Asia-Pacific Futures in 2040

Raising ambitions for a healthy environment

ESCAP 75
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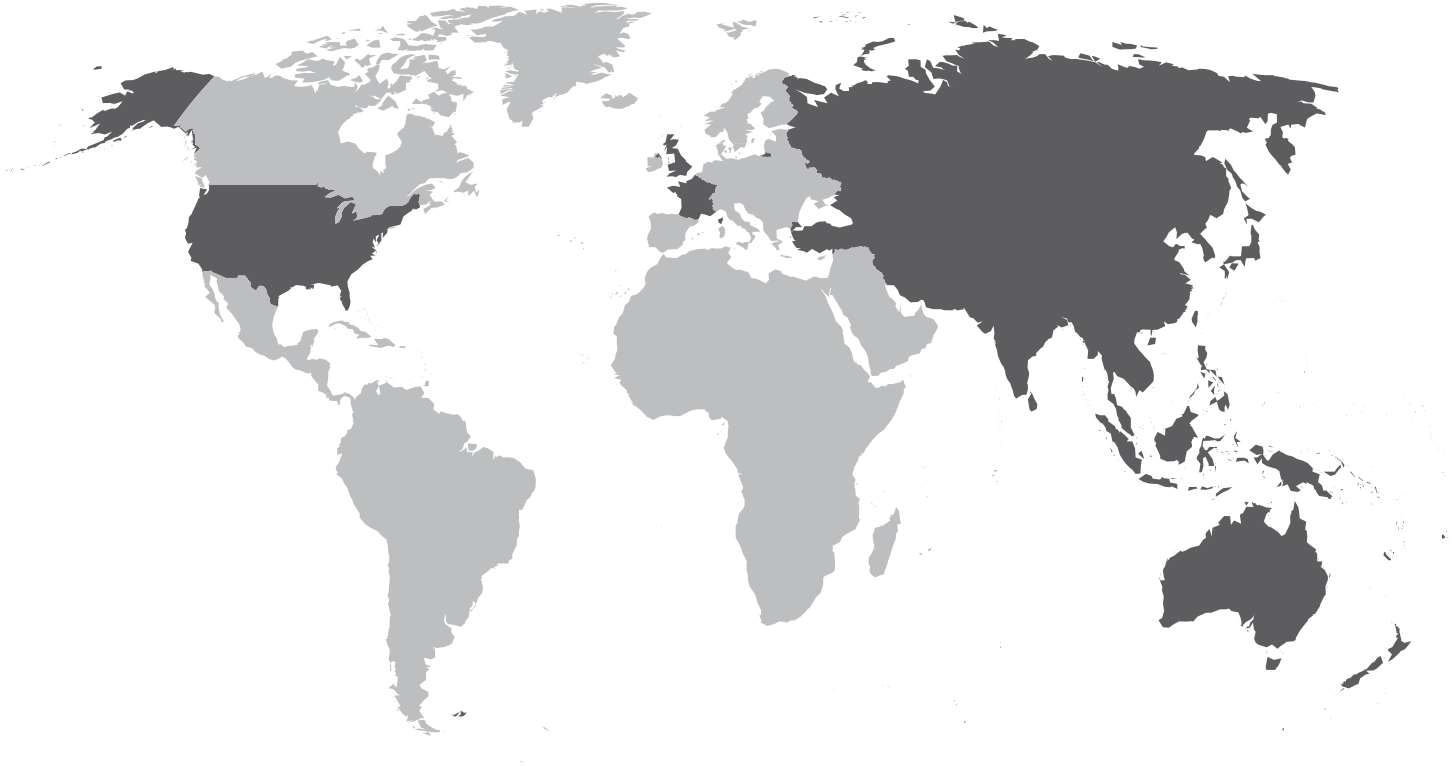

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Asia-Pacific Futures in 2040

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About this report

This report is produced by the Environment and Development Division of ESCAP to respond to converging environment and development crises affecting millions across the region. Rather than presenting regional environmental trends, it shares insights to Asia-Pacific development challenges. “Transformative futures” methods have been applied to outline alternative futures derived from two multi-stakeholder futures workshops, internal discussion and desk research. It also outlines transformative steps towards optimistic but realistic scenarios for the future, with a focus on mission-oriented, multilateral action.

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Executive summary

From where we stand —– looking to the future

The landmark report of the United Nations Secretary-General, *Our Common Agenda*, calls for "urgent and bold steps to address the triple crisis of climate disruption, biodiversity loss and pollution destroying our planet."

These crises are felt keenly in Asia and the Pacific. The region is exposed to a risk landscape of natural disasters and environmental change, income inequality, gender-based and other socio-cultural discrimination, and economic and political pressures that are aggravated by climate change and COVID-19. Ecosystem health, and the health of the region's people, are increasingly entwined. In this setting Asian and Pacific economies have become among the most resource-intensive and waste-producing in the world. Biodiversity loss here is the most rapid and serious among all regions, amid Earth's sixth mass species extinction. Progress in attaining the Sustainable Development Goals is off-track or reversing. A comparison of the region's targeted emissions reduction, as of October 2021, and current trends, shows that emissions must be reduced three times as quickly as planned. Business-as-usual is not an acceptable path.

Exploring alternative futures

Rather than a conclusive assessment of the state and future of the Asia-Pacific region, this report draws from the collective thinking of participants in a participatory foresight process. Workshops in 2020 brought together more than 100 government officials, civil society representatives, academics, development partners and ESCAP colleagues. Participants were asked what a desired future would look like, what worldviews and narratives would need to be shed in moving forward, and what steps could create narratives that are supportive of a desired future.

The results of those workshops were synthesized and deepened to define alternative scenarios and a possible path forward. Five drivers of systemic change were examined in this process and discussed in this report: (1) growing environmental consciousness, (2) evolving food systems, (3) increasing demand for natural resources and shifts in ownership and control, (4) rural–urban dynamics, and (5) environmental governance. Insights into each helped inform the scenarios and promote understanding of the changes needed for reaching a desired future. This report also provides brief insights on the current challenges, and considerations for the future in four environmental domains: climate action; clean air; healthy ecosystems; and sustainable urbanization, presented in the "Insights" special section. These four domains feature heavily in the four scenarios described in this report.

Four alternative scenarios for Asia and the Pacific in 2040

The four alternative scenarios provide clarity on the scale of ambition needed, and are presented to support social and institutional dialogue and decision-making.

- **A Green Anthropocene. An "ideal" scenario.** The lessons of COVID-19 were heeded. In 2040 the economies and societies of Asia and the Pacific are thriving, green, dynamic, healthy — and peaceful. *This scenario is preferred, best-case — something of a "utopia". It helps set the tone for all four scenarios, providing a clear picture of a desirable future.*

- **The Rivers Run Dry. A "disowned" scenario.** The children of the pandemic are now adults, living in a world of degraded lands and dry rivers. Ecosystems are failing, resources depleted, and some cities evoke a post-apocalyptic movie. The threat of open warfare over resources overhangs a divided Asia-Pacific region. *This "disowned" scenario is the future, following a "business as usual" path, one that is disquieting, going against the ideal view. It might happen if the worst aspects of "business as usual" are not corrected. This scenario provides clarity on what should not be allowed to happen.*

- **Great Collapse. An "outlier" scenario in four parts.** This is a future where "blind spots" have had a major disruptive impact, such as a future where (a) agrobiodiversity collapses, (b) "Day Zero" comes to Asian and Pacific cities, (c) intergenerational divisions regarding climate change have wider social Implications and (4) runaway air pollution and a new virus choke the region. *These unlikely, but possible futures are shaped by what we know, but also strongly influenced by a "blind spot", the influence of which could strengthen over time to become an important disruption. This scenario widens sensitivity to risk and raises awareness*.

