classification of protected area has gradually transitioned into socio-ecological production landscapes and seascapes (SEPLS) characterized by a diversity of land uses that offer more options and opportunities for local sustainability (Cumming 2011). These are multi-functional landscapes, which are essential for community wellbeing and inherently resilient to external shocks and stresses from long-term interactions between nature and people (Takeuchi 2016). The concept of SEPLS is related to the concept of community forestry in Lao PDR, Myanmar, and Thailand, the main objectives of which are to

1. improve local livelihoods;
2. reduce deforestation and improve forest quality; and
3. strengthen good governance.

Did you know?

In Japan, a place where nature and people exist in harmony is called Satoyama. You can view a case study showing how homegardens can be resilient agro-ecosystems and offer multi-functional uses at:

A video link

https://www.youtube.com/watch?v=PtF0R2JXAQ8

Box 5: Homegardens – special food production systems

A study in Bangladesh, India and Sri Lanka showed that between 1961 and 2010 the composition of homegardens had not changed despite evidence of climate change (APN, 2010). Homegarden ecosystems seem to be resilient to climate change due to the use of efficient and effective adaptation strategies by gardeners. These enabled gardeners to maintain diversity and rely on their produce for household food security. Their strategies include changing planting dates, use of traditional agronomic practices, use of soil and water conservation measures and irrigation technology as well as planting new vegetable varieties. Homegardens house a lot of species in relatively small areas and have complex structures which play an important role in biodiversity conservation including soil animals, insects and birds. In Japan, homegardens facilitate a food sharing culture which contributes to enhancing resilience against socio-economic changes and natural disasters (Saito *et al.* 2018).

2.3 Freshwater systems: fountains of life

Freshwater systems are vital resources with specific ecosystem functions that offer benefits to human needs, agriculture, industrial production, cultural activities and conserving ecosystems (Figure 6; Sandin and Solimini 2009; Millennium Ecosystem Assessment Board 2005). These systems, which include rivers, lakes, marshes, and rice fields, vary greatly across the Asia-Pacific region. Even though the region has 38 per cent of the world's share of renewable freshwater resources, it supports about 60 per cent of the world's population (UNEP-WCMC 2016). Therefore, in many areas around the region there is intense competition for available water supplies (WWF-ADB 2012).

Figure 6: Freshwater systems provide ecosystem functions such as regulating water quantity and quality, supporting habitats and biodiversity, and maintaining the equilibrium of physiological processes (Grizzetti *et al*. 2016; Sandin and Solimini 2009). These systems provide a variety of ecological benefits that are directly and indirectly linked to human survival

Access to clean drinking water

Safe drinking water is essential for people (Kumpel *et al*. 2018), and this aligns closely with SDG 6: Clean water and sanitation. People need to drink water daily for homeostasis (i.e. steady internal conditions) and to sustain the cells that make up the human body (Gleick 2009; Institute of Medicine 2005). To maintain the body's water balance, a daily water intake of 3.7 litres by adult men and 2.7 litres by women is needed by the vast majority of people (Sawka *et al.* 2005).

In Asia and the Pacific, almost 554 million people, 12.5 per cent of all Asians, do not have access to safe drinking water. A major challenge for the region is the contamination of freshwater resources that leads to infections, parasitic and other diseases that disproportionately affect very young children (World Health Organisation 2016; Singh *et al*. 2001; Rahman *et al*. 1997). The burden of water-related disease is extremely high in the region – 30 per cent of the South and Southeast Asia populations are estimated to use drinking water contaminated by human faeces (Bain *et al*. 2014). Fortunately, since the 1990s, the clean water supply ratio in Asia and the Pacific has increased significantly, but the supply of drinking water in urban and rural areas in the same country often varies considerably (Figure 7; UNICEF 2017).

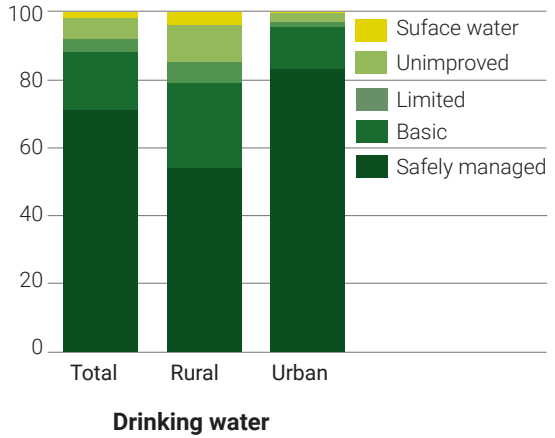
Water supports economic activities

Gross domestic product (GDP) growth rates of countries in Asia and the Pacific are increasing rapidly (Asia-Pacific Water Forum 2018). Here, the GDP at market prices refers to the expenditure on final goods and services minus imports (OECD 2018), and the agricultural and manufacturing sectors account for most of it (Statista 2018). These sectors include the running of power plants, the production of paper and pulp, chemicals and the electrical and electronic industries, which in turn support employment. These sectors all have a common need for a regular supply of freshwater to manufacture products and grow crops.

So, exactly how much water is being used for production in each industry? This can be quantified using an index called the water footprint. It is an integrated representation of water used and consumed by individuals, businesses, regions, countries or throughout the workplace. This is based on the Water Footprint Network (http://waterfootprint.org/en/water-footprint) guidelines and the international standardization of the International Organization for Standardization (ISO) (Figure 8).

In developing Asia, approximately one-third of the labour force depends on agriculture as the main source of their livelihoods, but in high income countries less than 5 per cent are employed by this sector (ADB 2016). To support the agriculture sector, irrigation is the dominant use of water, accounting for more than 90 per cent of total water withdrawals in many of the region's countries, most notably in India and Pakistan (Galang 2016). A major crop grown in Asian countries, particularly in China and India, is rice as it is not only the staple food, but also the major economic crop (Venkatesh 2016). For example, rice production has helped alleviate poverty in Bangladesh through the provision of jobs and income for rural communities (Sayeed and Mohammad Yunus 2018).

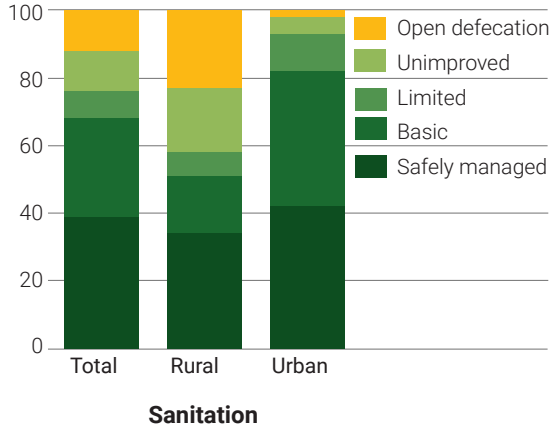
Access to safe drinking water and sanitation



Drinking water

SERVICE LEVEL	DEFINITION
SURFACE WATER	Drinking water directly from a river, dam, lake, pond, stream, canal or irrigation canal
UNIMPROVED	Drinking water from an unprotected dug well or unprotected spring
LIMITED	Drinking water from an improved water source for which collection time exceeds 30 minutes for a round trip, including queuing
BASIC	Drinking water from an improved water source, provided collection time is not more than 30 minutes for a round trip, including queuing
SAFELY MANAGED	Drinking water from an improved water source that is located on premises, available when needed and free from faecal and priority chemical contamination

Note: improved sources include: piped water, boreholes or tubewells, protected dug wells, protected springs, and packaged or delivered water.



Sanitation

SERVICE LEVEL	DEFINITION
OPEN DEFECATION	Disposal of human faeces in elds, forests, bushes, open bodies of water, beaches or other open spaces, or with solid waste
UNIMPROVED	Use of pit latrines without a slab or platform, hanging latrines or bucket latrines
LIMITED	Use of improved facilities shared between two or more households
BASIC	Use of improved facilities that are not shared with other households
SAFELY MANAGED	Use of improved facilities that are not shared with other households and where excreta are safely disposed of in situ or transported and treated osite

Note: improved facilities includes flush/pour flush to piped sewer systems, septic tanks or pit latrines; ventilated improved pit latrines, composting toilets or pit latrines with slabs.

Figure 7: Trends for 2000–2015 showing the usage status for drinking water and sanitation for urban, rural and total populations in Asia and the Pacific (UNICEF 2017)

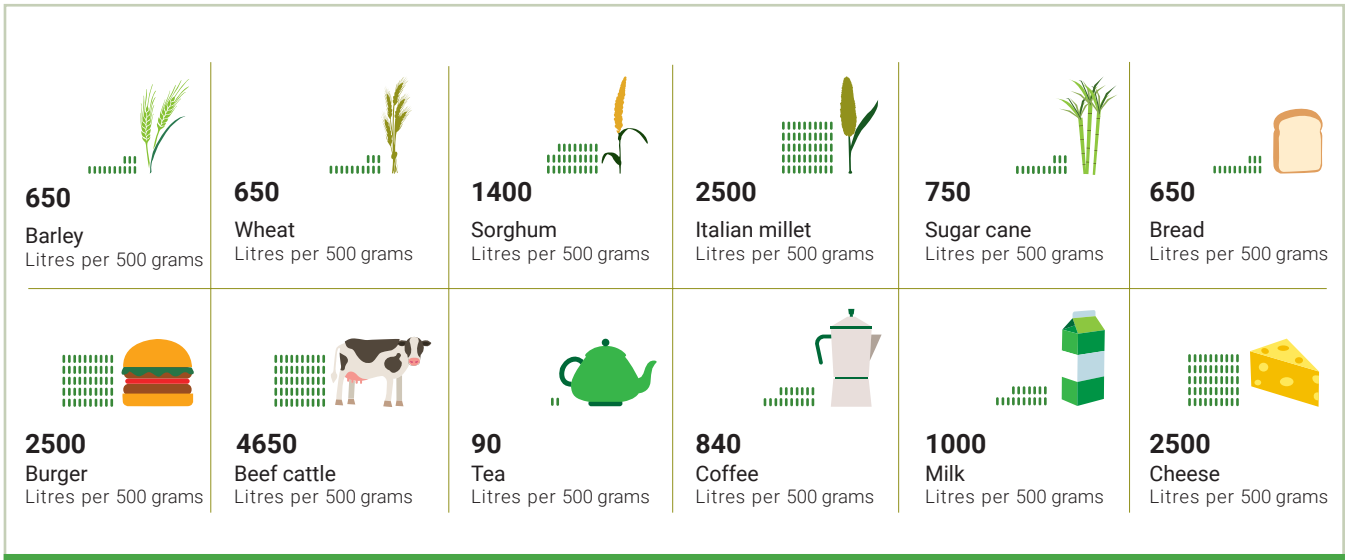
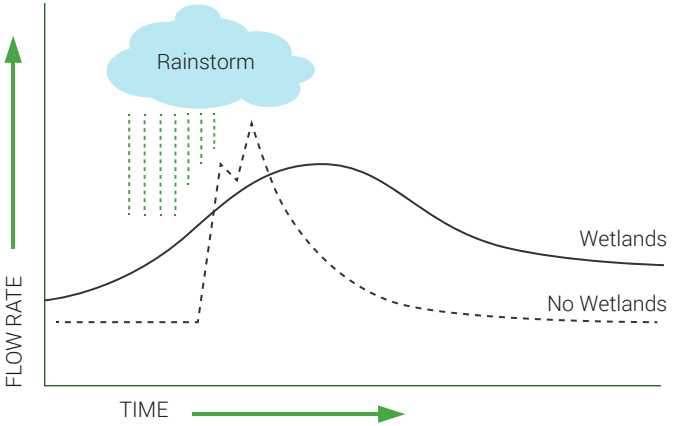


Figure 8: A summary of the water footprints of major agricultural products

Buffering against floods

Floods are caused by heavy rainfall, severe winds over water, unusually high tides, tsunamis, or the failure of dams, levees, retention ponds or other structures used to contain water. The Asia-Pacific region is known to be prone to natural disasters (UNESCAP 2016), which can cause substantial loss and damage. For instance, the loss and damage from flood events are immense for poor communities in Nepal, a nation that experiences frequent floods due to its varied topography and torrential rain during monsoon seasons (Devkot and Karmacharya 2014). Since 1980, national estimates indicate that flood events in Nepal have on average each killed about 200 people (UNDP 2009).

Freshwater bodies, floodplains, wetlands (Figure 9) and river zones, not only function as habitats; they are also effective natural flood controls (Palmer and Richardson 2009; Millennium Ecosystem Assessment Board 2005). Each habitat regulates the rate of water flow from land to freshwater bodies, and the vegetation on intact floodplains and along riverbanks act as buffers against floods. Without these flood control services, the frequency and magnitude of flooding are greatly increased (Box 6; Palmer and Richardson 2009).



This diagram indicates that wetlands reduce peak stormwater flows.
Source: Kusler 1983

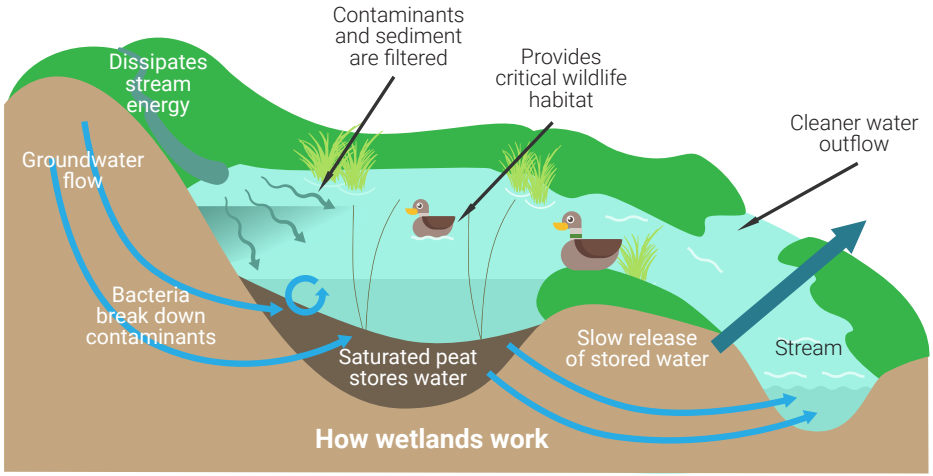


Figure 9. Wetlands serve as important habitats and provide a range of ecological services to people (Gregg and Wheeler 2018; ADB 2016). In particular, they provide important natural controls against floods (Kadykalo and Findlay 2016). Wetlands are natural reservoirs that act just like sponges, storing water and buffering against flood damage (Kusler and Riexinger 1986)

Box 6: Preserving wetlands in Colombo, Sri Lanka

Sri Lanka's Colombo metropolitan area, which is flood-prone, has about 2 000 hectares of wetlands, but about 23.5 hectares are disappearing each year. Funds from Japan's Policy and Human Resources Development Fund (PHRD Grant) and the Global Facility for Disaster Risk and Reduction (GFDRR) have supported studies on flood mitigation and urban wetland design. Now, with the World Bank's support, the Colombo local government has created its first Policy and Human Resources Development Fund (MCUDP) to protect and restore Beddagana Wetland Park.

According to the plan, almost 2.8 million people living and working in Colombo will benefit directly and indirectly and the project is also expected to generate revenues of approximately USD 13.6 million through recreational facilities provided by wetlands.

2.4 Coastal and marine systems: sea of life

The coastal and marine systems of Asia and the Pacific are among the most productive and dynamic habitats in the world and provide a wide range of services to people (Laurans *et al.* 2013; Brander *et al.* 2012; Fortes 1991). Some of the world's most outstanding coastal areas found in the region include the reefs of the Coral Triangle (Foale *et al*. 2013) and the mangrove forests of the Sundarbans in the Bay of Bengal (Perry 2011). Ecosystem goods and services provided by these different coastal habitats are estimated to have a natural capital value of up to USD 7.7 billion dollars (UNEP/COBSEA 2010). However, this natural capital may be endangered endangered by rapid economic and population growth (IPBES 2018).

The wealth of coastal and marine ecosystems

The Asia-Pacific region is widely recognized as having the world's richest coastal and marine biodiversity (UNDP 2014). For example, the Coral Triangle of 5.7 million square kilometres spanning the waters of six Asia-Pacific countries has been identified as a global biodiversity hotspot (Foale *et al*. 2013). The intrinsic biological value of these ecosystems also underpins many social and economic values (Figure 10). Through SDG 14, which aims to conserve and sustainably use the oceans, seas and marine resources for sustainable development, the oceans have become a global priority for the first time in history.

Coastal and marine ecosystems provide critical regulatory services such as helping to protect people's lives against natural hazards and the degradation of resources (Jones *et al*. 2012; Colls *et al*. 2009). They also provide employment opportunities in tourism and the sustainable harvesting of resources (Bennett *et al*. 2014; Samonte-Tan *et al*. 2007). For instance, livelihood security provided by fisheries to local communities in

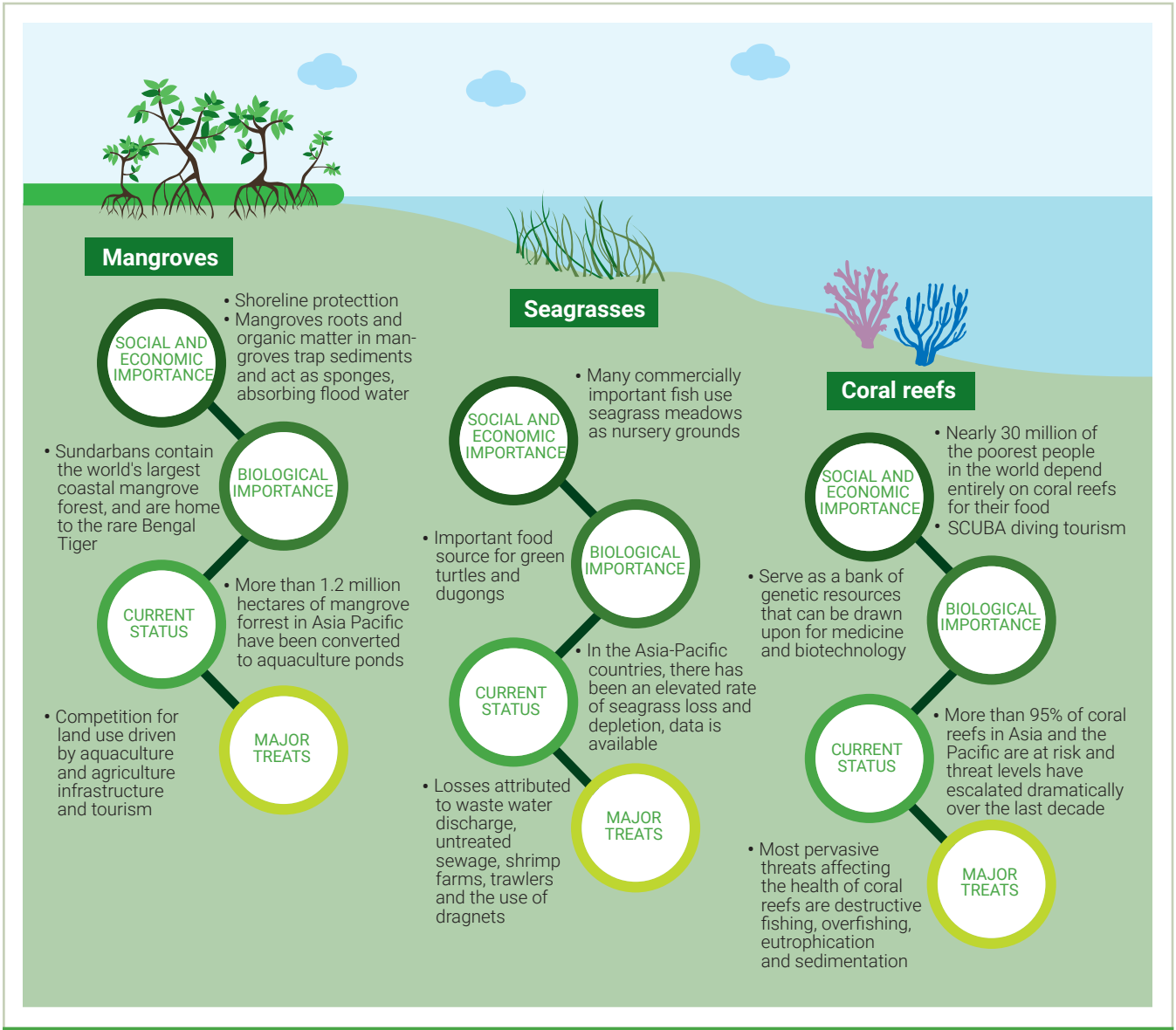


Figure 10. An overview of significant coastal and marine systems' ecological benefits to people's well-being, as well as their current status and major threats

Sources: Gisen *et al.* 2006; Wikinson 2008; Burke *et al.* 2011; UNEP 2006, 2016

the region is significant, especially for the women who contribute to seafood harvesting and trading (Monfort 2015; Harper *et al*. 2013). In other local communities, these ecosystems have spiritual and cultural significance that are equally as important as the other services; an example is the traditional knowledge systems of the Pacific island countries that have long been influenced and shaped by the nature of their local ecosystems (Forsyth 2011).