- **The Yangtze River Dolphin Returns. An "integrated" scenario.** In this future, the green, inclusive and sustainable recovery idealized in the wake of the COVID-19 pandemic has been achieved. In this scenario a thriving Yangtze River Dolphin population is symbolic of the myriad iconic species revived through ecosystem restoration efforts and reduced environmental pressures across the Asia-Pacific region. A tight mosaic of multilateral environmental agreements, technological collaboration, and shared values support the countries and people most in need, thus helping the region advance further. The Asia-Pacific region leads the globe in producing clean energy and trade in safe, nutritious, affordable, and sustainably farmed foods. *This integrated scenario brings together key elements of the "ideal" and "disowned" scenarios. It presents an ambitious, but actionable, vision of the future. It becomes the basis for identifying transformative action via "backcasting"*.

Looking back from the future – a roadmap to 2040

But how can the Asia-Pacific region get from critical tipping points observed in 2021, to its 2040 ambitions? The final chapter targets the 2040 scenario "the Yangtze River Dolphin returns" with a roadmap that opens opportunities for alternative futures. In line with "Our Common Agenda", the report of the United Nations Secretary-General, it focuses on strengthening multilateral collaboration, with greater networking and social inclusion. Possible milestones on the path to 2040 are defined in four phases:

2021 to 2024 — Building infrastructure for change. The "infrastructure" for partnership and collaboration is built and enhanced. Scientific and technology-led cooperation focus on delivering a healthy environment as a public good, benefitting all people.

2025 to 2029 — Confidence raises ambition. Following improved effectiveness in regional cooperation on transboundary air pollution in 2023, ambitions for cooperation are growing in this second phase. Reliance on the scientific and technology communities and actors has depoliticized environmental issues. During this second phase, additional agreements are made and become operational. Alliances of like-minded governments and stakeholders drive change.

2030 to 2034 — Consolidating the gains. During the third phase, partnerships strengthen and start to show results. The emphasis on transparency pays off. Countries are on track to meet or exceed net zero-emissions targets. The environmental limits set through multilateral cooperation have spurred innovation and protected people's livelihoods — a double dividend as greenhouse gas emissions start to slow for the first time. As 2030 comes to a close Asian and Pacific countries lead the post-SDG negotiations.

2035 to 2040 — Rising to new levels. The region is enjoying the gains of a green economy and improved health. A high degree of preparedness and resilient ecosystems makes for a highly resilient region and shared prosperity in this fourth phase. Frontrunner cities have already achieved carbon neutrality and the region is now ready to aim for higher impact.

The milestones on the roadmap to 2040 focus on environment and development interventions. In keeping with the times, or perhaps as a reaction to the times, they are aimed at strengthening solidarity, cooperation, and transparency. Each government, stakeholder group and development actor, whether state, non-state or development partner is invited to consider these proposals, explore the forces for change in their own contexts and help work with others towards a reinvigorated, networked, multilateralism and new partnerships for an alternative, preferred Asia and the Pacific in 2040.

Acronyms and abbreviations

ASEAN	Association of Southeast Asian Nations
BAU	business as usual
CLA	Causal Layered Analysis
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
COP26	26th Conference of Parties of the United Nations Framework Convention on Climate Change
COVID-19	Coronavirus Disease 2019
ESCAP	Economic and Social Commission for Asia and the Pacific
FAO	Food and Agricultural Organization of the United Nations
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GHG	Greenhouse Gas
INDCs	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
SDG	Sustainable Development Goals
SIDS	Small Island Developing States
NASA	National Aeronautics and Space Administration
NDCs	Nationally Determined Contributions
REDD+	Reduced emissions from deforestation and forest degradation in developing countries
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNESCO	United Nations Educational, Scientific and Cultural Organization

Symbols and notations

°C	degrees Celsius
tCO_2e	tonnes of carbon dioxide equivalent
US$	United States Dollars

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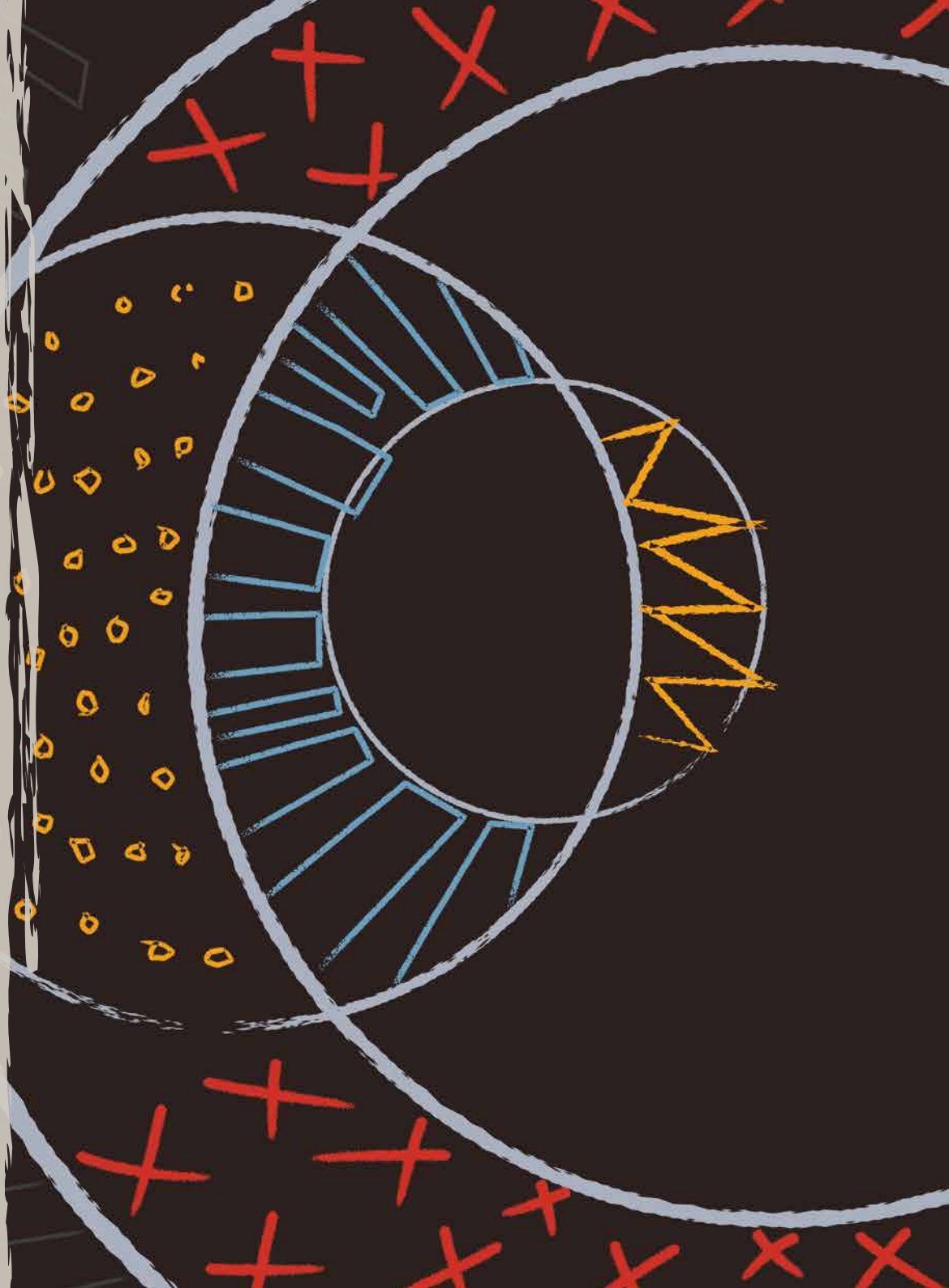
Environmental futures of Asia and the Pacific