The oceans also have a central role in regulating climate, and are by far the largest carbon sink of Earth. Almost 93 per cent of the world's carbon dioxide is stored in marine life, such as algae, fish and corals (Khatiwala *et al*. 2009). A new concept called fish carbon (Toomey 2018) describes the various carbon interactions of marine vertebrates that contribute to the storage of carbon that would otherwise enter the atmosphere and add to global warming (UNEP 2018; Rogers *et al*. 2014). It was roughly estimated that more than 1.5 billion tonnes of carbon are captured and stored annually by fish and other marine life in the high-seas ecosystems (Rogers *et al*. 2014). Most of the extra heat generated by global warming has gone into the oceans. There is an urgent need for nations in the Asia-Pacific region to recognize the role of oceans in mitigating climate change impacts and contributing to the achievement of SDG 13: Take urgent action to combat climate change and its impacts.

Maintaining healthy coastal and marine ecosystems will help guarantee the wellbeing of approximately 1 billion people who live near the coast (Talaue-McManus 2006). With an estimated 325 million people expected to live near the cost by 2026 (UNEP 2016), the integrity of these ecosystems is necessary to provide security to

A video link

https://vimeo.com/295991431

Source: Toomey, J. "Fish Carbon, Exploring Marine Vertebrate Carbon Services". Animated video, produced by GRID-Arendal and Blue Climate Solutions, 23 Sept. 2018,

human communities in Asia and the Pacific. At present, coastal and marine ecosystems are threatened, particularly the coral reefs in South and Southeast Asia (IPBES 2018). According to the mid-term review of the Convention on Biological Diversity (CBD) Aichi targets, "extensive coastal development and unsustainable exploitation of marine resources have resulted in the disappearance of over 40 per cent of coral reefs and mangroves, leading to declines in fish stocks" (UNEP-WCMC 2016). The damage to coral reefs, mostly due to pollution and climate change (Box 7), has wide-ranging implications for food security, tourism and overall marine biodiversity (IPBES 2018).

Box 7: Could we lose the largest coral reef in the world to climate change?

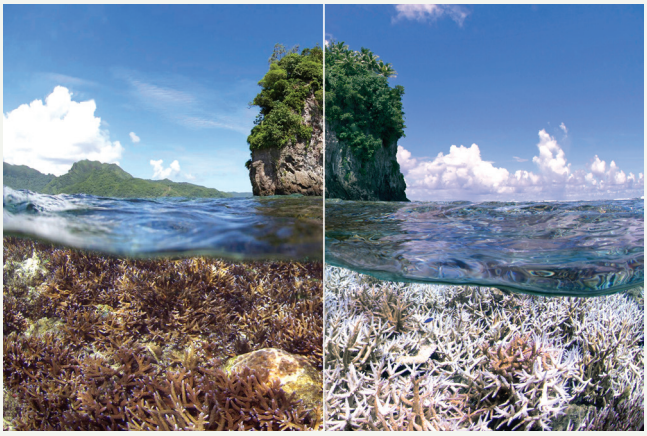
The Great Barrier Reef (GBR), located on Australia's northeast coast, is the world's largest coral reef system. This magnificent living structure can even be seen from outer space! Declared a World Heritage Site in 1981, the GBR more than 2 300 kilometers long, stretches over an area of about 344 400 square kilometers.

The most recent tragedy for these coral reefs is the worst coral die off ever recorded in the GBR (Hughes *et al*. 2018). In early 2014, driven by climate change, warming seawater temperatures triggered a global bleaching event that lasted for almost three years. By then, almost 29 per cent of the GBR's corals had died.

Watch this interview with Professor Terry Hughes, a coral scientist monitoring the condition of the GBR.

A video link

https://www.theguardian.com/environment/video/2016/jun/07/coral-bleaching-has-changed-the-great-barrier-reef-forever-video



Coral reef before and after it experienced severe bleaching in the 2016 mass bleaching event. Rising sea surface temperature causes large-scale coral bleaching, a phenomenon in which corals expel their symbiotic microalgae and turn white. This in turn, has been linked to high coral mortality rates.

Source: The Ocean Agency; XL Caitlin Seaview Survey; Coral Reef Image Bank.

Building ocean resilience

Marine protected areas (MPAs) are broadly described as areas set aside to protect and manage the biodiversity within coastal and marine ecosystems effectively and equitably (UNEP 2017; Elliott *et al*.2011). Simultaneously, MPAs help to achieve the long-term conservation of nature and its associated ecosystem and cultural values (Neumann *et al*. 2015). The region's countries are at the forefront of designating MPAs (Box 8). Between 2004 and 2017, the marine area protected in the region increased by 13.8 per cent (IPBES 2018). Many countries in Northeast and Southeast Asia, and Oceania are on track to fulfilling the Convention on Biological Diversity Aichi Target 11 of declaring 10 per cent of oceans as protected areas, which further strengthens the global efforts for marine biodiversity conservation outlined in SDG 14: Life below water (Rees *et al*. 2018).

The region's Coral Triangle has numerous MPAs of various sorts, including no-take zones in which no extractive activities are allowed, that are managed by various national agencies. To help guide management of such a large area, Flower *et al*. (2013) recommended taking an integrated and coordinated ecosystem-based approach to address the multiple impacts to the region's coastal and marine areas, and ensure their long-term sustainability for local people. When well managed, MPAs can contribute to reducing poverty (SDG 1: End poverty in all its forms everywhere), building food security (SDG 2: Zero hunger), and creating employment, as seen at four sites (Figure 11; van Beukering *et al*. 2013). As well as contributing to the achievement of a number of SDGs (UNEP 2017), MPAs and the ecological benefits they provide also contribute to the Convention on Biodiversity Aichi Targets (Rees *et al*. 2018), which may further support the SDGs by building resilience to climate change (Figure 12; Nippon Foundation-Nereus Program 2017; Neumann *et al*. 2015).

Effectively well-designed and managed MPAs that conserve critical habitats, species and ecological functions are useful for recovering, protecting and enhancing biodiversity, productivity and resilience (Reuchlin-Hugenholtz and McKenzie 2015). Increasing the coverage of MPAs is thus expected to enhance the provision of benefits from healthy marine ecosystems. In addition, strong governance to influence human behaviour and reduce impacts on the marine environment makes MPAs more effective (UNEP 2017). The region's main challenge is the effective management of its extensive MPA network. Despite the progress in coverage of MPAs in Asia and the Pacific, the Intergovernmental science-policy Platform on Biodiversity and Ecosystem Services (IPBES) (2018) reported that the rate of species loss had not slowed. This underlines the need for great urgency in ensuring the region's natural resources are appropriately managed by all the relevant stakeholders.

2.5 Urban systems: liveable and sustainable nature

Urban systems contribute to a higher quality of life, providing various health, cultural, recreational, and economic benefits to urban dwellers. An urban system is characterized by the complex, adaptive, and socio-ecological systems that occurs when society and the system are connected on multiple levels (Figure 13) (Nady 2016; Grimm *et al*. 2008; Bolund

Box 8: Two examples of marine protected areas in Southeast Asia and their management approaches.

Tubbataha Natural Reef Park (1988)

North and South atolls covering 130 028 hectares

Source: Dave Harasti

- Managed by the Tubbataha Protected Area Management Board containing stakeholders from national and local government, and the academic and the private sectors.
- A strict 'no-take' zone, it is the largest MPA in the Philippines.
- Republic Act 10067 (also known as the TRNP Act) provides the legal and institutional framework for enforcement on the Tubbataha reefs.
- Conservation fees from visitors cover recurrent costs such as administration and law enforcement.

Source: http://www.tubbatahareef.org/home

Raja Ampat Marine Park (2007)

Seven MPAs covering 1 185 940 hectares

Source: Sutirta Budiman on Unsplash

- Managed by the Ministry of Marine Affairs and Fisheries.
- The first marine park in Southeast Asia to enact laws to protect all sharks and rays in the marine park, creating shark and ray sanctuaries to facilitate the recovery of these threatened megafauna.
- Tourism revenue is channelled directly to the MPA to fund its operations, ensuring a sustainable funding model for the local authorities.

Source: Agostini *et al.* 2012.

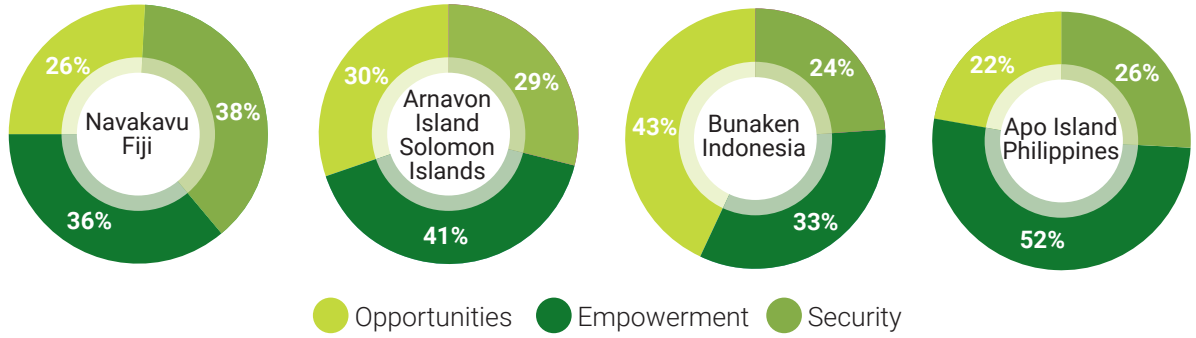


Figure 11: Relative contribution to reducing the three elements of poverty in four sites in Asia and the Pacific

Source: van Beukering *et al.* 2017.

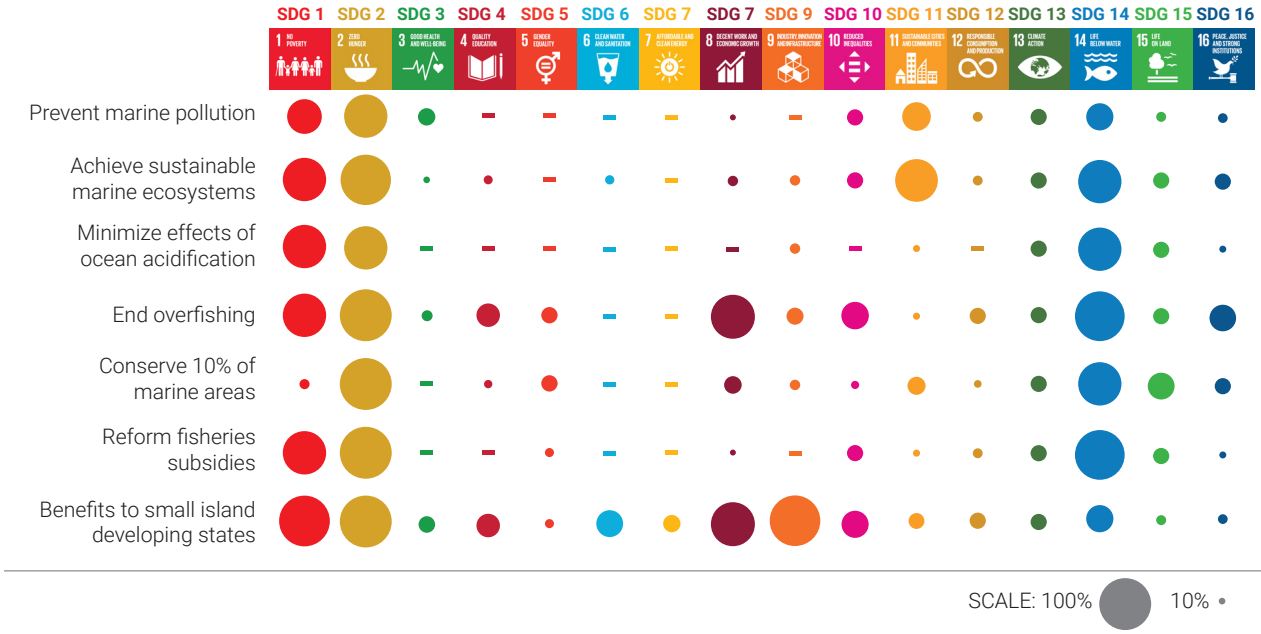


Figure 12: Co-benefits to other SDGs of achieving targets for SDG 14: Life below water

Source: Nippon Foundation-Nereus Program 2017

and Hunhammar 1999). Due to urban development, the area of artificial green spaces in urban systems tends to be larger than the natural ones (Bolund and Hunhammar 1999). Urban systems have, directly or indirectly, an immediate effect on human life, so human satisfaction with them is higher than with the various services provided, for example, by a dense forest in the suburbs, even if the type and quality of services are different.

Healthy urban systems provide economic benefits, promote human health and well-being, and generate aesthetic and visual benefits (Davies *et al*.2017; Chiesura 2004). Singapore has, for example, placed significant emphasis on urban greening as a key component of its development approach (Tan 2017; Tan *et al*. 2013). To ensure that Singapore could develop an economic growth model that did not compromise its environment, the country's first

Figure 13: Urban systems may look artificial but they could play an important role in the sustainability of modern cities. City dwellers can derive numerous ecological benefits when living in urban areas, as seen in the figure.

environmental was launched blueprint in 1992: the Singapore Green Plan (SGP) (Ministry of the Environment 1992). The plan is regularly reviewed to take into account of emerging ideas and issues, and the SGP 2012 was developed with specific targets to control air pollution, improve efficiency of water use and waste management, and maintain good public health (Ministry of the Environment and Water Resources 2016).

Green spaces, healthy people

The greatest benefits to people of urban ecosystems are health and recreation. There have been a number of studies that suggest that humans become more mentally and physically healthy if they can approach nature easily (Ulrich 1984). Furthermore, the ecosystem within a city has the effect of connecting people living in the city with nature (Clos 2015) and raising their interest in nature. In the Republic of Korea, for example, people visiting geen city centres showed high levels of satisfaction (Park *et al*. 2016).

The construction and management of green space is very important (APUFM 2017), especially in megacities – those with a population of more than 10 million people. Asia and the Pacific currently has 17 of these, and that number is expected to increase to 22 by 2030 due to rapid population and urban growth. Some of the countries in the Asia-Pacific region, such as China and the Republic of Korea are developing and implementing various strategies related to urban greening and urban forestry to improve the sustainability of their rapidly expanding cities (APUFM 2017). In 2017, the Food and Agriculture Organization of the United Nations (FAO) supported two Asia-Pacific Urban Forestry Meetings (APUFM), at the second of which the host nation, the Republic of Korea, developed the Seoul Action Plan, designed to raise the quality of life of its citizens and promote urban sustainability (Box 9).

Combining urban life and nature

As cities grow and develop, nearby forests become fragmented and reduced in size (Estevo *et al*. 2017); as a result, biodiversity and habitats disappear (Kim and Park 2011; Hahs *et al*. 2009). With careful urban planning, however, cities can be 'naturalized' to increase the presence and resilience of species through initiatives targeted at blending nature more broadly and deeply into urban life (Figure 14) (Boada and Maneja 2016). Large parks, for example, can serve as habitats for many species (Sing *et al*. 2016; Yuan and Lu 2016). But compared with other regions, relatively few studies on how to maintain urban biodiversity have been carried out in Asia and the Pacific (Botzat *et al*. 2016; Beninde *et al*. 2015).

Urban fauna can have both beneficial effects such as increasing urban biodiversity services and negative ones including disrupting or damaging infrastructure. Nonetheless, urban biodiversity is a strong indicator of human well-being. It can serve as a tool for monitoring global change and measuring a city's efforts to harmonize its activities with nature. Cities that are more species diverse are often more resilient and provide a greater variety of natural benefits to residents, such as enabling them to enjoy the beauty of seasonal plant and animal life (Figure 14). A deeper understanding of the importance of urban biodiversity can lead to improvements in the relationship between people and the planet, meaning sustainable cities provide hope for the future.

Box 9: The Seoul Action Plan – aligning with the Sustainable Development Goals

The Seoul Action Plan was created by participants at the Second Asia-Pacific Urban Forestry Meeting (APUFM) in Seoul, Republic of Korea, in 2017. It presents a set of action guidelines that includes eight goals and activities to be followed over the next 10 years. Through the Seoul Action Plan, the Republic of Korea is aiming to help achieve SDG 11: Sustainable cities and communities by setting environmental policy goals for raising the quality of life of its urban citizens, providing forests and green infrastructure around cities, and building cities for a sustainable future.

The Plan has a total of eight goals: greener cities, cleaner cities, cooler cities, healthier cities, more inclusive cities, more biodiverse cities, wealthier cities and safer cities. For each goal, key actions, indicators and targets, key players, funding, timing, outcomes and links to the SDGs are described. The following shows the first goal of greener cities.