Chapter 1
Environmental futures of Asia and the Pacific

The landmark report of the United Nations Secretary General, *"Our Common Agenda*, calls for "urgent and bold steps to address the triple crisis of climate disruption, biodiversity loss and pollution destroying our planet."[1]

More than half of the key indicators of planetary system function are at all-time highs or lows.[2] People across Asia and the Pacific have experienced extended drought, heatwaves, devastating flooding, wildfires, and extreme cyclones, while water stress is a new normal in parts of South and South-West Asia.[3] In the midst of Earth's sixth mass species extinction,[4] decline in biodiversity-related ecosystem services in Asia and the Pacific is estimated to be the most rapid and serious among all regions.[5] The report draws heavily on stakeholder consultations and a wave of evidence that tipping points are near or already passed. Rather than a conclusive assessment of the state and future of the Asia-Pacific region, *Asia-Pacific Futures 2040* draws from the collective thinking of participants in a participatory foresight process. Traditional policymaking has focused on the past or on current drivers, assessing progress and suggesting short-term solutions. Deep structural problems such as gender and other inequalities, environmental externalities,rapid, often unplanned urbanization, and a GDP-first growth model, are taken into account by this report.

Drawing from futures studies "of possible, probable and preferable futures, including the worldviews and myths that underlie each future,"[6] this report asks what futures do people wish for, and develops steps to arrive at this future through "backcasting". This approach enables broad and deep consideration of the paths forward, using scenarios of possible futures to capture possible variations in the way forward, as the future is unpredictable.[7] Governments are increasing their

1 United Nations, Our Common Agenda: Report of the Secretary-General (New York, United Nations, 2021). Available at: www.un.org/en/content/common-agenda-report/assets/pdf/Common_Agenda_Report_English.pdf

2 W. J. Ripple and others, World scientists' warning of climate emergency 2021, BioScience 71(9), 894–898 (2021). Available at: https://doi.org/10.1093/biosci/biab079

3 World Economic Forum and AlphaBeta, The Future of Nature and Business (Cologny/Geneva, WEF, 2020). Available at: www3.weforum.org/docs/WEF_The_Future_Of_Nature_And_Business_2020.pdf

4 C. Gerardo, P. R. Ehrlich and R. Dirzo, Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines, PNAS (2017). Available at: www.pnas.org/content/114/30/E60895 World Wide Fund for Nature, Living Planet Report 2020: Bending the Curve of Biodiversity Loss (Gland, Switzerland; WWF, 2020). Available at: https://livingplanet.panda.org/

6 Sohail Inayatullah, What Works: Case studies in the Practice of Foresight. Tamsui, Tamkang University, 2015

7 Sohail Inayatullah, Futures studies: theories and methods, in Fernando Gutierrez Junquera, ed., There's a Future: Visions for a Better World, 36-66 (Madrid, BBVA, 2013)

experience with applying this approach to complex challenges.[8] *Asia-Pacific Futures 2040* strengthens the pull of the future toward the preferred image of a green, inclusive and resilient Asia and the Pacific. Most importantly, in line with the transformative futures methods, it is "committed to multiple interpretations of reality" beyond what is empirically verifiable[9] — examining layers of reality to access defining worldviews and narratives.

A looming crisis

The 26th Conference of Parties (COP26) of the United Nations Framework Convention on Climate Change (UNFCCC) in November 2021 provided an opportunity for countries to raise the ambition of their nationally determined contributions so that they would be better aligned with the Paris Agreement goal of keeping global temperature increase well below 2 degrees and more importantly within the critical threshold of 1.5 degrees as defined by the IPCC. Nevertheless the commitments and pledges yielded ahead of, and during COP26, could see temperature increases of around 2.4 degrees by 2100[10] - which would bring severe consequences for people.

The IPCC warns that "business-as-usual" would likely take us to the critical threshold of 1.5°C to 2.0°C of warming within this decade, by 2030. Our overheated planet would suffer global average temperatures elevated by as much as 5.5°C. Even if action is immediate, stabilizing current negative trends likely requires 20 to 30 years, or a full generation.[11]

Asian and Pacific countries are likely to be among the most affected. The region is especially vulnerable to disaster, growing income inequality, persistent socio-cultural discrimination, and evolving economic and political pressures. While investment in robust early warning systems has resulted in fewer people dying of natural disasters, the region is ill-prepared for a risk landscape that is currently being reshaped and expanded by climate change and the COVID-19 pandemic. ESCAP's projections estimate that annual economic losses from cascading risk could almost double to US$ 1.344 billion, equivalent to 4.2 per cent of Asia-Pacific GDP under the worst-case climate change scenario.[12] Other estimates point to a climate-change-induced decrease in the South-East Asian GDP of some 11 per cent by the end of the century,[13] and net welfare losses in Central Asia

8 Asian Development Bank, Futures Thinking in Asia and the Pacific: Why Foresight Matters for Policy Makers (2020). Available at: www.adb.org/sites/default/files/publication/579491/futures-thinking-asia-pacific-policy-makers.pdf. Available at: https://www.bbvaopenmind.com/wp-content/uploads/2013/03/03_estudios_futuro1.pdf

9 Sohail Inayatullah. Futures Studies (2013).

10 Climate Action Tracker. Glasgow's one degree 2030 credibility gap: net zero's lip service to climate action. (November 2021). Available at: https://climateactiontracker.org/documents/997/CAT_2021-11-09_Briefing_Global-Update_Glasgow2030CredibilityGap.pdf

11 Collins, M., R. Knutti, J. Arblaster, J.-L. Dufresne, T. Fichefet, P. Friedlingstein, X. Gao, W.J. Gutowski, T. Johns, G. Krinner, M. Shongwe, C. Tebaldi, A.J. Weaver and M. Wehner, 2013: Long-term Climate Change: Projections, Commitments and Irreversibility. In: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: www.ipcc.ch/site/assets/uploads/2018/02/WG1AR5_Chapter12_FINAL.pdf

12 ESCAP, Resilience in a Riskier World, Asia-Pacific Disaster Report 2021 (Bangkok, United Nations, 2021). Available at: www.unescap.org/kp/2021/asia-pacific-disaster-report-2021

13 ADB, A Region At Risk: The Human Dimensions of Climate Change in Asia and The Pacific (Manila, ADB, 2017). Available at: www.adb.org/sites/default/files/publication/325251/region-risk-climate-change.pdf

of some US$ 66 million in by 2040.[14]

The number of people migrating voluntarily and involuntarily in Asia and the Pacific is estimated to have been 65 million in 2019.[15] Even with concerted action, by 2030 some 40 million people in South Asia who are likely to become climate migrants, by one estimate,[16] would swell the numbers of people migrating voluntarily and involuntarily in the Asia-Pacific region.