Outcomes for greener cities

- The canopy cover of cities in the region has increased by at least 10 per cent by 2027 (e.g. if a city currently has a 10 per cent cover, it would increase it to 11per cent)
- By 2027 the green space available per resident has increased by at least 10 per cent as compared to 2017

▶ **SDG 11**

Who will do?	UN agencies, national institutions, local stewardships, academies of science and universities, city governments; local authorities; non-governmental organisations and the private sector
Action	• Getting information on and surveying the canopy and green space, considering various environmental factors • Develope education/research programmes for assessing and monitoring ecosystem services • Producing a periodic report on the State of Urban Forests in Asia and the Pacific
Funding	UN agencies (UN-HABITAT, FAO), Asia Developement Bank, Asia-Europe Foundation (ASEF)

Source: APUFM 2017

Figure 14: Otter-ly encouraging! Having not been spotted in the 70s and 80s, smooth-coated otters (*Lutrogale perspicillata*) were thought to have become extinct in Singapore – but then they were seen again in the city's wetlands in the 1990s. Since 2007, these otters have moved into the urban areas such as the man-made reservoirs of Serangoon and Punggol, as well as other highly urbanized places including Marina Bay and Changi Airport. These urban areas appear to offer otter populations a healthy supply of fish and suitable den sites safe from any disturbances, despite human presence

Source: Jeffrey Teo, Otter Watch Singapore

2.6 Nurturing nature's gifts

In this chapter, we have seen how each system plays big ecological roles and provides ecological benefits to both biodiversity and human wellbeing. These various systems are also intricately connected to one another – the processes and activities in one system invariably have impacts on others, both in positive and/or negative ways (Figure 15).

The Asia-Pacific region offers many opportunities for a synergistic relationship between nature and people, with the natural capital of the region providing goods and services that human wellbeing and ensure people's survival. The health of this cycle of life, with which we co-exist, has a role in achieving sustainable development. Our present-day decisions on the well-being of nature will influence or affect our wellbeing and that of the future generations. The time to change is now as we have the power to save the few remaining pockets of pristine environments.

However, the cycle is overworked and overexploited, and the imperative for us all to live in harmony with nature and shift to using natural resources sustainably has become urgent. Chapter 3 highlights the major environmental issues caused by people, affecting people's health and wellbeing, and emphasizes that we need to take action right now.

Tips and recommendations:

- When visiting forests, rivers and the ocean, remember – take nothing but pictures; leave nothing but footprints.
- Participate in meaningful activities such as planting more trees, cleaning up waterways and joining dives against marine debris.
- Planting more trees in a city can help beautify the landscape as well as creating refuges for urban wildlife.

Figure 15: To explore the role of ecosystems play in helping people adapt to climate change in coastal areas and learn more about coastal ecosystem-based adaptation

Link http://web.unep.org/coastal-eba/what-is-coastal-eba

Box 10: Nobuyuki Ishiwata, Organic Farmer

Nobuyuki is a young farmer who grows kiwifruit (amazingly) without the use of any fertilizers, pesticides, disinfectants or any other chemicals. He says this makes the soil soft and allows the absorption of water when it rains, as well as providing a habitat for various kinds of living creatures. Click the figure below to see his video interview!

A video link

https://www.iges.or.jp/en/projects/unea4/geo-6-youth

CHAPTER 3

Life on the Line

3.1 Development for wellbeing

Every day, most young people ride a bike, car, bus, train, metro or boat to school or work. When seeing something that interests us, we can look it up on our mobile devices. There is enough light to study (or procrastinate) at night. There is generally enough food, and when hungry, we can drop by the nearest convenience store. Our lives are dramatically more convenient than they were 100 years ago; but are our convenient lifestyles really sustainable? It seems we are walking a thin line, trying to balance environmental lifelines and economic development (Figure 16). People are actually compromising our own lives by polluting and contaminating our surroundings. Why is this happening? Is there anything that can be done so that we won't have to choose between economic or environmental wellbeing but aim for sustainable development without sacrificing the environment?

3.2 Watering the future

Past generations have built an industrial, consumption-based economy requiring vast volumes of water and emitting many pollutants. How does that impact young people? And what can be done about it?

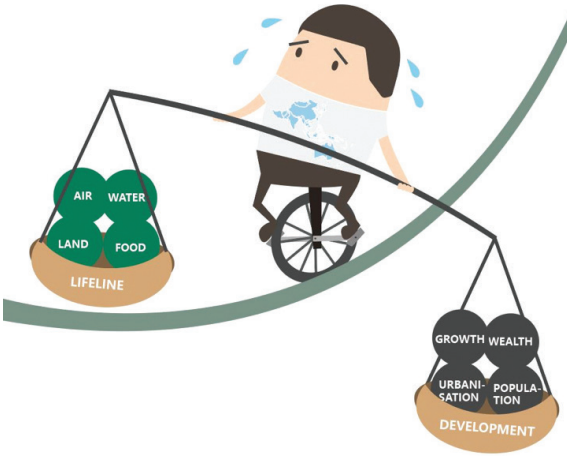


Figure 16: Life on the line

What's happening here? I'm getting better… but we're using more than ever

Although per-person water use is decreasing, total water use is increasing as a result of population growth. Asia and the Pacific now accounts for over half of the world's water use. The good news is that thanks to technological advances, it now takes less water to generate the same economic revenue compared to 35 years ago (Figure 17; UNEP 2016).

Pollution… say it, don't spray it

As a result of the growing population and economy, water pollution from domestic and industrial wastewater, agricultural run-off and waste landfill leachates continues to be a big problem in Asia and the Pacific. Common pollutants across the region include organics, nutrients such as nitrogen and phosphorus, dissolved salts, heavy metals, pesticides and chemicals.

Saltwater intrusion linked to coastal erosion and extensive groundwater extraction can be commonly observed in coastal areas (UNEP 2016). Sanitation

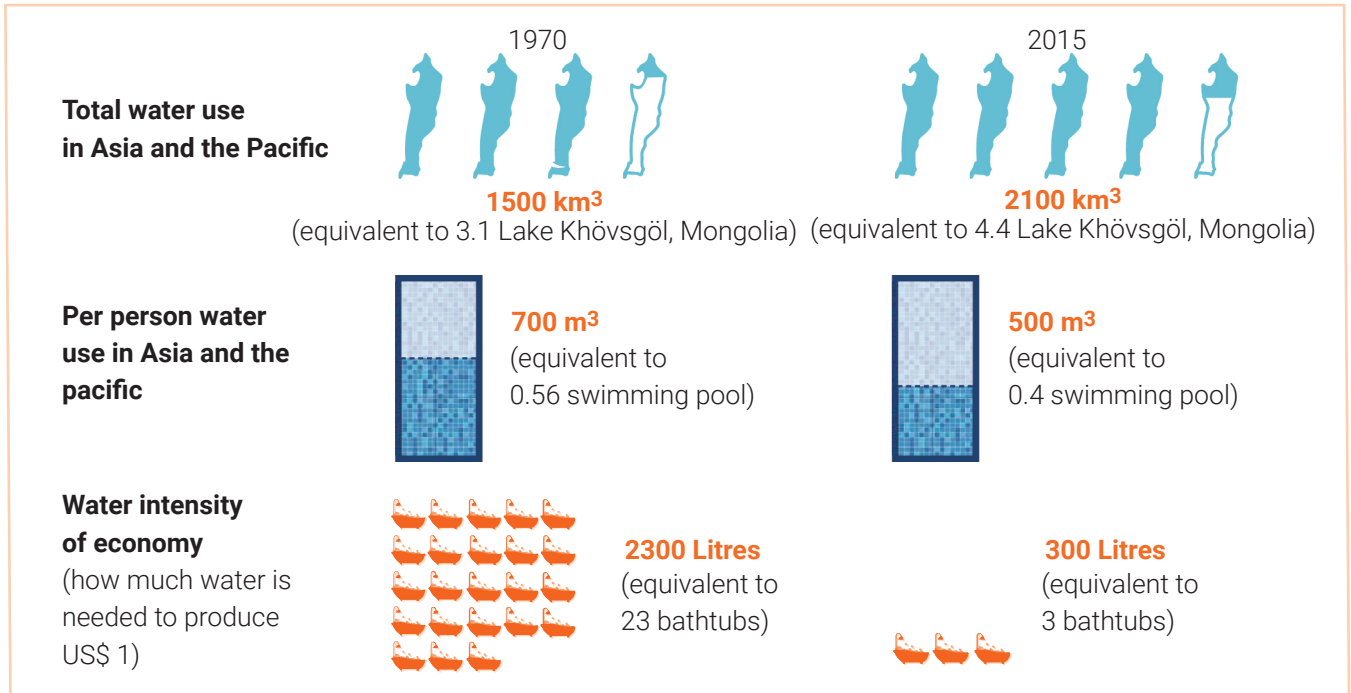


Figure 17: Water use trends in Asia and the Pacific. Source: UNEP 2016

continues to be a major source of pollution in the Asia-Pacific region. As of 2015, less than 50 per cent of people in Afghanistan, Cambodia, India, Kiribati, Nepal, Papua New Guinea, Solomon Islands and Timor-Leste had access to safe sanitation, and across the region tens of millions of people become ill, disabled or even die as a result of unsafe water and sanitation (Anand 2012). The Pacific island countries and territories face enormous stress from contamination of their limited water resources as a result of increasing populations, climate change and lifestyle change. On atolls, the groundwater supply exists in the form of freshwater lenses, where freshwater, being lighter, floats on top of salty seawater. These valuable lenses are very fragile and susceptible to exploitation and contamination by human activities – mainly from open-bottom toilets (Figure18; Kayanne 2017).

Where's the fun without water? The Eaulympics

We all need water to survive, and so do the Olympic and Paralympic Games. Twelve out of 42 sports, 30 per cent, of the Summer Games, and 15 out of 15 sports, 100 per cent, of the Winter Games directly use water. And if you add the indirect use of water, such as when football pitches and volleyball beaches are watered or the water that the athletes need to drink, ALL Olympic and Paralympic Games need water.

Water circulates in the environment in all forms (Figure 19). Once water is polluted, it takes enormous amounts of energy and chemicals to purify it before it goes into your baby's milk formula or into a swimming pool. In addition, there are chemical substances such as pesticides or pharmaceuticals which cannot be

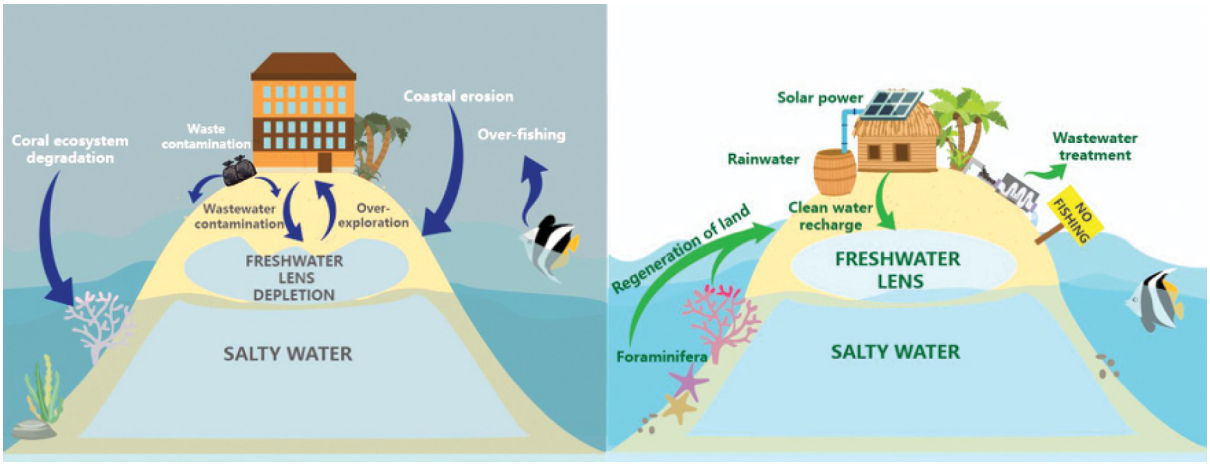


Figure 18: Non-sustainable (left) and sustainable (right) water-use practices on atolls

Source: Kayanne 2017

completely removed by traditional water treatment methods. Who would want their favourite athlete or their children to be drinking powerful and potentially dangerous chemicals every time they go for a swim?

Watch an interview with Japanese Paralympian Monika Seryu on water (Box 11). Olympic athletes are young professionals, just like us – so can we also play our part?

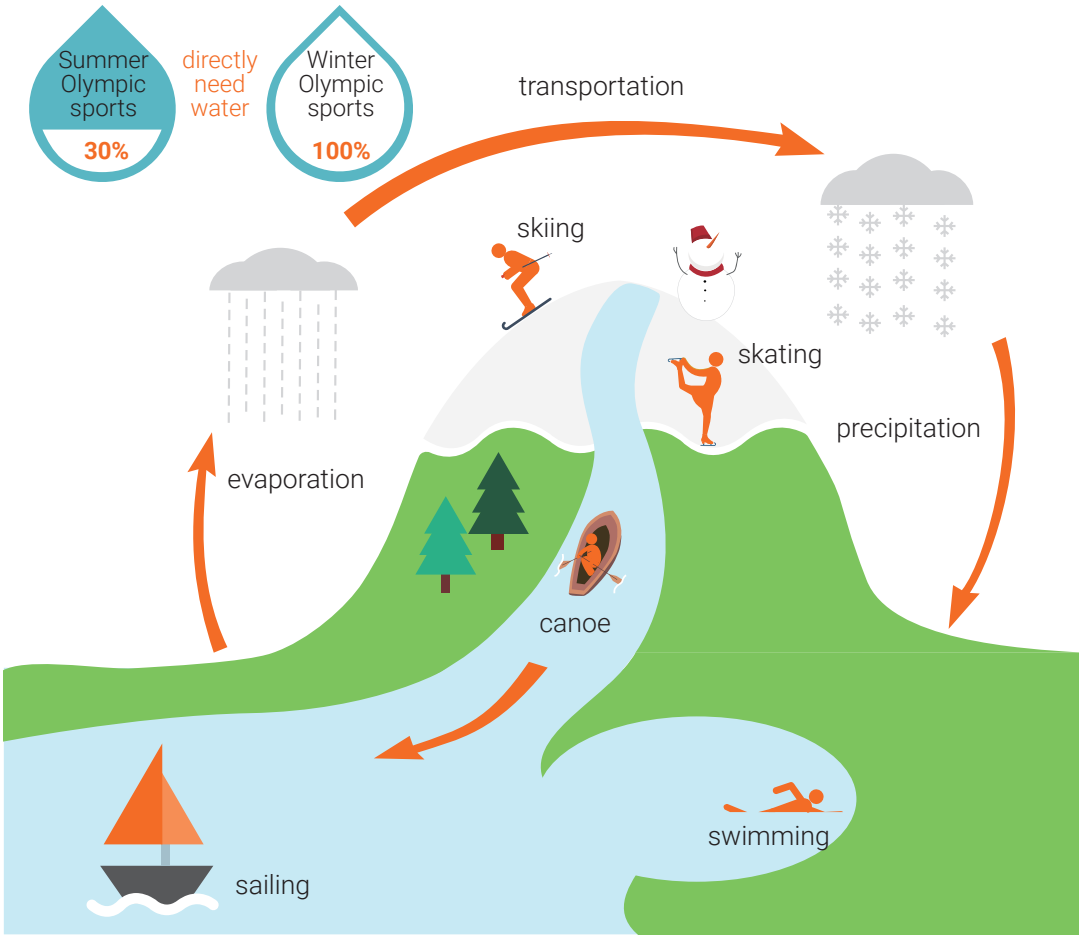


Figure 19: The water cycle and Olympics

Box 11: Youth voices for GEO-6: Monika Seryu, Paracanoeist

Meet Monika, a Japanese Paralympian canoeist. Beaming, she tells us that canoes liberated her from her disability. Her sport depends heavily on water and she spends every day in or on water. She mentions that water quality or physical obstacles such as debris can alter an athlete's performance. Check out the video for more!

A video link

https://www.iges.or.jp/en/projects/unea4/geo-6-youth

I got it… so what do we do now?

Securing means of implementation, including finance, technology, capacity building and strengthening the links between science and policy, have been identified as the first step in achieving greener and bluer pathways. Leapfrogging and transformative pathways have been investigated so that developing states do not have to repeat the same mistakes but instead will be able to achieve a low carbon society rapidly without as many resources or producing as many emissions (UNEP 2015). To achieve all this, collaboration among all sorts

of stakeholders and the involvement of each and every one of us is key.

Orange may be the next black - is nitrogen the next carbon?

UN Environment is partnering with the Organisation for Economic Co-operation and Development (OECD) and various international organizations to combat the threat of nitrogen pollution. Nitrogen, along with phosphorus, has been identified as having exceeded their planetary boundaries – the safe operating space for humanity (Rockstrom, 2015). International society came together to combat carbon emissions – can we now do the same for nitrogen?

3.3 Air pollution, the inescapable threat

One of the things that is absolutely necessary for life is breathable, clean air. It is from the atmosphere that all organisms, including humans, take the gases that they need to survive. Keeping air clean requires all components of ecosystems. For example, plants filter the air and dissipate pollutants, while being the source of oxygen on which all animals, including humans, depend.

But some processes also contribute harmful substances in the atmosphere (Figure 20). Gaseous air pollutants include nitrous and sulphur oxides (NO_x; SO_x), which contribute to smog, haze and acid rain. Ozone (O_3) found in the stratosphere is essential to life because it keeps ultraviolet light from reaching the surface of the Earth. However, excess ozone at ground level can have harmful effects on human health, crops and the climate.

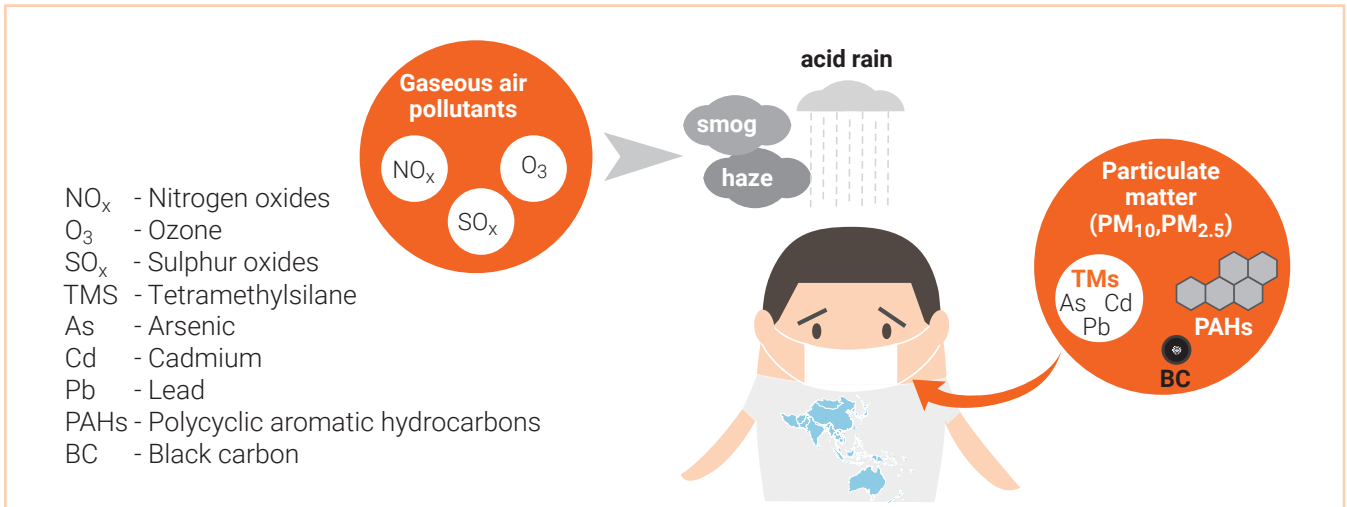


Figure 20: Gaseous pollutants and their harmful effects on human beings

Harmful substances can be present as small particles in the air, called particulate matter (PM). These vary in size, larger particles, PM_{10} and fine particulates, $PM_{2.5}$, can come from both natural and human-made sources. Some PM is a part of the normal composition of outdoor air, such as sea salt from the oceans and loose dust, but many components of PM are toxic.