Displacement due to a range of phenomena is already well underway — primarily made up of populations with environmentally sensitive livelihoods and those living in vulnerable and marginal areas. The displacement of people is projected to increase to 2050 and accelerate after that point, with the potential to cause instability, tension and conflict.[17] For the Small Island Developing States of the region, the environmental crisis threatens their very existence.

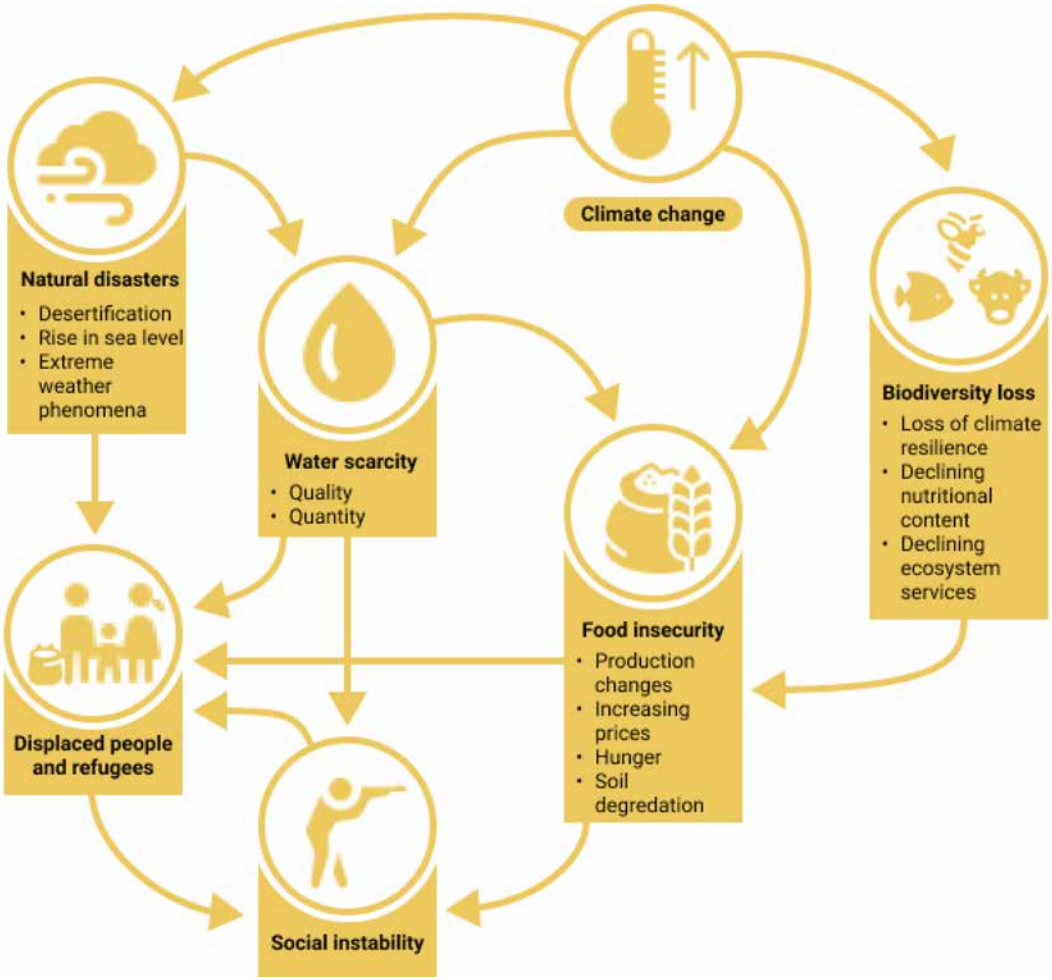
14 CAREC Institute, Visiting Fellow Program 2020: Assessing Economic Impact of Climate Change on Agriculture (Urumqi, Xinjiang, China; CAREC Institute, 2020). Available at: www.carecinstitute.org/publications/visiting-fellow-program-2020-assessing-economic-impact-of-climate-change-on-agriculture/

15 ESCAP, Asia-Pacific Migration Report 2020: Assessing Implementation of the Global Compact for Migration (Bangkok, United Nations, 2020). Available at: www.unescap.org/resources/asia-pacific-migration-report-2020

16 S. Harjeet and others, Costs of Climate Inaction: Displacement and Distress Migration (Johannesburg, ActionAid International, 2020). Available at: https://actionaid.org/publications/2020/costs-climate-inaction-displacement-and-distress-migration

17 K. K. Rigaud and others, Groundswell: Preparing for Internal Climate Migration (Washington, DC, World Bank, 2018). Available at: https://openknowledge.worldbank.org/handle/10986/29461

Figure 1.1 Environmental change and human vulnerability



Adapted from: Instituto Español de Estudios Estratégicos. Panorama of geopolitical trends: Horizon 2040. (Government of Spain, 2019)

Course correction needed

There is under-delivery on the environmental Sustainable Development Goals (SDGs) in particular SDGs 12, 14 and 15 in Asia and the Pacific.[18] Against this backdrop the Asia-Pacific economies are among of the most resource intensive and waste producing in the world. More than half of endangered and threatened species are endemic to this region.

The UNFCCC Secretariat estimates that global emissions must be reduced by 45 per cent by 2030 to keep warming to no more than 1.5°C, but Nationally Determined Commitments (NDCs) submitted as of September 2021 targeted only about one quarter of what is needed.[19] ESCAP's analysis of Asia-Pacific emissions reduction targets, as of October 2021, concludes that commitments translate to one third of the needed[20] reductions. Emissions must, therefore, be reduced three times as quickly as currently planned. Failing to deliver on planned targets could mean almost doubling of GHG emissions by 2030.[21]

One year from the onset of the pandemic, an analysis of spending by leading economies, finds that only 18 per cent of announced recovery spending can be considered 'green,'[22] despite near-universal commitments to recovery spending that 'build back better.'