Air pollution is a threat that is present almost everywhere in the Asia-Pacific region: about 92 per cent of the total population is exposed to levels of air pollution that present a significant risk to their health. Knowing that the threat is affecting so many people, we are challenged to come up with effective solutions that will prevent the problem from getting worse over time.

Climate-altering air pollutants

When climate change comes to mind, most people think of excess levels of carbon dioxide (CO_2) as the primary concern. New research shows, however, that there are more substances in the atmosphere that require our attention: short-lived climate pollutants (SLCPs). These include black carbon, methane (CH_4) and and ground-level ozone. While short lived, they only tend to stay in the atmosphere for short periods of time, these pollutants significantly affect local and global climate.

Black carbon, in the form of soot, decreases atmospheric visibility by producing persistent haze and smog over affected areas. It can also change local climate conditions by causing changes in temperature. Its overall effect in the atmosphere is to increase the temperature, although it can have a cooling effect, for example, after volcanic eruptions, as the particles block some energy from the sun from reaching the Earth (Bond *et al*. 2013).

Methane is a greenhouse gas several times more effective in causing glbal warming than carbon dioxide that is mainly produced from rice paddies, livestock production and the breaking down of organic waste. Additionally, when methane interacts with other gaseous pollutants, such as nitrogen oxides, in the presence of sunlight it forms another air pollutant and greenhouse gas: ground-level ozone, which also impacts crop production.

Air pollution is a severe health hazard

Both short-term and long-term exposure to these air pollutants brings high risks to human health. The risks from PM depend on the particle size: smaller particles are more dangerous. PM_{10} (particles with diameter of 10 micrometres or less) are mostly trapped in the nose and throat while $PM_{2.5}$ (particles with diameter of 2.5 micrometres or less) can be directly absorbed through lungs into the bloodstream, where they contribute to increased incidences of various lung and heart diseases, as well as cancer (van Berlo *et al*. 2012). This is due to the toxic components of $PM_{2.5}$: it can contain black carbon, toxic metals such as lead, arsenic and cadmium, and polycyclic aromatic hydrocarbons (PAHs) which are carcinogenic molecules. These toxic particles are often produced from a range of sources including vehicle exhausts, burning of waste, use of charcoal and wood for cooking and heating and industrial processes,

Particulate matter pollution is the fifth most frequent cause worldwide of premature deaths and illnesses, as well as affecting people's quality of life (Cohen *et a*l.

2017). Particulate matter has very harmful effects on the human body, to which young children and middle-to-old aged people are particularly susceptable (Solaimani *et al*. 2017; Karottki *et al*. 2014; Schuepp and Sly 2012). This effect is even more pronounced in rural areas where the usage of biomass cooking stoves disproportionately affects women who cook indoors and their small children (Devakumar *et al*. 2018).

Additionally, the presence of high PM levels in the atmosphere has been shown to reduce outdoor activity in young people, reducing overall physical activity (An and Yu 2018). Many cities the Asia-Pacific region have $PM_{2.5}$ levels high above the World Health Organization (WHO) guideline of an annual mean of 10 micrograms per cubic metre (μg/m^3) (Figure 21), and serious action is needed for people in these highly urbanized areas to breathe cleaner air.

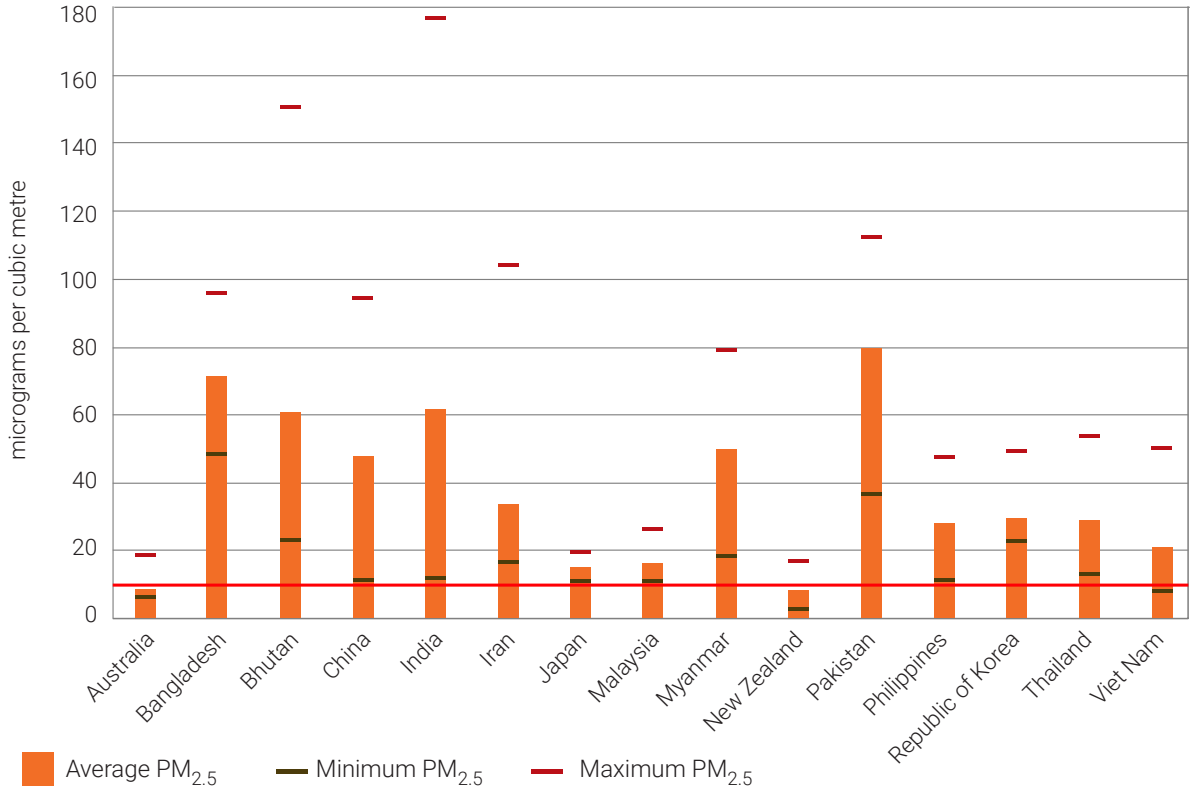


Figure 21: Annual mean $PM_{2.5}$ exposure in selected countries in Asia and the Pacific

Source: WHO, 2018

Gaseous pollutants are also linked to long-term health effects: exposure to nitrogen oxides increases the risk of developing several cardiovascular problems such as hypertension and coronary artery disease. Aside from this, prolonged exposure to sulphur oxides, methane and ground-level ozone is also directly linked to the incidence of long-term chronic asthma and other obstructive lung diseases.

Cleaning up the air

Reducing air pollution means tackling its source (Figure 22) – taking action to prevent emissions from happening in the first place. Many sources of toxic PM and gaseous pollutants are associated with burning and combustion. In most cities, it is also important that cars, buses and other vehicles have better engines and fuels, or better yet, people start using electric vehicles. Cities should be planned to accommodate not only vehicle traffic but also mass transport systems and have dedicated walking and bicycle lanes.

It is important to consider that as the economic competitiveness of cities in Asia and the Pacific increases, the resulting development must take account of not only mobility and easy access. Diverse modes of transport and the planning of green spaces are also required to offset air pollution in urban areas.

Cleaner energy also means cleaner air: industry and power generation activities can be improved by switching to renewable sources of energy. In rural areas, many people still use charcoal and fuel wood for cooking and heating, but providing access to low-emission stoves and fuels would help reduce pollution from this source and contribute to healthier air for more people.

3.4 Food for thought

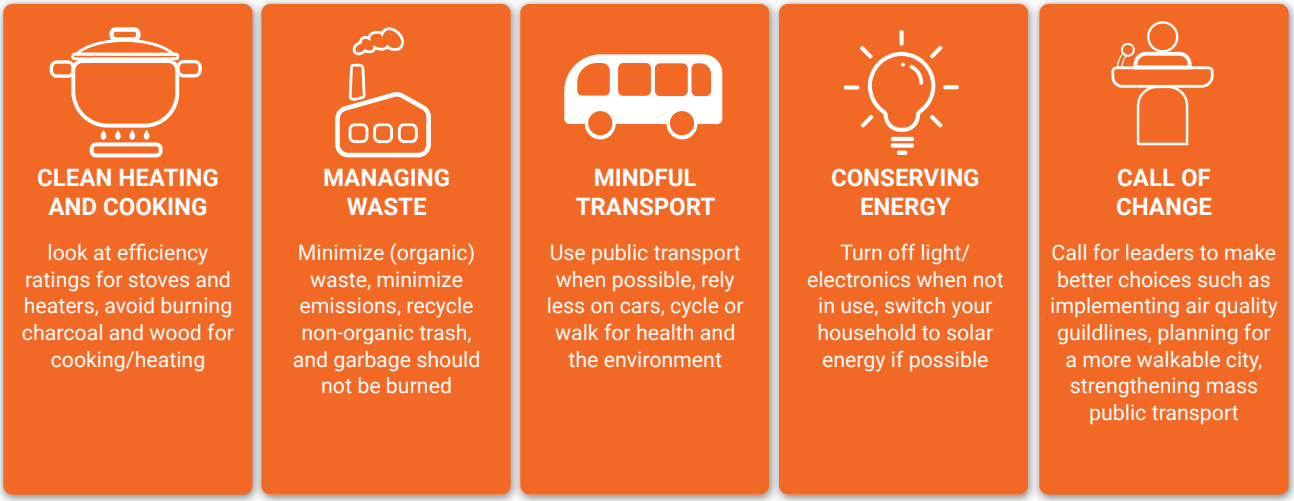
Food production – is it enough to meet demand?

Ensuring adequate food supply to an exponentially growing population, while protecting biodiversity, and sustainably managing the world's fixed amount of arable land is an significant challenge in the 21st century. Approximately 10 billion people will need to be fed by 2050; to meet that need the planet will have to produce more food in the next 80 years than it has been previously produced in all of human history (Smith 2018).

The Asia-Pacific region is an important area in terms of food production, but its output has been declining (Taniguchi *et al*. 2017). While the use of synthetic fertilizers has boosted global agricultural production (Erisman *et al*. 2008), it has contributed to environmental degradation, such as algal bloom and increased greenhouse gas emissions (Section 3.2). Climate change is complicating food production, threatening several important food crops in southern Asia and southern Africa if adaptation measures are not be implemented (Lobell *et al*. 2008).

Another challenge for food production is how to minimize pesticide use without losing crops to pest infestations. Some pesticides accumulate in the environment and then find their way into the food chain (Carvalho 2017), potentially posing risks to human health (Han *et al*. 2018). Furthermore. recent evidence suggests that some pesticides such as neonicotinoids threaten biodiversity by negatively impacting non-target

Individuals can help reduce air pollution by:



Link to UNEP's BreatheLife campaign: http://breathelife2030.org

Figure 22: Individual solutions to air pollution

Source: http://breathelife2030.org/

species, including bees (Rundlöf *et al*. 2015) and birds that feed on insects (Hallmann *et al*. 2014).

Emerging strategies to feed the world

With the needs of a growing population putting pressure on farmers to produce ever more food, innovative responses are desperately needed. Innovative food-production strategies include the promotion of a number of sustainable farming practices. Regenerative farming, for example, relies on a series of practices that aim to simultaneously improve soil health, agricultural productivity and farm profitability. This system has increased maize farmers' profits by up to 78 per cent, with a 10-fold decrease in pest infestations (LaCanne and Lundgren 2018). Semiochemical-mediated pest management is also gaining traction as an alternative to synthetic pesticide use (Box 12). Semiochemicals are natural compounds emitted by insects and crops, which can be utilized to lure pests into traps or disrupt their behaviour (Norin 2007). The cultivation of gene-edited crops for food production is also currently being explored, as some new varieties have been bred to be drought and/or heat resistant, effectively climate

Box 12: Allies in the war against crop infestation

Coconut is an important crop in Southeast Asia and a significant contributor to the local economy. Recently, coconut plantations in the Philippines have faced massive infestations of coconut scale insect (CSI) *Aspidiotus rigidus* (Watson *et al*. 2015). Infested trees produce coconuts with sour juice and thin meat. One of the control measures used is the application of neonicotinoids through trunk injections. Considering the negative impacts of these pesticides on non-target species (Section 3.4), greener pest-control methods are highly sought after. One such is the use of a biological control agent, a natural predator of the CSI pest. A wasp-like insect was recently discovered in the Philippine Southern Tagalog Region, which hatches its eggs inside mugature CSIs (Almarinez *et al*. 2015). This new species was named *Comperiella calauanica* (Barrion *et al*. 2016) and may play a critical role in managing CSI infestations.

Comperiella calauanica (the black insect) is inserting its eggs into a coconut scale insect, *Aspidiotus rigidus* (yellow and white scales). Scale bar = 0.30 mm.

Source: Ph Dr. Billy Joel Almarinez, De La Salle University, Philippines

change ready while others have had their nutritional value improved. While scientific consensus on the safety of gene-edited crops has yet to be reached (Hilbeck *et al*. 2015), evidence suggests that growing them has increased farmer profits by up to 68 per cent, increased crop yields by up to 22 per cent, and decreased pesticide use by 37 per cent (Klümper and Qaim 2014).

Food security is everyone's business

Food security is the availability of clean, safe and affordable food (Pinstrup-Andersen 2009). While it is usually discussed at a global or national scale, everyone can help attain food security without compromising the environment. The easiest way is minimizing waste, such as food and packaging. Also, adopting healthy diets that are rich in vegetables can help reduce significant amounts of greenhouse gases associated with food and particularly meat production (Tilman and Clark 2014; Baroni *et al*. 2007). You can get greater access to vegetables easily by growing them in your backyard, or by engaging in urban agriculture (Box 13). This is not just an enjoyable hobby, it could also be profitable if you sell any excess vegetables. Growing you own also ensures that the vegetables you eat are safe. Another easy way is to consume local produce, since such products needed less inputs to pack and transport. These are simple steps that everyone can do without much effort, but the positive impact on the environment will be tremendous.

Box 13: Urban culture, why not urban agriculture?

Urban agriculture is the rearing of animals and growing of plants within and around cities. It has an important role in enhancing urban food security as the costs associated with supplying and distributing food in towns and cities based on rural production and imports continue to rise. With a population of 5 million in a small area (1 060 square kilometres), Hong Kong produces 45 per cent of the fresh vegetables, 15 per cent of the pigs and 68 per cent of the live chickens consumed by its population on just 10 per cent of its total area (Yeung 2018). Urban agriculture can take many forms from large-scale commercial production of food, as in Hong Kong, to small-scale community gardens or even on apartment balconies and in backyards. Cultivating your own food can help families save money while improving the environmental quality your surroundings.

An urban agriculture setup growing lettuce on a building rooftop.

Source: De La Salle University Publishing House

3.5 Waste: not a good taste

Waste is everything that is thrown away or discarded. Poorly managed waste affects the environment, the economy and human wellbeing (World Bank Group 2012). It can be a source of pollution on land, in water and air (Figure 23). It can contribute to the spread or emergence of diseases such as dengue, diarrhoea and respiratory ailments in communities.

Around 2 billion tonnes of municipal solid waste (MSW) is thrown out each year (UNEP and ISWA 2015). Households in Asia and the Pacific produce 43 per cent of the world's total MSW and this means that one person generates 1.4 kilograms of garbage every day. The region is facing a major threat, as alongside the increase in MSW generation, there are issues with emerging waste streams, including plastic waste, e-waste and food waste. But at the same time, waste is just a misplaced resource; we just need to find a use for it.

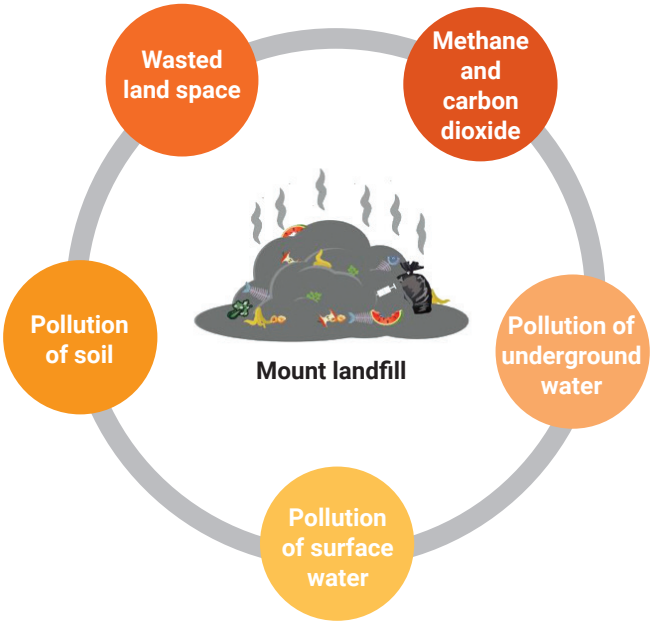


Figure 23: Mismanagement of waste and its associated hazards

Plastic waste – mismanaged plastics are attacking us!

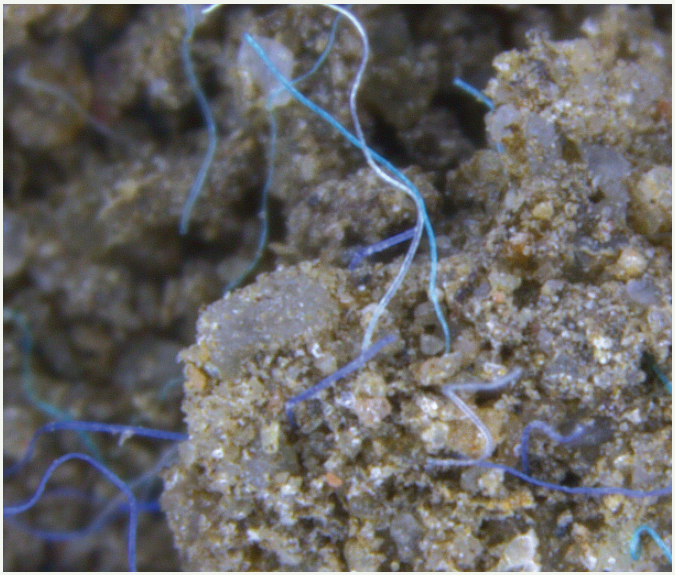
So are we saying plastic is bad? No, not at all. *"Plastic is a miraculous material which human beings have created! So the problem is not of plastic but of human irresponsibility"*- Sadhguru.