Changing gears with urgency, solidarity and ambition

There is a real risk of falling into apathy. But there is also reason to be hopeful. The economics of energy are changing, with renewable energy prices falling below the cost of fossil fuels for electricity generation some parts of the region. The pandemic response has revealed the power of partnership and of social solidarity. Despite facing severe hardships of disrupted education, unemployment and decreasing civic space, members of Generation Z, born between 1997 and 2012, are, in general, optimistic and confident in their ability to effect meaningful

18 ESCAP, Asia and the Pacific SDG Progress Report 2020 (Bangkok, United Nations, 2020). Available at: https://www.unescap.org/publications/asia-and-pacific-sdg-progress-report-2020

19 United Nations Framework Convention for Climate Change (UNFCCC), "Nationally determined contributions under the Paris Agreement, Synthesis report by the secretariat" (2020). Available at: https://United Nations Framework Convention for Climate Change (UNFCCC).int/documents/306848

20 Against a baseline of 2010 emissions levels and based on pre-COP26 commitments. See ESCAP UNWomen, and Greenwerk, Is 1.5 C within Reach for the Asia-Pacific Region? Ambition and Potential of NDC Commitments of the Asia-Pacific countries (Bangkok, United Nations, 2021). Available at: https://www.unescap.org/kp/2021/15degc-within-reach-asiapacific-region-ambition-and-potential-ndc-commitments-asia-pacific#:~:text=Ambition%20and%20Potential%20of%20NDC%20Commitments%20of%20the%20Asia%2DPacific%20Countries,-Report&text=Countries%20in%20the%20Asia%2DPacific,of%201.5%C2%B0C%20goals. See also ESCAP Progress of NDC implementation in Asia-Pacific: Methodological Framework and Preliminary Findings (Bangkok, United Nations, 2020). Available at: https://www.unescap.org/resources/progress-ndc-implementation-asia-pacific-framework-andpreliminary-Findings

21 ESCAP UNWomen, and Greenwerk, Is 1.5 C within Reach for the Asia-Pacific Region? Ambition and Potential of NDC Commitments of the Asia-Pacific countries (Bangkok, United Nations, 2021)

22 Oxford Economic Recovery Project and United Nations Environment Programme (UNEP), "Are we on track for a green recovery? Not Yet" (2021). Available at: https://www.unep.org/news-and-stories/press-release/are-we-track-green-recovery-not-yet

change.[23] This generation will make up one quarter of the region's population by 2025. The 'digital generation' is environmentally conscious,[24] values creativity and collaboration,[25] and is aided by technology that is precipitating change in financial systems, businesses and the way societies live and work.

The private sector is also stepping forward – in places. The ESCAP Sustainable Business Network is developing a Green Deal For Business reflecting a changing mood of companies brought about by the need to manage reputations, risk and changing consumer preferences. As one example of this shift, Australian businesses have argued for tougher GHG emission reduction targets, proposing that reductions of up to 50 per cent below 2005 levels by 2030 were achievable, and would also provide "big benefits" to the economy.[26]

A focus on a green, resilient and more equal Asia and the Pacific, in line with the vision of the 2030 Agenda for Sustainable Development, the Paris Agreement and other global environmental and human rights agendas, holds the potential to avert the worst aspects of an environmental crisis and create economic opportunities. Game-changing investments in sustainable infrastructure could add another $3 trillion in business and 117 million jobs by 2030[27] while mitigating emissions and improving quality of life. In South-East Asia alone, opportunities to make built environments smarter could be worth up to $26 billion, while improving quality of life indicators by between 10 and 30 per cent, improving public health and safety, creating a cleaner and more sustainable environment and supporting civic engagement.[28] Similarly, investing in sustainable agricultural practices improves climate resilience, agrobiodiversity, and food safety.

Higher levels of ambition are needed, and ambition is growing. Of the 53 Asia-Pacific countries, 34 carbon neutrality pledges have been made – and counting. All Asia-Pacific countries have submitted INDC or NDC statements, which outline a plan for reducing their GHG emissions.

While high-profile climate action captures the headlines, there is still a long way to go on ramping up the actions for other important environmental issues, including soil degradation, water scarcity, biodiversity loss, ocean health, and food security.

23 McCann Worldgroup Asia Pacific, "89% of Gen Z in APAC Believe They Have the Power to Influence Global Brand's Actions and Behaviours for the Better" (2021). Available at: https://www.lbbonline.com/news/89-of-gen-z-in-apac-believe-they-have-the-power-to-influence-global-brands-actions-and-behaviours-for-the-better

24 Aimee Kim and others, "What makes Asia−Pacific's Generation Z different?" (2020). Available at: https://www.mckinsey.com/business-functions/marketing-and-sales/our-insights/what-makes-asia-pacifics-generation-z-different

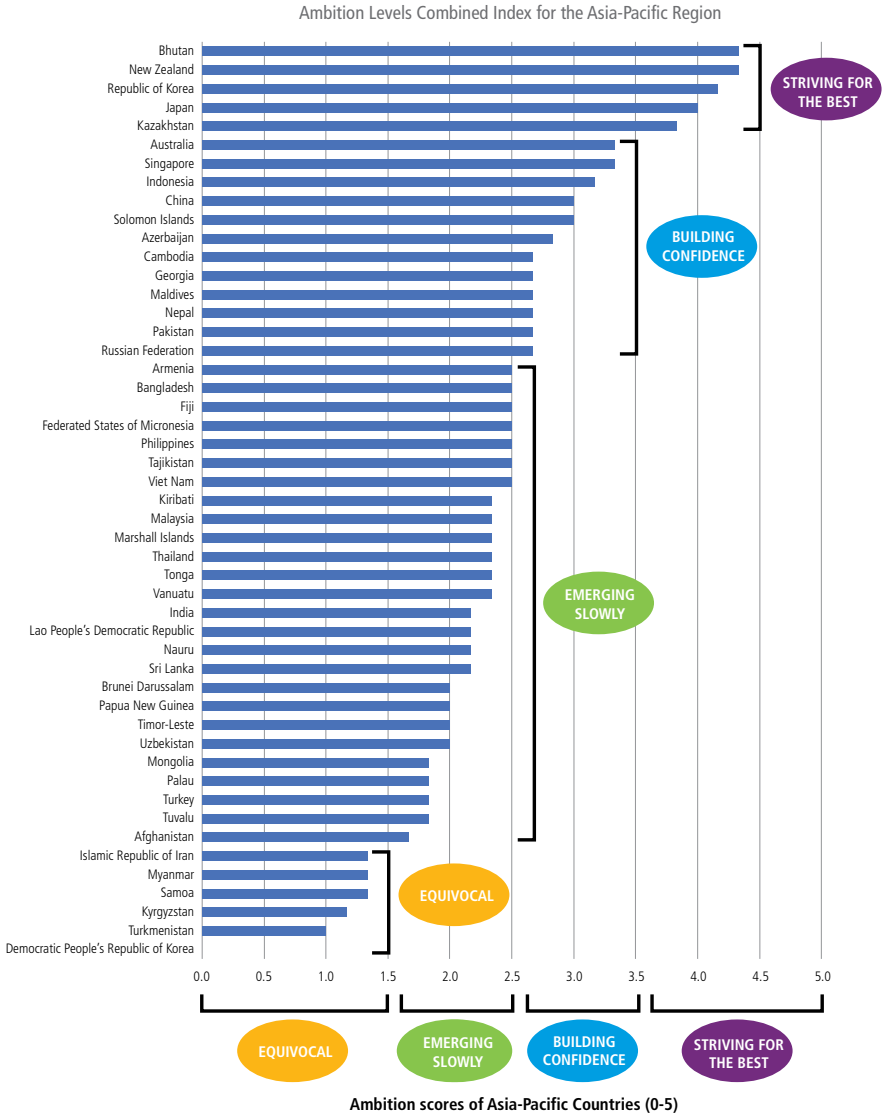
25 Elodie Gentina, "Generation Z in Asia: A Research Agenda" (2020) in The New Generation Z in Asia: Dynamics, Differences, Digitalisation (The Changing Context of Managing People) Emerald Publishing Limited, Bingley, pp. 3-19., ed. by Elodie Gentina and Emma Parry. Available at: https://doi.org/10.1108/978-1-80043-220-820201002