A video link

https://www.youtube.com/watch?v=vcSG0TusOtc

Plastics are everywhere! Just take a look around – can you find an item that does not contain plastics? The durability of plastics is the reason for their popularity (Hammer *et al*. 2012) but it also is one of the reasons why plastics have become major pollutants on sea and land. With plastics used in millions of products as well as being the primary choice for packaging, plastic waste has rapidly increased in the past few decades, reaching 335 million tonnes in 2016 alone – with almost 60 per cent of this coming from just five countries in Asia and the Pacific (Bloomberg 2018).

Box 14: How tiny plastics are entering our soil



A video link

https://www.unenvironment.org/news-and-stories/story/plastic-planet-how-tiny-plastic-particles-are-polluting-our-soil

Polyacrylic fibres in soil.

Source: Anderson Abel de Souza Machado

The mismanagement of plastic waste has harmful impacts on human well-being. Improper disposal or burning of plastic waste is dangerous to human health. People living near plastic incineration sites can be exposed toxic pollutants emitted in the process that can lead to skin and respiratory hazards, and eye damage (Lithner 2011).

Pesky plastics ending up in our seafood

Silent, small and almost invisible microplastics are entering our food chain (Figure 24; Bhargava *et al*. 2018; Seltenrich 2015). Seafood, a key dietary component for people living in Asia and the Pacific (Section 2.4), is likely to be the direct cause of human exposure to microplastics and other toxic compounds such as heavy metals and persistent organic pollutants. In Malaysia, a study suggests that people who eat dried fish product could be eating up to 246 pieces of microplastics a year (Johnston 2017; Karami *et al*.2017)! And there is a need to be very concerned about plastics in this region's marine environment. Plastics are affecting marine biodiversity, water quality, and now, our food – it is about time that we took urgent action, or these plastics will stay with us for a very, very long time.

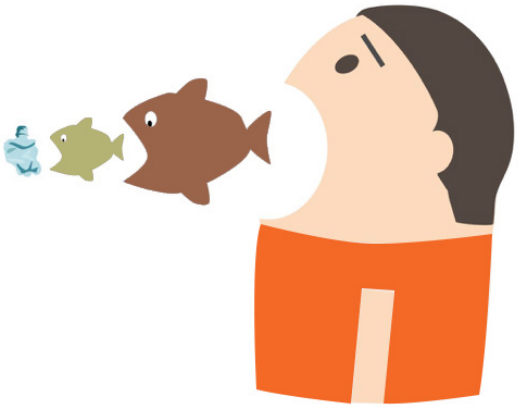


Figure 24: Microplastics are entering our food chain through seafood supply. Watch this for more information

A video link

https://www.youtube.com/watch?v=nb7tbfjYu3o

Fight against plastic waste

To combat plastic debris, some countries have started to implement policies to reduce plastic litter by imposing bans or taxes on plastic bags and utensils (UNEP 2016). Recently, China has also stopped importing plastic waste, forcing the exporting countries to sort out their own waste issues. Technologies to solve plastic pollution – such as using biodegradable plastics and converting plastics to fuels or high value-added products including wood-plastic composites or carbon nanotubes – are continuously being explored and developed (Najafi 2013; Bazargan and Gordon 2012). Every one of us can play a major role in driving market forces by reducing our personal use of plastic.

Can we become responsible consumers by avoiding single-use plastics such as plastic straws and polythene bags? Ask yourselves: do you need plastic utensils for your take away food? We all need think and act now – before irreversible damage is done to our environment and well-being.

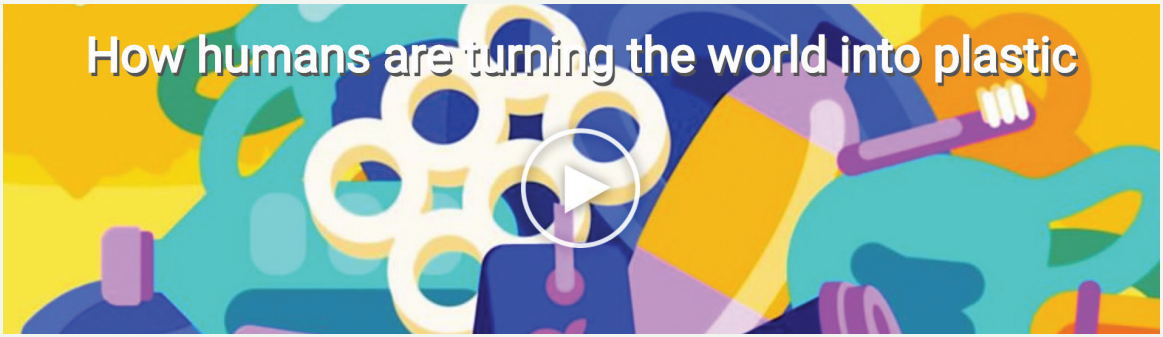
Electronic waste: phones could last longer!

How often do you buy a new phone? What happens to your old ones? The use of electronic devices such as mobile phones, computers, televisions and printers has increased dramatically (Figure 25). But the lifespan of electronics is getting shorter and shorter, generating tremendous amounts electronic waste, or e-waste.

Box 15: Simple ways to reuse big volume of plastics!

In India, engineers are adopting a method of taking waste plastics – crisp packets, chocolate bar wrappers, plastic bags, bottles, lids, etc. – shredding them and using the resulting material as a substitute for bitumen in road construction. This method takes a waste product and reinvents it as a useful construction material.

Fun to watch: Say goodbye to plastics.



A video link

http://web.unep.org/environmentassembly/beat-pollution/

E-rase the e-waste

Globally, 44.7 million tonnes of e-waste is generated each year and the Asia-Pacific region is one of the largest generators. E-waste contains heavy metals which are hazardous to the environment and therefore needs to be handled in properly. E-waste also contains rare metals of great economic value, but only a small fraction of all e-waste is being formally recycled. The vast majority of e-waste, a vast amount, is dumped in landfills or incinerated causing severe health and environmental problems (Zeng *et al*. 2016; Song *et al*. 2015;).

When electronic devices are burnt, toxic metals, such as lead, and chemicals are released into the air, soil and water (Sepúlveda *et al*. 2010). Women are disproportionately affected by the e-waste sector, as many are employed in extracting precious metals from it and are exposed to toxins (Figure 26; McAllister *et al*. 2014). The emitted toxic substances can cause severe health problems, including spontaneous abortions, stillbirths, premature births and DNA damage (Grant *et al*. 2013).

1.6 billion

cell phones manufactured in 2012. Electronics are packed with toxic chemicals – arsenic, lead and brominated flame retardants.

18 months

the time the average American keeps a cell phone.

60% wasted

of our e-waste ends up in landfills – both at home and in other countries – from where toxic metals leach into the environment.

30% lost

even when electronic devices are recycled, significant amount of valuable materials cannot be recovered.

Figure 25: Phones could last longer!

Source: iFixit.org.

Figure 26: A child and a woman in India working for the informal e-waste recycling sector

Source: Sadia Sohail

E-waste disposal should be carried out under strict government regulations and operators should make serious efforts to protect local communities from exposure to it. Electrical and electronics engineering companies should also work towards seriously lengthening their products' life cycles (Figure 27).

Food Waste –make haste to lessen food waste

According to Food and Agriculture Organization of the United Nations (FAO), about one-third of the all food produced for human consumption is wasted (FAO 2018). Do you get more food than you can eat during parties or buffet lunches? Do you keep food in the refrigerator and only remember about it when you are ready to throw it out? How much food do you waste? Hunger and food security are serious global issues. At present, there are around 7.6 billion people, and by 2050 it is projected that there will be 9.8 billion (UNDESA 2017). The challenge now is how we feed the world's unfed and increasing population? And couldn't a reduction in food waste contribute to addressing this issue?

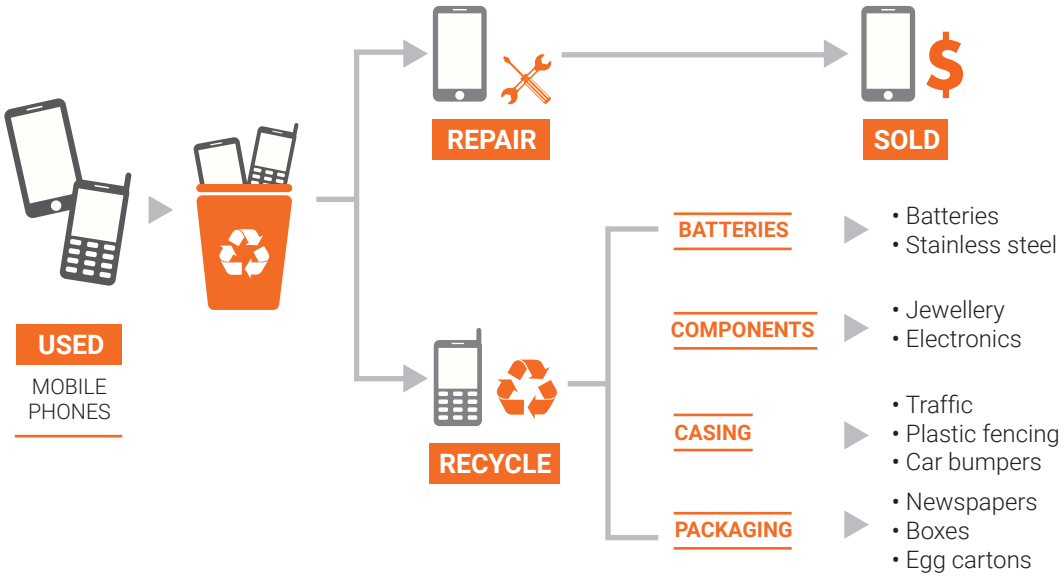


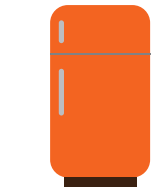
Figure 27: Phones could last longer!

Source: tunza.eco-generation.org.

The food you waste could feed the hungry

When we were growing up, how many of us were reprimanded for not finishing the food on our plate? How many times have we been told by our parents not to take too much food and be mindful of our eating habits? Do you remember how your parents tried to make you feel guilty by saying that other children would be more than happy to finish what was on your plate? Today's food-waste reality definitely needs all these reminders (Figure 28). So, what can we do?

To begin minimizing your personal food waste, you will have to start breaking old habits. Let's start by not going to the grocery and grabbing every single food item you are craving for when you feel hungry,. Plan your meals and buy only what you need. Enjoy food with your friends when you dine out by sharing with one another. You will not only be able to taste different dishes but you will be reducing food waste as well! As you minimize your personal food waste, you will also be saving money!



49% (of 4 000 people surveyed) forget about leftovers in the refrigerator

34% (of4 000 people surveyed) prepare too much food

11% (of people around the world) hungry or undernourished

Figure 28: Food wastage and the hungry population

Source: https://www.asiaone.com/asia/80-households-asia-pacific-regularly-waste-food-home-survey, FAO (2019)

Box 16: Food Stock Exchange

At the Food Stock Exchange, a restaurant in Jaipur, India, prices of food keep changing on the big screen – just like the share market. The concept is based on changing demand. Can we use a similar concept of price reduction for vegetables/curries nearing their expiry date but still fit and safe to consume? Are you willing to buy such food items? Food for thought?

Box 17: Singapore food waste to digester

Greendale Primary School in Singapore started a food-waste reduction programme in August 2017. It involves weighing food waste collected at the end of every recess. The waste is then poured into a biodigester, which uses microbes to convert it into compost. The compost is then used to fertilize the school's gardens. Additionally, canteen staff asking pupils if they want smaller portions has helped cut the daily food waste from 17.9 kilograms to less than 10 kilograms.

http://www.straitstimes.com/singapore/food-waste-food-for-thought-for-students

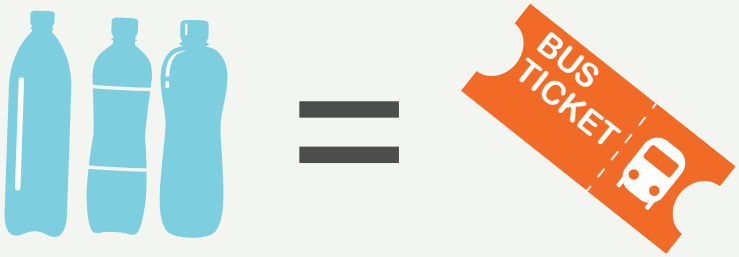
Don't be wasteful

Waste avoidance and reduction have not received enough attention in Asia and the Pacific. How can we help waste management? Participation in public awareness campaigns and cooperation in waste management practices are good starting points. Adequately following separation practices in your locality and sorting your garbage at home, in the office and in other public or private places, can significantly contribute to the treatment and disposal of waste. Recycle, reuse and get creative!

3.6 Pollution free, the way to be

In today's society, technology has provided us with endless possibilities and benefits to ensure our well-being by providing more and increasing convenience in our daily lives. But this has led to a compromise that has put life on the line. In addition, the adverse effects of technology on the environment are now at alarming rates – global warming, pollution, frequent extreme weather events and decreasing and degraded resources. At present, the condition of our water, air and food is greatly compromised. All the while, the world's

Box 18: In Indonesia, commuters pay bus fares with plastic waste



https://asiancorrespondent.com/2018/05/in-indonesia-commuters-pay-for-the-bus-with-plastic-waste/

population continues to increase, urbanization is spreading and more waste is generated.

Technology, despite its many disadvantages, can be an ally in pursuing sustainability. Cleaner technologies that reduce emissions, innovative farming practices and state-of-the-art waste management facilities are providing better options for society. Research and development are underway to improve the utilization of technology to address global issues as well as reduce their environmental impacts. But to safeguard our environment, strict laws, a social conscience and technological innovation are all needed. The integrity of our ecosystems is essential so that we can continue to enjoy clean water, fresh air and good food. Society's need for both technology and nature is undeniable, therefore, it is essential that optimized solutions and alternative action be formulated and implemented. Our personal choices and decisions. such as valuing nature and saving resources by recycling, can also greatly help in a positive way as personal awareness becomes a collective effort to utilize technology better and to look after our environment.

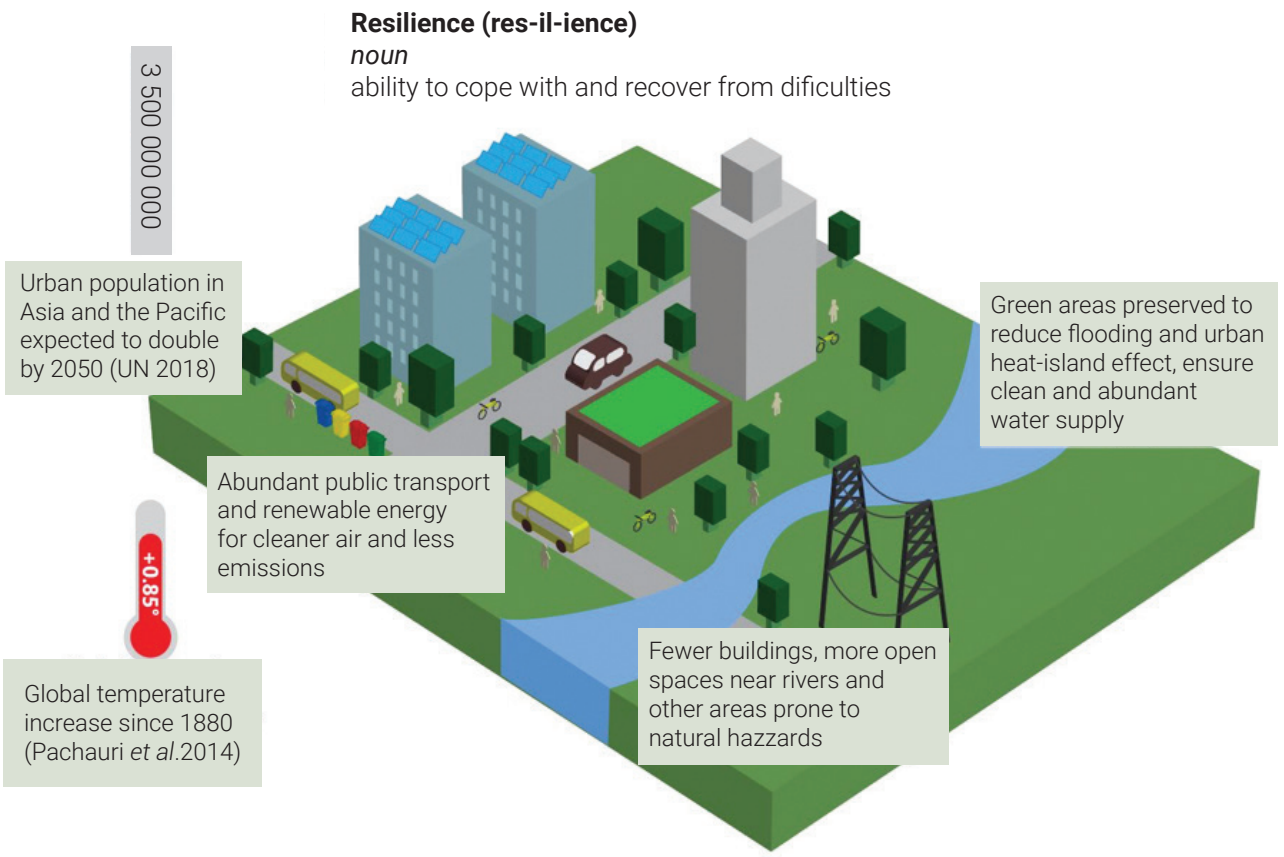
Resilience and sustainability play vital roles in helping humanity adapt to this dynamic, ever changing world. Chapter 4 discusses potential solutions to various environmental issues that are made possible by community- and national-level initiatives.

- Plastic is a miraculous material for the wise ones. Are you one of them? Recycle products as much as you can and avoid single use plastic utensils – disposable plates, glasses, bottles, cutlery and, of course, straws!

Figure 29: Ways to reduce waste

CHAPTER 4

Sustainability and Resilience in a Changing World



4.1 Adapting to change

In the previous chapters, we learnt a lot about the environmental challenges facing the Asia-Pacific region. Because action taken in our cities and local communities now can also have effects 20, 30 or even 50+ years into the future, we need to ensure that resilience and sustainability are instilled in our communities. That's the only way to ensure future generations get to enjoy the same or an even better environment and quality of life than we enjoy. In the Asia-Pacific region, rates of rural-urban migration continue to rise, and future population growth is also projected to be concentrated in urban areas (Figure 30).