26 Cable News Network (CNN). "Australia's energy minister dismisses call for tougher carbon emission limits on polluters" (2021). Available at: https://www.cnn.com/2021/10/10/australia/australia-emissions-targets-polluters-intl-hnk/index.html

27 World Economic Forum. New Nature Economy Report II: The future of nature and business (2020). Available at: http://www3.weforum.org/docs/WEF_The_Future_Of_Nature_And_Business_2020.pdf

28 McKinsey Global Institute (2018), "Smart Cities in Southeast Asia". Available at https://www.mckinsey.com/~/media/mckinsey/industries/capital%20projects%20and%20infrastructure/our%20insights/smart%20cities%20in%20southeast%20asia/mgi-smart-cities-in-southeast-asia.pdf

Figure 1.2 Climate ambition scores of Asia-Pacific countries



Source: ESCAP, UNEP, UNWomen and the greenwerk. Is 1.5 C within Reach for the Asia-Pacific Region? Ambition and Potential of NDC Commitments of the Asia-Pacific countries (United Nations, Bangkok, 2021).

Assessing where we are, and stepping forward to a realistic but ambitious future

With the objective to identify realistic, strategic and potentially game-changing interventions, ESCAP convened government officials, civil society organizations and other experts to define and explore alternative future scenarios for Asia and the Pacific in 2040. These scenarios are the result of a facilitated "transformative futures" process involving two facilitated futures workshops, desk reviews and further expert inputs to map out a no-regrets path to a preferred future (see box 1.1).[29] An ESCAP team built on the wealth of inputs from the experts' workshops to further develop and enrich each scenario.

The results of the workshops, desk reviews and expert inputs are presented in this report to support social dialogue, inspire and inform a strategic shift to a more hopeful future path. **Chapter 2** explores some of the systemic factors that can help shift the balance towards a sustainable future. The Insights provides an overview of trends and insights into four domains for environmental action: climate action, healthy ecosystems, clean air and sustainable urbanization that help to anchor the scenarios.

29 The process started in September 2020 with training of ESCAP staff members in transformative futures methodology. Process design and futures literacy support was provided by Metafuture.org and Professor Sohail Inayatullah, UNESCO Chair in Futures Literacy. Two workshops held in September and October 2020 engaged more than 100 participants from Asia-Pacific countries and different stakeholder groups, including government experts, youth, academia and development partners

In **Chapter 3**, four types of scenarios with a time horizon to 2040 are presented:

- **A preferred scenario – the ideal, somewhat utopian future;**
- **A disowned scenario – the future that is not wanted, largely based on business as usual;**
- **An "integrated scenario" – integrates the most compelling of the previous two scenarios to present a plausible, but ambitious scenario for the future; and**
- **An 'outlier' scenario – the future where a series of overlooked factors, or 'blind spots' become disruptive.**

Of the four scenarios presented in Chapter 3, the integrated scenario is the most compelling, because of its optimistic but potentially achievable vision of Asia and the Pacific in 2040. **Chapter 4** looks at what needs to happen to deliver on this scenario, stepping back from 2040 to 2021.

Box 1.1 Applying transformative futures methods to produce the *Asia-Pacific futures in 2040* report

Over the last 50 years the study of the future has moved from predicting the future, to mapping alternative futures, to shaping positive visions of the futures.[(a)] This report draws on transformative futures methods to outline alternative futures for Asia and the Pacific in 2040. It also proposes a roadmap in which each milestone progressively opens the way for transformation towards the desired future scenario of a green, resilient and inclusive Asia-Pacific in 2040.

Two workshops organized by ESCAP in September and October 2021 invited the participation of government and civil society experts, think tanks, academia, development partners and ESCAP staff. Working group compositions enabled deep dives into key environmental themes and, at the same time, exploration of the broader development context of the region. As reflected by the "Insights" special feature of this report, working groups were organized to address the topics of – clean air, healthy ecosystems, climate action, and sustainable urbanization, and a fourth topic, Asia and the Pacific in 2040.

The first workshop focused on the following questions:

1. What are some of the "used" futures, i.e. the narratives and worldviews that prevent change towards a green, resilient and inclusive Asia and the Pacific?
2. What seems impossible now, but if, possible, would enable a desired future?

3. What are the key elements of four alternative futures?
   d. a "disowned" future – a negative scenario of "business as usual"
   e. an "ideal" future, a utopian future that provides clarity on the direction of change
   f. an "integrated" future, which brings the disowned and ideal future together to present a realistic but ambitious vision of the future; and
   g. an "outlier" scenario

One month later, the second workshop engaged the same group of participants in:

1. Revisiting and deepening the scenarios, which had been elaborated by the ESCAP team
2. A "causal-layered analysis" to compare the current reality and the desired future. This futures research technique looks at change through the lens of progressively deeper layers of reality – from the superficial picture of what is seen daily, to the worldviews and myths that shape each; and
3. "Back-casting", brainstorming steps to the desired future, looking backwards from 2040.

The results of these short workshops provide the foundation for this report. Chapter 2 explores some of the debates. The "Insights" special feature touches on trends that anchored the workshop discussions. Chapter 3 shares the scenarios elaborated post-workshop by the ESCAP team, synthesizing across working group themes. Chapter 4. considers participant feedback in laying a path to a desired future, with a focus on milestones that governments and stakeholders can establish together. The challenge of this report was to resist presenting a shopping-list of actions, and to focus on the deeper layers of change.

The futures methods used in this process can be applied at multiple scales, from the individual to the institutional, to the national and as in this report, the regional level. These methods are particularly useful for exploring wicked problems such as those at the environment and development interface.

In a comprehensive process transformative futures methods provide an opportunity for the host/lead institution to consider the internal changes needed to shape the desired future. Governments across the region, including from Armenia, Cambodia, Mongolia, the Philippines, and Timor-Leste among others, have applied these methods to look at issues ranging from institutional change in economic planning, to economic structure change.[(b)]

(a)See Sohail Inayatullah, Futures studies: theories and methods," in Fernando Gutierrez Junquera, ed., There's a future: Visions for a Better World. Madrid, BBVA, 2013, 36-66.
(b) See Asian Development Bank, Futures Thinking in Asia and the Pacific: Why Foresight Matters for Policy Makers (ADB, Manila, 2020)

2

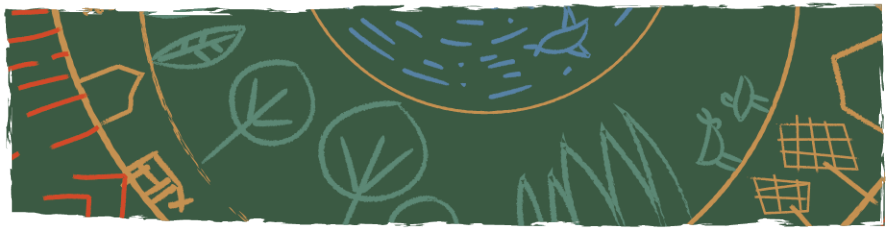
Shaping opportunities for change

Chapter 2
Shaping opportunities for change

Any thinking around environmental futures needs to take into account the factors that could change the direction of environmental trends. Drawing from the workshop discussions and further reflection within the Environment and Development Division, five 'big-ticket' thematic drivers described in this chapter helped to elaborate key points of the alternative future scenarios presented in Chapter 3.