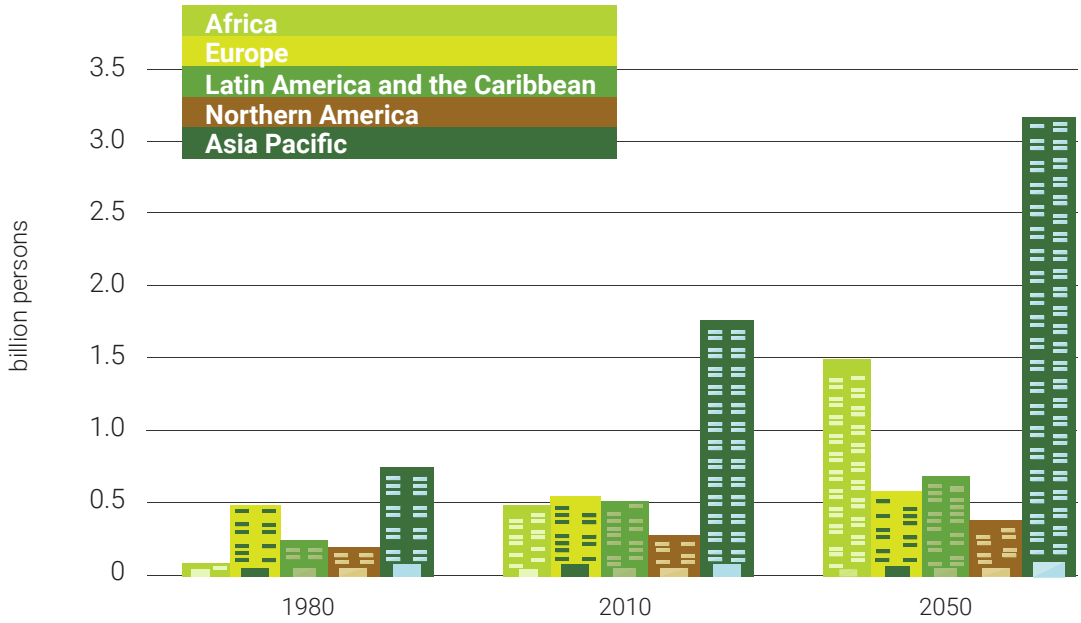


Figure 30: Urban populations, 1980, 2010 and 2050

Source: UN 2014

As millions of people move to cities in search of jobs and other opportunities, these cities will continue to expand their boundaries. Satellite imagery of the Earth at night (Figure 31) shows how urban areas have already shaped the planet and lit up the darkness. By 2025, Asia will host seven of the world's ten largest metropolitan regions, and by 2050 the urban population in Asia and the Pacific is projected to increase to be 3 billion up from 2 billion in 2015 (UN 2014).

This urbanization is also causing challenges in many rural areas in the region, such as depopulation and aging of populations which can have serious impacts on the local labour market and economy. In parallel, climate change is happening, contributing to more climate-related disasters, rising temperatures and sea levels, and the Earth's limited natural resources are being depleted. Faced with these challenges, it is clear that the Asia-Pacific region needs to take action to ensure the resilience and sustainability of its environment and society.

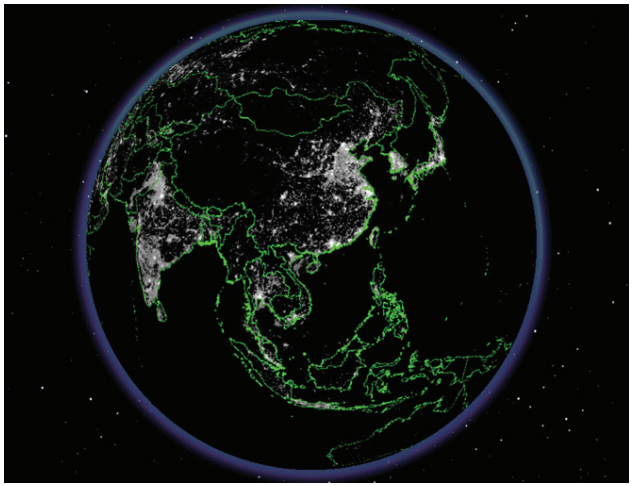


Figure 31: Night-time lights across Asia and the Pacific

Source: NASA's DMSP-OLS satellite.

This chapter highlights selected resilience and sustainability measures that can be implemented in towns and cities now to ensure that our communities, as well as future generations, will be able to deal with the challenges our region faces. Sections 4.2 and 4.3 deal with building the resilience of towns and cities to climate-related disasters and rising temperatures, while Section 4.4 covers potential measures that can be taken within the built environment to address the use of the limited natural resources including fossil fuels, land and water. Box 19 summarizes the key issues and selected measures highlighted in this chapter, together with the related SDGs.

4.2 Know disaster, no disaster

It's raining, it's pouring, we'd better not be snoring

Disasters linked to extreme weather events, particularly those related to climate change, have been increasing in frequency globally since the 1940's, with the most common types being floods (Figure 32) and drought (Munang *et al*. 2015). The Asia-Pacific region has the highest number of extreme weather events in the world (Guha-Sapir *et al*. 2016) and, throughout the region, the frequency, magnitude and impact of these events are increasing due to climate change (IPCC 2014). These facts really drive home the need for action to ensure

Box 19: Highlights of Chapter 4

Problems discussed in this chapter	Selected measures for enhancing resilience and sustainability
Increase in climate-related disasters 	1. Ecosystem-based disaster risk reduction 2. Climate-smart land-use planning 3. High-tech natural hazard monitoring and response systems 4. Disaster preparedness efforts by local and online communities
Rising temperatures and sea levels  	1. Enhancing social capital in communities 2. Urban greening 3. International inter-city collaboration
Limited natural resources   	1. Develop more renewable energy 2. Energy-efficient buildings 3. Sustainable transport systems 4. Effective urban-rural links – such as cities and peri-urban areas supporting each other

that our towns and cities are better prepared to cope with climate-related hazards, as well as the need to take a proactive approach in addressing climate change.

So what kinds of action can be taken? The latest Intergovernmental Panel on Climate Change (IPCC) report identified some key measures including ecosystem-based disaster risk reduction, climate-smart land-use planning and implementing better disaster monitoring and early warning systems (IPCC 2014). Action taken by households, local government and communities, including online communities, can play an important role in reducing people's vulnerability to climate-related natural hazards. Additionally, we can work to reduce our greenhouse gas emissions now so as to limit future climate change.

Figure 32: Floods following Typhoon Milenyo in the Philippines, 2006

Source: Erlinda C. Creencia, City of Santa Rosa

Natural ecosystems: our ally for disaster risk reduction

Natural ecosystems play many important roles in protecting our towns and cities from climate-related natural hazards. Forests and other green spaces, for example, can reduce flooding by enabling soil to absorb large amounts of rainfall (Section 2.2) and reduce landslides by preventing erosion. Mangroves and coastal wetlands protect our cities and infrastructure along coastlines by reducing the effects of storm surges, tsunamis and sea level rise. Because of these benefits of nature, ecosystem-based disaster risk reduction has become a hot topic in recent years. In practice, this involves activities such as conserving existing natural ecosystems, planting trees and creating new urban green spaces to maximize ecosystems' potential to mitigate climate-related disasters. Unlike traditional man-made infrastructure measures like levees and seawalls, these ecosystem-based measures also protect local biodiversity and provide many other environmental benefits to residents in non-disaster times including reducing urban heat-island effects (Section 4.3).

Tools for disaster risk reduction

The UN Sendai Framework for Disaster Risk Reduction, an international agreement for reducing disaster risks by 2030, identified rapid and unplanned urbanization as an underlying driver of increased risks (UNGA 2015). Thus, to ensure cities are climate resilient – well-suited

to current and future climate conditions – many local governments have begun incorporating climate risk assessments into their urban planning processes. As one example, geographic information systems (GIS) data and climate models can be used to simulate the climate-related risks to people and infrastructure under different future land-use and climate change scenarios (Figure 33), and help urban planners avoid placing new developments in disaster-prone areas – or at least include some measures to reduce the disaster risks in these areas.

Unfortunately, it is impossible to prevent all climate-related disasters. For this reason, high-tech monitoring systems are also being developed and used to help handle the complex and often unexpected situations that may arise. Following the earthquake, tsunami and nuclear triple disaster that occurred in Japan in 2011, for example, satellite imagery provided by the country's space agency (JAXA) proved to be one of the best ways of assessing the damage around the Fukushima nuclear power plant because low-altitude aircraft were unable to fly in the area due to radiation risks.

Figure 33: Simulating the impacts of land-use changes on flooding

Hand-in-hand for disaster risk reduction

Resilience to natural hazards can also be increased through the efforts of individual households and communities. Households, for example, can reduce their exposure to floods by raising the elevation of the land on their property before building, or by building their homes on stilts or piles. Communities can take collective action by advocating the conservation of local ecosystems/local urban green spaces, or by conducting such disaster preparedness training as flood evacuation drills. Through online communities and crowdsourcing, people from all over the world now have the power to participate in disaster risk reduction and recovery efforts. The Humanitarian OpenStreetMap Team (https://www.hotosm.org/), for example, regularly organizes mapathons in which volunteers work together online to map key infrastructure – buildings, roads, etc. – in areas heavily affected by climate-related disasters.

4.3 Heat waves and rising sea levels

In addition to disasters, other impacts of climate change on urban development can be seen in gradually rising urban temperatures and sea levels (Hunt and Watkiss 2011). While rising temperatures pose an issue for the region as a whole, it is particularly relevant to urban areas. This is because temperatures tend to be higher in cities due to increased human activity, such as heat generated by vehicle exhausts, low vegetation cover and the wide use of highly-absorbent construction materials such as black asphalt (McCarthy *et al*. 2010). This phenomenon is commonly referred to as the urban heat island. So, cities face increasing temperatures due to changes in both the global and local climate. Over time, heat islands can raise energy demand and costs, increase air pollution, affect water availability and quality. and lead to heat-related illnesses (Box 20; Deilami *et al*. 2018). This has direct economic, social and health impacts on people living in cities. Rising urban temperatures are especially concerning for Asia and the Pacific given the prevalence of mega-cities in the region.

The coastal location of many cities in the Asia-Pacific region also increases their exposure to another impact of rising global temperatures, sea-level rise (Prasad *et al*. 2009). Sea-level rise can lead to increased flooding and damage to the built environment, and negatively affect the health and well-being of urban residents, particularly the most vulnerable people (Barbier 2014).

It is also important to consider the level of vulnerability of the people living in the areas affected by these problems. For example, as Figure 34 shows, areas with a high risk of sea-level rise and storm surges are often occupied by poorer, socially disadvantaged people. Pre-existing social structures and socio-economic gaps within a society can also hinder people's ability to adopt mitigation and adaptation approaches to address the long-term effects of climate change. In this context, we need to enhance people's capacities by improving social capital in local communities, municipalities, countries and regions (Sarzynski 2015). Social capital, the shared values the understanding within communities that allows them work together effectively, underpins effective collective activities for climate change adaptation – coping with these challenges. The following subsections provide some examples of approaches that tackling rising temperatures, including the heat-island effect and sea-level rise. They can be utilized at the local community level, municipality level, and international level, respectively.

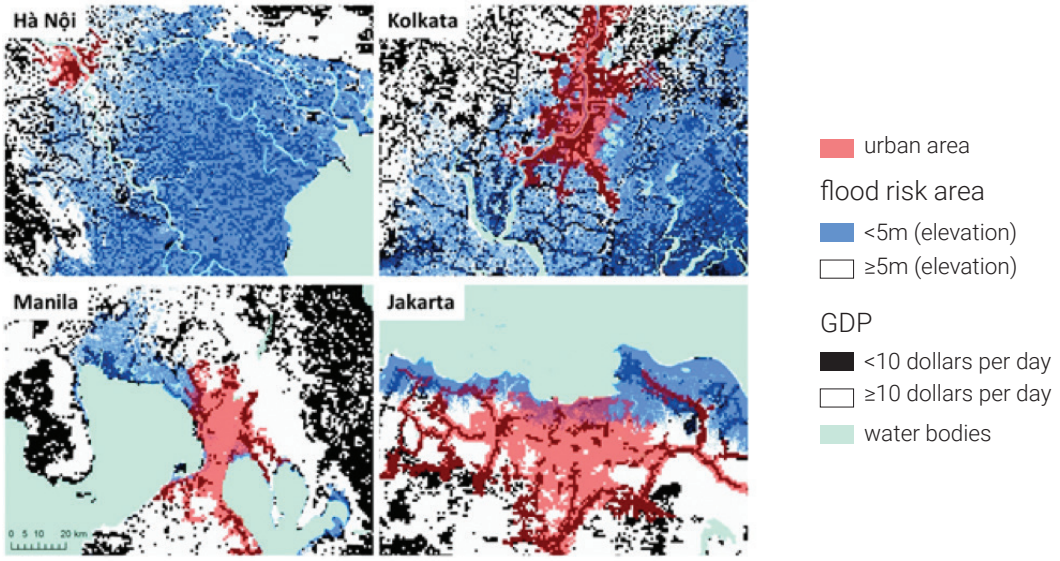


Figure 34: Flood risk and socio-economic gaps

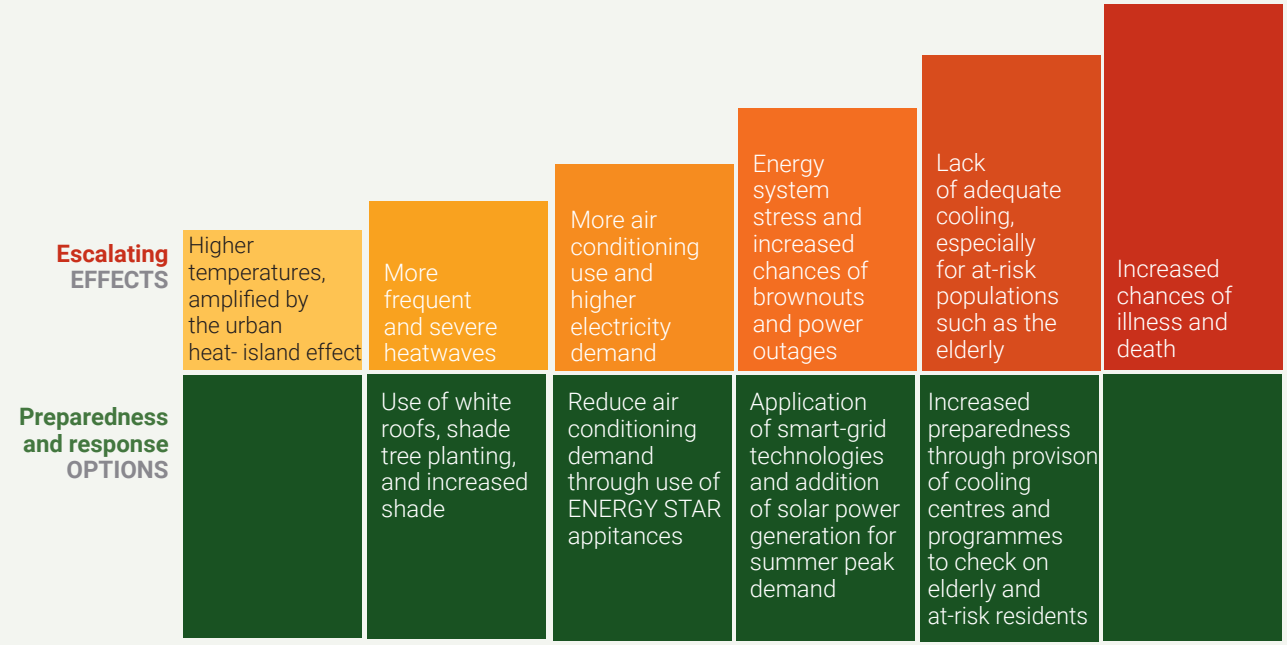
Data sources: NOAA:Estimate of Gross Domestic Product (GDP) (https://ngdc.noaa.gov/eog/download.html), ORNL:LandScan population grid (https://landscan.ornl.gov/), NASA:Shuttle Radar Topography Mission (SRTM) (https://lta.cr.usgs.gov/SRTM).

Green spaces for cooler and closer communities

Conservation or development of natural green areas as cooling spots can contribute to reducing heat islands as well as enhancing environmental quality (Hatvani-Kovacs *et al*. 2018). The city of Daegu in the Republic of Korea provides a striking example of how local efforts to create extensive green areas has led to significant reductions of the heat-island effect (Box 21). In Jakarta, Indonesia, it was found that these kinds of green cooling spots can enhance not only environmental quality but also the frequency of communication in local communities, as they provide comfortable places for local people to gather and talk to one another (Murakami *et al*. 2014). In this regard, the appropriate design of cooling spots can also contribute to building social capital, which is important for many aspects of community resilience such as the organization of spontaneous groups of volunteers for disaster response (Twigg and Mossel 2017]). Furthermore, the natural cooling spots help to decrease energy consumption in the nearby areas, leading to fewer greenhouse gas emissions (Larsen 2015).

Box 20: Urban heat-island effect and human health

Increasing urban temperatures have a negative impact on human and ecosystem health. Understanding of the causes and effects of urban heat-islands in individual cities is needed to develop countermeasures



(http://nca2014.globalchange.gov/report/regions/southwest)

In addition to use of natural cooling spots, urban agriculture is gaining international attention (Lwasa and Dubbeling 2015). Like natural cooling spots, areas of urban agriculture can contribute to reducing urban temperatures, improving local environmental quality, reducing energy consumption and building social cohesion as well as reducing urban food insecurity.

As with artificial urban infrastructure, the management of green areas and their connectivity, sometimes called green infrastructure, requires the support of citizens and collaboration among various sectors including urban planning, environmental management and social welfare (Box 22; Andersson *et al*. 2014; Benedict and McMahon 2012). In Japan, the city of Yokohama has implemented an urban greening programme through which a small city tax of around US$ 8 per person is levied to support activities related to forest and agricultural conservation as well as education on the benefits of urban green space (http://www.city.yokohama.lg.jp/kankyo/midoriup/english/tax-fund.html).

Box 21: Green Daegu Project to reduce the heat-island effect

Daegu, a city in the Republic of Korea, has undergone widespread development linked to industrialization and urbanization since the early 1980's (Yoon *et al*. 1994). Daegu typically experienced higher temperatures than other regions because of its geographical location and high level of urban development. To counteract this effect, the city started creating green areas in 1996, and has planted 10 million trees in only 10 years – by 2016, a total of 35 million trees had been planted and there are plans to plant a total of 50 million trees by 2021. As a result of these efforts, the vegetation cover of the city has increased to more than 60 per cent and the maximum mid-summer temperature decreased by 1.2º Celsius compared to 30 years ago.

The expansion of urban forests have proven to be effective in reducing the heat-island effects as shown below.

Source: https://yoursay.tr.qld.gov.au/greenis/photos/34697
http://info.daegu.go.kr/newshome/mtnmain.php?mtnkey=articleview&mkey=scatelist&mkey2=2&aid=233786

Cooperating Cities for Sustainability

International city-level collaboration can be another effective approach of enhancing urban resilience and sustainability, through, for example, sharing experience and technology among cities. Such collaboration can encourage adaptation and mitigation action and policies on climate change through facilitating urban greening, enhancing social capital and reducing greenhouse gas emissions and other environmental impacts of cities, while sustaining their economic activity. To promote international collaboration among cities, city-level indicators, measurements of a city's economy or environmental sustainability, can be a useful tool. By comparing the values of different indicators, the similarities and differences between cities can be understood, allowing for more efficient and effective communication between cities for policy-making (Uchiyama *et al*.2015). In addition to facilitating international collaboration, management of cities can be improved by using the municipal-level indicators. For example, the City Sustainability Index (Mori *et al*. 2015; Shen *et al*. 2011), which is made up of several indicators including carbon dioxide emissions, gross regional product per person, and measurements of income or wealth distribution among residents (the Gini coefficient), is often used to evaluate the status and trends of cities' environments, economy, and societal characteristics and thus guide policy making. Other information that can be used in the evaluation of cities includes aggregated community-level census information and micro-level information on their environmental and socio-economic status collected by monitoring activities with citizens.

4.4 Adopting sustainable solutions

"To counteract the socioeconomic drivers leading to environmental degradation, an economic transformation that is particularly based on improved energy and transportation systems and smart green growth for urban areas is urgently needed." UNEP (2016).

The continuing rapid growth of the Asia-Pacific region's economy and the anticipated affluence of approximately 3 billion additional people in the coming years will put tremendous pressure on its limited natural resources. The region's future competitiveness will depend heavily on progress made in the trasition to a low-carbon future and on how efficiently the region's natural resources are used. Climate change will also have far-reaching implications for Asia and the Pacific. Sustainable pathways include dramatically increasing energy efficiency, reducing reliance on fossil fuels by supporting the uptake of renewable energy, adopting strategic approaches to urbanization and eco-friendly building design, relying more on mass transit and railways for long-distance transport and changing lifestyles to alleviate pressures on finite natural resources.

Renewable energy – it's real and reliable

In 2015, the world burned fuels emitting 32.3 billion tonnes of carbon dioxide (IEA 2017). Of this, 67 per cent was for electricity generation. Even though on a per kilogram basis it is not as environmentally harmful as carbon monoxide, methane or nitrous oxide, carbon dioxide is largely responsible for climate change and related disaster events simply because of it abundance in the atmosphere – more than 80 per cent of annual greenhouse gas emissions are of carbon dioxide.

In addition, burning fuel releases harmful pollutants to the air and water systems, that can affect the well-being of all living organisms on Earth.

Currently, the world is only generating just less than 13 per cent of its electricity from renewable sources. By definition, renewable energy sources are those which can be used repeatedly and/or replaced naturally. Renewable energy sources include wind, the sun (solar), rivers (hydro), biomass, waste, geothermal and tide.

The challenge for Asia and the Pacific is how to provide for increasing energy demands while improving the continuity of energy supplies and reducing greenhouse gas emissions. The global instability of oil prices and the depletion of oil reserves put pressure on long-term energy supplies. Across the region, fossil fuel resources are unevenly distributed, but each country is abundant with at least one renewable energy resource (Figure 35). Nepal alone has a hydropower potential of 83 000 megawatts (MW) while even if Nepal's demands increase by 10 per cent a year, domestic demand will only reach 3 500 MW by 2025 (Shukla *et al*. 2017). Moreover, Southeast Asia has double the solar energy potential of Northern Europe. For many countries such as India, the generation of rooftop solar energy for household consumption is cost effective and can support household savings over a period of 5–15 years. Increasing the use of these resources and innovations in cleaner, sustainable technologies can help the region go a long way to meeting future energy needs sustainably. In addition, emphasizing energy saving will significantly help deal with limited resources at a household level, bolstering energy security and reducing dependence on fossil fuels. Community-level renewable energy development using microgrids can aid energy security on individual, community and national levels.

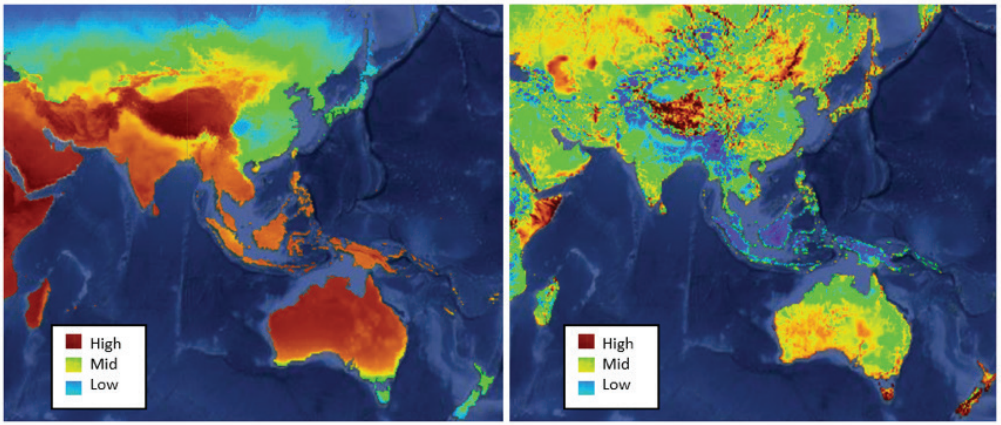


Figure 35: Solar (left) and wind (right) renewable energy resource map in the Asia-Pacific region (IRENA 2017)

The costs of generating electricity from various renewable technologies in Asia are shown in Figure 36. Plenty of factors affect the actual cost, including labour and site location, so they are represented in the figure as ranges, with the cost range for coal-based electricity generation represented by the red broken lines. Interestingly, only concentrated solar power, solar photovoltaics and offshore wind have higher costs than coal-based power generation. Currently, hydropower is the cheapest renewable option in the region (Figure 36), while onshore wind gradually becomes more competitive due to improvement in capacity factors and decreases in installation, operation and maintenance cost. The cost for solar photovoltaic generation is following the same trend.

To put the transition to clean energy on track, stable policies and clear regulatory processes should be in place. Inconsistent, complicated and unpredictable policies have been regarded as the biggest obstacles to increasing investment in renewable energy projects. Having concrete targets and roadmaps from the government would significantly enhance the attractiveness of such projects.

In addition, total investment in renewable energy still lags behind the estimate of what is needed to meet the goal of the UN Framework Convention on Climate Change (UNFCCC) Paris Agreement of keeping global temperature rise this century well below 2º Celsius above pre-industrial levels. Many governments are introducing de-risking instruments and covering early-stage financing to initiate private investment, in addition to traditional financial instruments such as grants. These new financing mechanisms could encourage investment from diverse stakeholders promoting accessibility to various renewable energy investment opportunities.

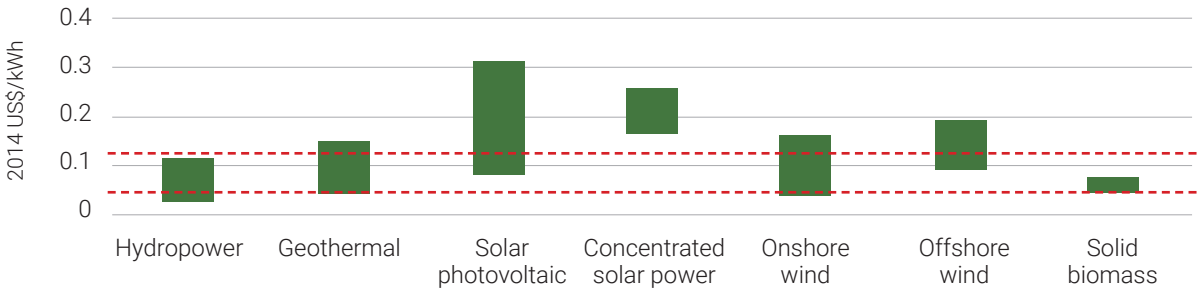


Figure 36: Levelized cost of electricity from different technologies in Asia. The red broken lines show the cost range for coal-based power generation

Energy and water efficiency: save some for tomorrow!

Energy efficient homes provide financial savings and have the added benefit of reducing greenhouse gas emissions that are intensifying climate change. Improving the energy efficiency of your home and appliances will reduce electricity bills associated with lighting, cooling heating and the running of appliances. Similar opportunities exist to reduce energy related emissions and operating costs in the industrial and business sectors. Improving the energy efficiency of commercial and industrial activities in mining, agriculture, textile production and food processing, among others, will support significant positive environmental outcomes and financial savings.

Similar to energy, water efficiency in the operation of industries and businesses in Asia and the Pacific has the potential to reduce ongoing costs and promote the sustainable consumption of freshwater. Freshwater is embedded in most of the things we consume and use, from the meat we eat to the aluminium we carry our drinks in – 20 litres of water are needed to produce a single can. While the water we use at home may seem trivial in comparison, its conservation is a step towards increasing our knowledge and conscious use of this life sustaining resource. And of course, water conservation at a domestic level will both help to reduce the monthly operating cost of households and safeguard this precious resource.

That's a cool house!

Buildings account for 40 per cent of the total worldwide energy use and around 30 per cent of global carbon dioxide emissions (Zang and Cooke, 2010). This share could double or triple by 2050 if we do not act, as buildings have a long lifecycle that locks in their energy use (WBCSD 2018).

Building design influences the water and energy efficiency of a home. There are plenty of nifty ways of achieving household efficiency some of which are shown in Figure 37. Heating and cooling requirements are the primary source of energy consumption in buildings (Ürge-Vorsatz 2015). In addition to a variety of green technologies that are available to increase energy efficiency, building design guidelines are continually being adopted throughout the region. A sustainable building will cost only marginally more to construct, but the initial cost will be recovered as the operating costs of this type of building are lower than those of a conventional structure (Weerasinghe 2017).

An example of sustainable building design is Josh's House in Australia. Josh Byrne, an environmental scientist and well-known ABC television gardening presenter, actively engaged the public in the step-by-step build of his own home, known as Josh's House. The house does not need air conditioning or heating, generates its own electricity, and harvests and recycles water. The building achieved ten stars in the Nationwide House Energy Rating Scheme of Australia. (Joshhouse.com.au).

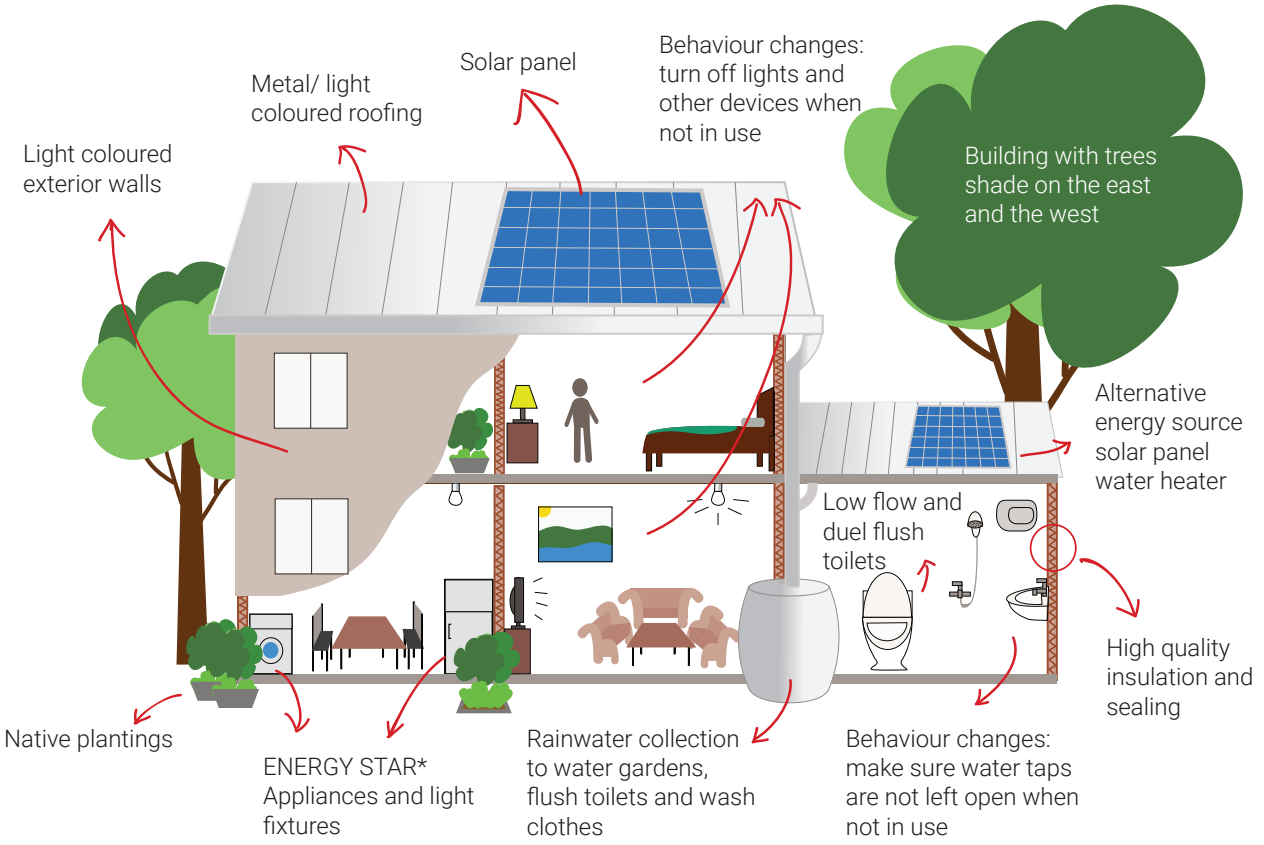


Figure 37: The many ways you can convert your house into a sustainable home

A video link

https://joshshouse.com.au/videos/series-1-the-build/

Sustainable buildings: a long-term investment

The types of materials selected at the design stage of building a home will impact its longer-term sustainability. These choices have implications for saving energy, improving resilience to climate events

and improving comfort for its inhabitants. Selecting materials made from repurposed or recycled products will reduce the house's carbon footprint and cut construction costs significantly.

Passive design relies on the climate to maintain a comfortable temperature in a building (Box 22). Such design considerations can play significant roles not only in reducing greenhouse gas emissions but also in lowering household heating- and cooling-related expenses. The energy efficiency of buildings can be improved through passive design considerations. A significant amount of energy can be conserved over the lifetime of a building by proper orientation to minimize direct sunlight at the hottest times of the day and through the installation of insulation, double-glazed windows and energy-efficient heating and cooling systems.

Passive building solutions need to be adapted to the country and local climate. Aside from designing passive buildings or taking the opportunity to incorporate sustainable design aspects during renovations to existing buildings, monitoring the operational performance is important. One of the easiest ways to do this is to monitor the energy usage through electricity bills and the thermal comfort of the inhabitants.

Box 22: What is a Passive House?

The following video provides information on the basic principles of a passive house

A video link

https://player.vimeo.com/video/74294955

How sustainable is your daily commute?

Transport is one of the most energy-intensive sectors in the world today – and there is something that can be done about it. In 2015, 29 per cent of the world's energy consumption was just for transport (IEA 2018) – roughly 1.1 litres of oil per person per day. In terms of emissions, transport was responsible for 7 737.8 million tonnes of carbon dioxide emissions (IEA 2017), the main greenhouse gas. To that has to be added costs to human health and other damage done by pollution. It is alarming how motorized transportation has become something we cannot live without, as daily travel distances have gown longer due to urbanization (Figure 38). Because of this, transport poses a threat to climate, energy security, health and even access to basic services.

Transport is a multi-faceted problem. On one hand, the world is fortunate to see the development of alternatives to fossil-fuel powered vehicles, such as pure electric and hybrid vehicles as well as biofuel, fuel-cell and natural-gas powered vehicles (Lopez *et al*. 2018). However, the increasing dependence on private cars is a fundamental problem in itself. In developed countries, more than half of passenger transport is in private vehicles. In developing ones, it is almost evenly shared between private and public modes. As income levels rise in developing countries, private vehicle use is expected to rise even more.

As motorcycle transport is huge in Asia, it is also interesting to look into. Two- and three-wheelers make up 60–90 per cent of the road vehicle fleet in Southeast Asia (IEA 2018), the majority of which are in the 125 cubic centimetre (cc) range. According to a Vietnamese case study (Bray and Holyoak 2015), flexibility, shorter travel times and moderate purchase costs make motorcycles a popular option. A study in Iran (Hassani and Hosseini 2016) estimated that motorcycles use 78 per cent less fuel than passenger cars per 100 kilomtres travelled on average. The same study revealed, however, that motorcycles emit 250 per cent more carbon monoxide, 130 per cent more total unburned hydrocarbons, but 87 per cent less nitrogen oxides per kilometre travelled than a passenger car. It seems pretty straightforward when we only look at purchase and operational costs, but a little more thought is worthwhile when we begin add societal considerations to the picture.

The transport problem is as much social as it is technical. How many of you would be willing to take a bus or train or even bike or walk to work? Taking the bus to work could reduce your transport emissions per kilometre by as much as 99 per cent. One remarkable transport story concerns Singapore, which has made great efforts to control private vehicle ownership rates and ensure high quality public transport services. During peak hours, a train arrives every 2–3 minutes while buses come every 10 minutes. To control private car ownership, Singapore operates a vehicle quota system and electronic road pricing (LTA 2017a; LTA 2017b). One of the city's ultimate goals is to have a train station within a 10-minute walk for all households by 2030. In addition, there is a trend towards mixed-use land development, which combines multiple land uses in the same area, such as residential, work and recreation, to reduce the need for long distance travel (Banister 2008). Singapore also encourages walking, jogging and cycling in the city. The city of Adelaide in Australia fully supports what Singapore

Figure 38: Traffic jam in Bangkok

Source: GEO-6 Asia-Pacific Regional Report

has pioneered and has published its own mixed-use development guide, which can be found here (https://www.cityofadelaide.com.au/planning-development/) for further reference.

Another interesting development in transport is sparked by developments in internet technology (Figure 39).

Bike sharing, for example, has become huge in a many cities in Asia and the Pacific. In Shanghai, China, for instance, users rent bikes using a mobile phone application, making all transactions over the internet. Other examples include increasing opportunities to work from home or conduct meetings, shop or book rides all through the power of the internet.

Figure 39: A row of bikes available for rent. Left: Users rent the bike by scanning a code at the rear of the bike with their mobile phones

Source: Lingmin Peng, Tongji University, Shanghai, China

Put the plan in urban planning

Urban sprawl and unregulated urban development has lead to the loss of valuable natural areas. Urbanization is competing with finite arable land and natural landscapes, which is having negative effects on the environment and food security, water supplies, and overuse of local resources. Unregulated urbanization has the potential to create social issues including high levels of poverty, high unemployment and a lack of social services.

Water is the sauce of life

Water is a fundamental but finite natural resource. As cities and urban areas in Asia and the Pacific grow, large volumes of rainwater run off impermeable surfaces, changing the timing, speed and volume of water flows in waterways and bays. Water-sensitive urban design aims to mimic the natural water cycle as closely as possible by utilizing urban planning and building design to manage and stop stormwater from entering exposed waterways. Drainage and stormwater management considerations in planning and urban

design are key climate change adaptation tools used for flood-risk reduction, protecting the natural water cycle and the health of aquatic ecosystems (City of Greater Geelong 2018).

Irrigation for agriculture is responsible for 70 per cent of total global water withdrawals. Increasing efficiency in irrigation and improved agricultural water management could increase freshwater availability, catalyse development, reduce soil erosion and lead to increased and diversified agricultural yields (Wenzlau 2013). Enhancing water efficiency in agriculture will bolster water security and increase our ability to provide the nutritional requirements of growing populations. This is critical for the Asia-Pacific region's population that is projected to rise to nearly 5 billion by 2050 (UN 2014).

4.5 Alert today, alive tomorrow

Urbanization and infrastructure development will continue in the years to come. Sustainable design and practices will have to be part of the strategy to ensure good quality of life for generations to come. However, socio-economic challenges such as income inequality, cultural differences and gender issues need to be also kept in mind and addressed. Low-income communities, for example, tend to live in higher-risk areas for flooding and landslide events, exacerbating their vulnerability. Cultural differences also affect social cohesion in the city, and largely impact decision making for disaster response. The consideration of gender is also significant in the transition to sustainability. Indeed, recent studies have shown that women have significant influence on household energy consumption due to the division of labour in traditional societies.