- **Rising environmental consciousness**
- **Evolving food systems**
- **Demand for natural resources and shifts in ownership and control**
- **Rural-urban dynamics and**
- **Environmental governance**

The description of each thematic driver of change also outlines the forces for and against change in relation to each of these. Identifying these forces for change helps to localize responses to the challenge of creating a more sustainable pathway forward. They also influence the alternative futures described in Chapter 3.



Rising environmental consciousness

Some of the most dramatic growth in engagement on environmental awareness has happened in Asia and the Pacific – notably in India, Indonesia and Pakistan.[30] Public attitudes influence political action and mobilize people and resources, and are critical drivers of change.

Scientists have joined youth activists and grassroots movements in stridently and unapologetically challenging governments to take action on environmental issues ranging from climate change mitigation to biodiversity protection and the right to clean water and air. Consumers, especially those from younger age groups, are now willing to pay higher prices for environmentally conscious goods and services, various reports show.[31] There is now broad support for comprehensive climate responses across nationalities, age groups, expressions of

30 Economist Intelligence Unit. An Eco-wakening Measuring global awareness, engagement and action for nature. https://eiuperspectives.economist.com/sustainability/eco-wakening-measuring-global-awareness-engagement-and-action-nature-0 (2021)

31 Partha Dave, International FMCG/CPG Report 2021: Consumer goods in a crisis (2021). Available at: https://business.yougov.com/content/35160-International-FMCG-CPG-Report-2021?_ga=2.168898273.1547063855.1631141503-1245027503.1631141503

gender and education levels.[32] Information and communication technologies are being successfully deployed to access, use, create and disseminate information, which allows activist movements to expand traditional social, political and geographic boundaries.[33]

The pandemic has highlighted the importance of family, health and social connection. People have craved social connection during periods of lockdown and are now far more likely to recognize social responsibility as a daily concern. The interest in health and a healthy diet is growing, along with the market for plant-based protein alternatives.

However, increased income inequality, disinformation, social division and diminished trust in public institutions all act against these positive trends. The ongoing *'infodemic'* of disinformation spread via the internet and the social divisions created by social media are negative outcomes of the misuse of digital public space. Civic space essential for asserting critical human rights, including environmental rights, is assessed as decreasing. Civil society also notes a "deteriorating democratic and human rights situation in Asia,"[34] as well as increasing violence against women, minorities and marginalized social groups. Environmental defenders are subject to harassment and are being killed in increasing numbers.[35]

Other factors that constrain progress in a positive direction are shown in figure 2.1. Whether a sufficient, critical mass of people and governments will shift towards sustainability worldviews that positively influence consumption and production behaviour is still to be revealed.

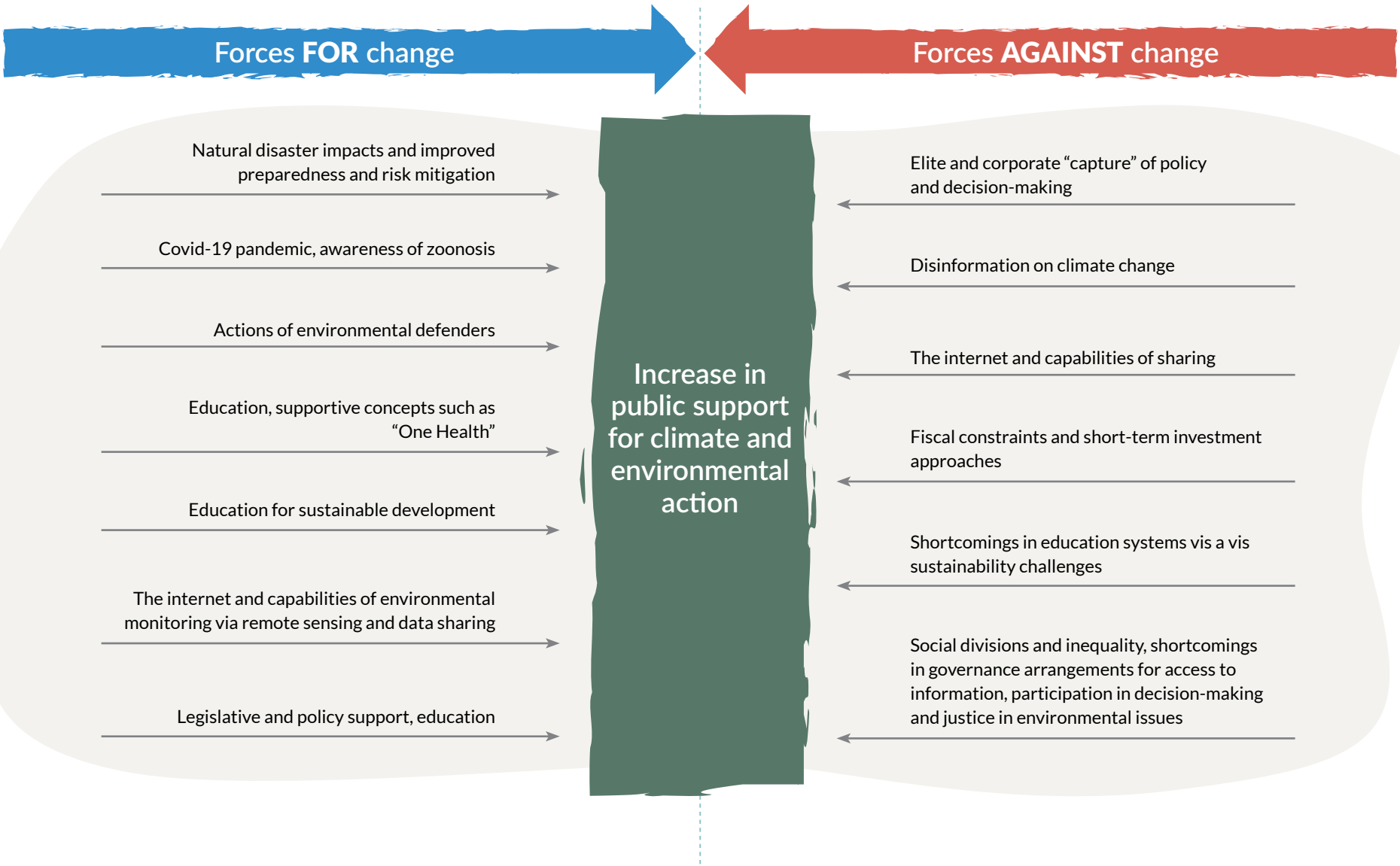
32 Emily Gray and Chris Jackson, "How does the world view climate change and COVID-19?" (2020). Available at: https://www.ipsos.com/sites/default/files/ct/news/documents/2020-04/earth-day-2020-ipsos.pdf - 14 countries polled are: Australia, Brazil, China, Canada, France, Germany, Great Britain, India, Italy, Japan, Mexico, Russia, Spain and the United States of America. Of these: nine are nationally representative samples, the other 5 are based on a national sample that is more urban and educated, and with higher incomes than their fellow citizens.