Moreover, settlements and communities will have to become resilient to the more frequent and intense climate-related hazards occurring due to climate change. It is not enough, however, to only focus on the technical aspects of these issues, as vulnerability to the impacts of climate change often varies according to people's socio-economic status. Unfortunately, as a result of climate change induced migration, we also see more frequent cases of human trafficking. Populations particularly at greater risk from climate-induced hazards include internally displaced persons, women-headed households and children who lose their parents during the subsequent disasters. There may be plenty of social factors which divide us, but there are certainly more things that tie us together, including this precious planet on which we live and the value we put on life.

Sustainability and resilience in water and food systems are equally important issues. Overall, there are many other potential measures that each of us can take to improve the resilience and sustainability of our communities and livelihoods. A informed community can face the challenges of a changing world, and continue to thrive for generations to come. In the concluding chapter, youth perspectives on the SDGs and environmental issues are presented, and we reflect on what young people need to do as a colhesive group to further influence real change.

Tips and recommendations:

- Learn more about the exposure of your house to climate-related hazards – check local flood hazard maps, etc.
- Participate in , or lead, a local disaster preparedness exercise.
- Leave your car at home. Try public transport – you'll appreciate it in time.
- Be conscious of your water and energy consumption -- save money and help save the world too!

Box 23: Mizuki Shikimachi, professional violinist

Mizuki is a young violinist who plays the tsunami violin – a violin made from the debris from the Great East Japan Earthquake and Tsunami of 2011. He is a remarkably resilient young man himself, having overcome cerebellar hypoplasia through his violin, and is now aspiring to build the resilience of society through music.

This interview was conducted just for GEO-6 for Youth, and contains the first ever recording of a song , titled Road to hope, he composed himself during a visit to the disaster-affected areas. Enjoy!

A video link

https://www.iges.or.jp/en/projects/unea4/geo-6-youth

CHAPTER 5

Transition to Action

5.1 Our goals, our vision

Table 1: The future in 2050 as perceived by youth

Youth envision a future where…	Youth do NOT want a future where…
	
This is 2050.	**This is 2050.**
The region's population growth has seemingly slowed down. We have managed to achieve zero poverty. The income gap, gender gap and discrimination have r ly compared to 2020. All energy is renewable. All homes can now generate their own energy as well as treat their own waste and wastewater. There is less	Humans are slowly dying out due to a widespread pandemic caused by a mutation of a virus found in factory-raised meat. Sea levels have risen by 8 meters since 2020 due to mass melting of ice at the northern and southern poles. There are no more natural forests. Frequent

Table 1: The future in 2050 as perceived by youth (cond.)

Youth envision a future where…	Youth do NOT want a future where…
waste, and some countries have even achieved zero waste, as manufacturers take complete responsibility for 100 per cent 3Rs (reduce-reuse-recycle) of their products. Miraculously, the international community has successfully banned all military weapons, including nuclear ones. These resources have been redirected to improving education. More than half the land on Earth has been designated as natural reserves, and the rest is certified as *Satoyama* – where people live sustainably with nature while enjoying the various benefits it provides. Biodiversity is slowly coming back thanks to a global multi-stakeholder effort. Delicious vegetarian meals have become the norm since meat is now taxed according to its water, carbon and nitrogen footprints. People no longer need to wash vegetables or fruit as hazardous chemical products are no longer used in agriculture. ***People are happy and contented. This is paradise.***	conflicts occur through groups wishing to control fossil-fuel reserves, although not many are left. A couple of years back, a terrorist group simultaneously detonated nuclear bombs in many of the world's top cities, making them uninhabitable. Drinking water is regulated, with taps only operating once a day. Only the rich can afford the luxury of clean water, while others in the world use water contaminated by viruses, pathogens and residual pharmaceuticals that people are taking in attempt to combat the pandemic. Land has become so contaminated that farmers can only grow food in factories. The weather is either burning hot or pouring rain. Floods are frequent, with robbery, violent crimes and social unrest occurring after the flood events. Undesireable cockroaches, flies and mosquitoes are thriving, while most other insects are extinct due to the use of pesticides. The oceans are empty except for the Great Pacific Garbage patch, which is now larger than Australia and has been dubbed Garbactica to replace the loss of Antarctica. ***People do not talk about nightmares anymore because we are living one; every day.***

Source: independent survey conducted by GEO-6 for Youth Asia-Pacific team.
Figure : Mirza Nasir Baig, 2016 International Cartoon Competition on Environmental Protection

Youth and the Sustainable Development Goals

In September 2015, the international community agreed to a new vision and a set of global goals for a better world by 2030 – the Agenda for Sustainable Development 2030 and 17 SDGs, described in the preamble of this report (page VI) or at: http://www.undp.org/content/undp/en/home/sustainable-development-goals/

When asked about the most important global goal to address environmental issues in the GEO-6 for Youth Asia-Pacific survey, young people highlighted SDG 12: Responsible Sustainable Consumption and Production. SDG 12 was also raised in the GEO-6 Asia-Pacific 2015 report as key to economic transformation of the region (UNEP 2015). Achieving economic growth and sustainable development require that we urgently reduce our ecological footprint by changing the way we consume and produce goods and resources. A large share of the world's population is still consuming far too little to meet even its basic needs. Halving per person food waste at retail and consumer levels is also important for creating more efficient production and supply chains. This would help with food security and shift us towards a more resource efficient economy.

Only 20 per cent of young people surveyed, however, recognized the importance of SDG 17: Partnerships for the Goals although it is the critical factor that binds all the other goals together (SDGs 1–16). One of the components of SDG 17 is capacity building and as a result, government and civil society should actively seek out substantive awareness-raising and engagement of youth in international, regional and national-level discourse, planning and implementation. For this, improving access to technology and knowledge is important. However, more than half the world's population, that is 4 billion people, do not have access to the internet, and 90 per cent of them are from the developing world. Increasing the number of people who can easily access this portal to the world and opportunity would make a huge difference in achieving the SDGs!

The role of youth as active agents of change in achieving the SDGs is crucial as illustrated in Chapter 1. Young professionals of today will be at the forefront in decision making and be role models –approaching environmental challenges in innovative and integrated ways as future leaders, educators, business people and drivers of sustainability.

5.2 Act now

Youth perceptions

As mentioned earlier, an online survey was conducted to understand youth perceptions. More than 200 young people across Asia and the Pacific shared their ideas on, opinions about and understanding of the SDGs, the current state of the environment and the future. When asked about the current state of the environment, 91 per cent agreed that it is deteriorating (Figure 40). It is encouraging to know, however, that in the face of environmental challenges, about half of those surveyed felt empowered to take action (Figure 41).

In the same survey, the youth ranked SDGs 12:

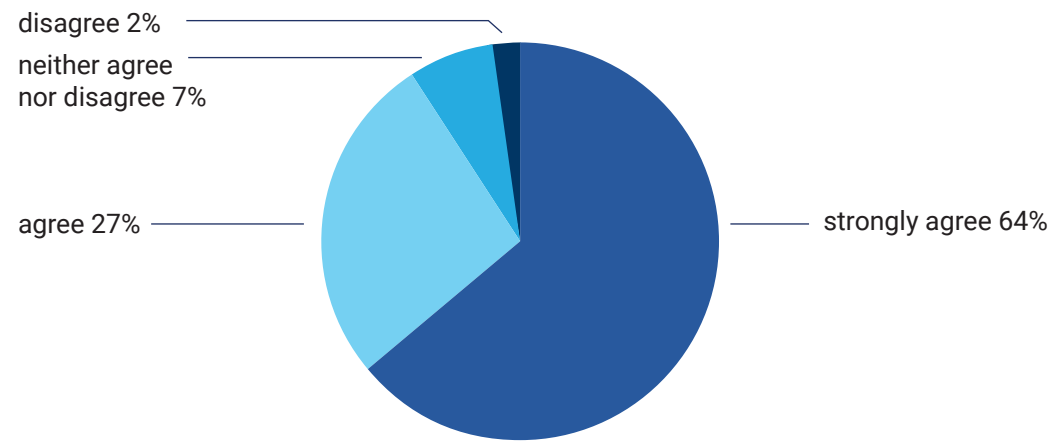


Figure 40: Youth perception: is the state of the environment deteriorating? None of the young people surveyed strongly disagreed

Source: GEO Youth for Asia and the Pacific Survey

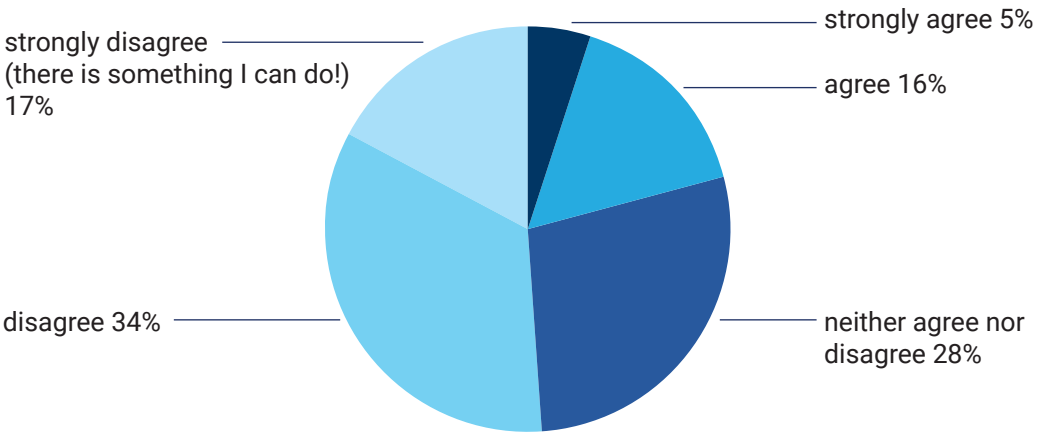


Figure 41: Youth perception: in the face of environmental challenges, I feel helpless…

Source: GEO Youth for Asia and the Pacific Survey

Responsible Consumption and Production, 13: Climate Action and 4: Quality Education as the three most important SDGs in relation to tackling current environmental issues. The urgency to focus on these SDGs can be seen from the following facts:

Around 1.3 billion tonnes of food is wasted every year whereas 2 billion people go hungry and are undernourished. At the same time, around the world about 2 billion people are obese or overweight.

Since 1970, the number of natural hazard events has gone up by almost 400 per cent. Between 1901 and 2010, sea level has risen by 19 centimetres due to warming temperatures and melting ice.

103 million young people worldwide lack basic literacy skills and more than 60 per cent of them are women. In developing countries, one in four girls do not go to school.

Youth as game-changers

Asia and the Pacific is home to successful role models and champions. Take a look at the compilations of successful initiatives and stories in the region shown below (Box 24).

Young people are acting at various levels across the region. What is your plan of action?

What are your views?

Take a few minutes of your time today to share your ideas on the same questions:
https://goo.gl/forms/JregH5XFblftNeGH3

Results will be presented at International Student Conference on Environment and Sustainability to be held on World Environment Day on 5th June 2019

Box 24: Initiatives by youth and children across the Asia-Pacific Region

Upcycling of used banners

In the Republic of Korea, about 5,000 tons of banners are used every year. To address the problem, Korea Polytechnic University and Sangmyung University produced and distributed eco-bags, made from used banners on campus. Touch4Good, a social enterprise founded in 2008 by youth, is also producing and selling upcycled canvas banners. Read more.

World's largest beach clean-up

In 2015, Afroz Shah and his neighbors started cleaning the accumulated waste on Versova Beach in Mumbai, India. Soon, the Versova Resident Volunteers group was formed. In 2016, their efforts were recognised internationally with the UN Environment calling it the "world's largest beach clean-up in history". Read more.

Sustainable community-based waste and sanitation management

Yuyun Ismawati of Bali, Indonesia, implemented community-based waste and sanitation management programs that provide employment opportunities to low-income populations and empower them to improve the environment. Ismawati also supported national agencies in developing Indonesia's first-ever bill on waste management. Read more.

Innovative solar heater

Teoh Siang Teik of Malaysia designed and patented a solar water heater, which doesn't require electricity and can be built using materials available at a local hardware store. Read more.

Environmental awareness

Kindergartens South in New Zealand won the Environmental Action in Education Award in recognition of their Nature Discovery programme, carried out on a ten-acre block of land. It offers children from 11 kindergartens the opportunity to understand the environment, and grow their ecological identities. Read more.

Reforestation initiative in Fiji

Youths of Biausevu village in Fiji are conserving biodiversity by replanting native Fijian trees. The project provided the villagers a joint goal and raised awareness about the importance of protecting their natural resources. Read more.

Turning Mongolia green

Tsendsuren Deleg established the first angiosperm (flowering plant) nurseries in Mongolia. Each year, her nurseries produce 850,000 saplings and plants. Her nurseries contribute to the greening of Mongolia and provide jobs for the unemployed. Read more.

Agroforestry as a lever for positive change

A group of villagers in Khao Din, Thailand, replaced monoculture cash crops with an agroforestry system featuring a variety of trees and crops for food, trees, and medicine. They successfully reversed the decline of green cover, restored ecological health, and forged a stronger community. Read more.

Empowerment through energy

In 2012 six young Australians set up Pollinate Energy, an initiative to provide children living in slums in Bangalore, India with light to study. Through the distribution network and phone app developed, products such as water purifiers, clean cooking facilities, and sanitation equipment were distributed. Today, Pollinate Energy is working across many cities beyond Bangalore and is selling a diverse range of products aiming to break the cycle of poverty. Read more.

Energy-efficient stoves to stop deforestation

Corn is the main produce of Son La, Viet Nam. Nguyen Duc Chinh designed an improved stove which could use corn cobs and husks for fuel. Introduction of the new stove eliminated the need for collecting firewood, decreasing deforestation. Read more.

Sustainable lunch boxes

Tharushi Widushika Rajapaksa, a 17 year old girl from Sri Lanka, has created the reusable and biodegradable "alternative lunch pack" as an alternative to polythene “lunch sheets”. Read more.

Turning waste into fuel

Shutong, a young professional in China, founded a company which turns waste cooking oil into biodiesel for transportation. This simultaneously tackles the challenges of food safety, waste, and pollution across the air, road and marine sectors. Read more.

Reusable sanitary pads for a sustainable future

Angelica Salele is promoting reusable sanitary pads in Samoa to reduce plastic waste. Read more.

Reusable products to reduce waste

Fides Gimenez is the founder of GoZero, a startup company providing sustainable alternatives to single-use plastic products in the Philippines. Her products currently include metal drinking straws and bamboo toothbrushes. Read more.

Robots enabling environmental and human-friendly workstyles

In 2018, a cafe was launched in Tokyo, Japan, where customers could be served by robots operated remotely by persons with disabilities. Kentaro Yoshifuji, CEO of Ory Lab and developer of these robots, started his career as an inventor in high school and was selected as one of the “30 under 30 Asia” by Forbes Magazine in 2016. His robots are in use all over the world by children remotely receiving education, teleworkers, and persons with disabilities. Read more.

Follow the action, tips and recommendations from GEO Youth Asia and the Pacific, join us by:

(1) introducing the e-book to your community or inserting an environmental sustainability session in your meetings/seminars. Email a summary with photos/videos of your event to geo6-youth.asiapacific@un.org

(2) take action on your campus or in your Family and/or community on selected SDGs, and email a summary with photos/videos of your event to geo6-youth.asiapacific@un.org

(3) participate in Youth Empowerment - 2018-2019 International Cartoon Competition on Environmental Protection, see http://cartoon.chinadaily.com.cn/zhuanti/dasai/2018/dongtaiview.shtml?id=1860

(4) share your views on SDGs and support their promotion: take a few minutes of your time today to share your ideas at https://goo.gl/forms/JregH5XFblftNeGH3

Participants from Asia and the Pacific with innovative ideas will be invited to the World Environment Day Conference in 2019-2020 at Tongji University, Shanghai, China, to share experiences with youth leaders from around the globe.

Together we can do it

In the previous chapters, we have highlighted various environmental issues and corresponding action we can take to address them. And fortunately, you, young people, have validated the urgent need for some change through the survey. However, what else do we need to do to create real change?

One key aspect requiring collective action is the science-business-policy dialogue. In this digital age, young people are faced with the burden of wading through a lot of false information and misinformed perspectives. Because of this, decision making based on sound science must be promoted. Moreover, it is not a secret that real change cannot be realized without involving the largest corporations in the world – you and I can only do so much. You, the world's youth, will have to influence policy makers and businesses equally to take action on the issues we highlight in this report.

Achieving the SDGs will involve governments in implementing strong policies and taking decisive environmental action and we, young people, should actively support them. Governments will have to be efficient in carrying out their current responsibilities and young people can assist them implement effective environmental assessments and monitoring through citizen science and citizen journalism. Public participation often mitigates conflicts and generates more opinions and solutions to problems.

International Student Conference on Environment and Sustainability, Tongji University, Shanghai, China,

International Student Conference on Environment and Sustainability (ISCES) has been hosted each year by the United Nations Environment Programme, Tongji University, Beijing Environment Foundation for Young Talents and Xinhua News Agency since 2011 in the week of the World Environment Day on 5th June. It aims to provide young people with access to the international stage to raise their voices on environmental and sustainable development issues.

Free Registration for 2019 International Student Conference on Environment and Sustainability to be held on World Environment Day on 10th – 14th June 2019
Venue: Tongji University, Shanghai, People's Republic of China
Date: 10th – 14th June 2019
Contact: unep_tongji@tongji.edu.cn
Website: http://unep-iesd.tongji.edu.cn/
(2018-2019)

International Cartoon Competition on Environmental Protection

The theme of the cartoon competition is Youth Empowerment/Youth Action. Focus your cartoons on the theme of the competition, though contributions relating to environment protection will also be accepted.

Organizers: China Daily, United Nations Environment Programme, World Wide Fund for Nature (WWF), China Environmental Protection Foundation; China Journalistic Caricature Society; Tongji University.

Website: http://unep-iesd.tongji.edu.cn/index.php?classid=169&newsid=3043&t=show

Moreover, the youth can influence businesses by being mindful in their purchases, and the services they use. If we are well informed and really understand important environmental issues, with time we can make the correct decisions for he planet and future generations.

For more details of specific action young people can take and more, see The Lazy Person's Guide to Saving the World.

5.3 Be the change you want to see in the world

The environment is currently facing a lot of challenges and deteriorating. For thousands of years, the Earth and humanity have shared a wonderful and nurturing relationship, but over time people have exhausted some of the Earth's resources and significantly altered its state. It may now seem inevitable that everything will come to an end, but the battle is not yet lost. Let us take this opportunity to create the most coveted twist in this story, and work towards a vision of a better tomorrow. There are certainly limits to what each of us can achieve on our own, but collaboration at family, community, local, national, regional and global levels can have significant impacts and lead to wonderful results. It is our turn, let's make it happen!

This brings us to the end of the report. We hope you have enjoyed reading it as much as we have writing it. Please spread the word!

The GEO6 for Youth Asia-Pacific Team :-)

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