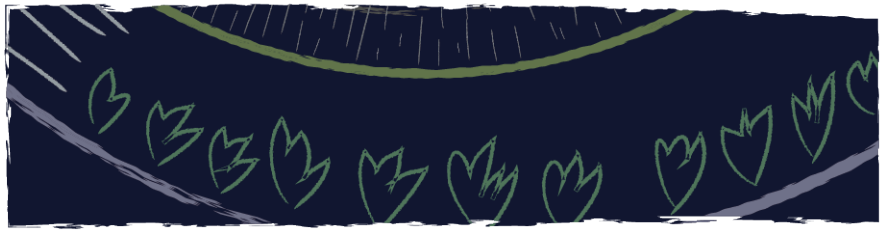
33 Jessica Vandrick, "The Internet's Influence on Environmental Awareness" (2011). Available at: https://via.library.depaul.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1010&context=cmnt

34 Asia Development Alliance, "Declaration of the SDG16 Plus Forum – Asia" (2021). Available at: https://ada2030.org/

35 Global Witness, 2021. "Last Line of Defense: The industries causing the climate crisis and attacks against land and environmental defenders. Available at: https://www.globalwitness.org/en/campaigns/environmental-activists/last-line-defence/

Figure 2. 1 Forces for and against increase in public support for climate and environmental action





Evolving food systems

Nearly one in ten people globally and just over 1 billion people in Asia and the Pacific face moderate or severe food insecurity.[36] Looking to the future, food production must increase by some 60 per cent relative to 2005-2007 to meet global needs by 2060. However, one survey of some 400 business leaders showed that about 40 per cent have little or no confidence that current food systems will adequately meet future needs a decade from today.[37] The FAO Food Price Index in September 2021 showed that nominal food prices increased by almost a third in only one year.[38] When inflation is factored in, real food prices are estimated to be higher than in 2010, when food prices contributed to the Arab Spring.[39]

While needing to adapt to climate and environmental change, the food system is also a driver of environmental degradation. Research by ESCAP shows that food supply chains across the region are becoming less climate resilient, as food suppliers consolidate and markets lose diversity of supply.[40] Unsustainable approaches to production, processing, distribution and consumption of agricultural products drives extraction of natural resources including water, loss of agrobiodiversity, land-use change and biodiversity loss, soil erosion, loss of stored carbon, and generation of GHG emissions. The International Resources Panel estimates that cultivation and processing of biomass is responsible for almost 90 per cent of global water stress and land-use related biodiversity loss.[41] In South-East Asia, North-East Asia and South-West Asia, unsustainable crop production is the biggest threat to biodiversity, including the loss of essential

36 Food and Agricultural Organization of the United Nations, International Fund for Agricultural Development, United Nations International Childrens' Fund, World Food Programme and World Health Organization, The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets (Rome, 2020). Available at: https://doi.org/10.4060/ca9692en

37 Economist Intelligence Unit, "Fixing Asia's food system", (Cargill, 2018). Available at: https://impact.economist.com/perspectives/sites/default/files/Fixing_Asia%27s_food_system_0.pdf?_ga=2.6474034.1885712465.1637395704-26587691.1636894193

38 Food and Agricultural Organization of the United Nations (FAO), "World Food Situation", 2021. Available at: http://www.fao.org/worldfoodsituation/foodpricesindex/en/

39 Alastair Smith, "Why global food prices are higher today than for most of modern history" (2021). Available at: https://theconversation.com/why-global-food-prices-are-higher-today-than-for-most-of-modern-history-168210

40 ESCAP, Asian Development Bank, United Nations Development Programme, Policy brief: An application of resilience thinking to Asia-Pacific food systems, Asia Pacific SDG Partnership (2018). Available at: https://sdgasiapacific.net/knowledge-products/0000018

41 Bruno Oberle and others, Global Resources Outlook 2019: Natural Resources for the Future We Want (UNEP, IRP, 2019). Available at: https://www.resourcepanel.org/reports/global-resources-outlook

pollinators.[42] Agriculture, forestry and land use also account for just under a quarter of anthropogenic GHG emissions and are an essential part of an effective climate response.[43]

The livelihoods of just under half of the Asia-Pacific region living in rural areas that are largely agriculture-dependent are vulnerable to climate change. In countries with special needs, this number is more than 60 per cent.[44] Globalization of supply chains means that opportunities for farmers have increased, but small farmers, including family farms that make up some 80 per cent farming families globally, produce 60 per cent of the world's food.[45] However, small farmers are challenged to link with supply chains and may earn a declining portion of the returns from agricultural production.[46] The threat of climate change, biodiversity loss, water crisis, insecure land tenure and landlessness, and natural disaster increases the precariousness and vulnerability of rural communities and livelihoods – and increases food insecurity.

The loss of biodiversity, including agrobiodiversity, threatens food security, reducing the resilience of food systems and their ability to provide access to nutritious affordable food. Only nine plant species accounted for two thirds of total crop production in 2014, although some 6,000 plant species have been cultivated for food. Similarly, only a handful of animal species provide the vast majority of the global output of meat, milk and eggs.[47] The reliance of the global food production system on a small number of high-yielding but genetically uniform varieties contributes to deterioration of agrobiodiversity. Climate change is projected to be the most significant driver of biodiversity loss by the end of the century,[48] with marine and freshwater organisms more vulnerable than terrestrial, and variable impacts across geographic scales.[49] The loss of agrobiodiversity threatens the climate resilience of farming systems, degrading the flow of the very ecosystem services on which a productive farm depends, including pollination andsoil health. The erosion of crop diversity is an often-overlooked threat to food security and nutrition.[50]

42 Madhav Karki and others, The IPBES regional assessment report on biodiversity and ecosystem services for Asia and the Pacific (2018). Available at: https://doi.org/10.5281/zenodo.3237373

43 United Nations Framework Convention on Climate Change, "Land use, land-use change and forestry (LULUCF)" Available at: https://United Nations Framework Convention for Climate Change (UNFCCC).int/topics/land-use/workstreams/land-use--land-use-change-and-forestry-lulucf

44 Food and Agricultural Organization of the United Nations (FAO), The Future of Food and Agriculture – Trends and Challenges (2017). Available at: https://www.fao.org/3/i6583e/i6583e.pdf

45 Food and Agricultural Organization of the United Nations (FAO), "Family Farming in Asia and the Pacific" (2021). Available at: http://www.fao.org/family-farming/regions/asia/en/

46 Food and Agricultural Organization of the United Nations (FAO), "COVID-19 & Family Farming" (2021). Available at: http://www.fao.org/family-farming/themes/covid/en

47 Bélanger, J. and Pilling, D. (eds.), The State of the World's Biodiversity for Food and Agriculture (2019). Available at: https://www.fao.org/documents/card/en/c/ca3129en/

48 Millennium Ecosystem Assessment (2005). Available at: https://www.millenniumassessment.org/en/index.html

49 Hans-Otto Pörtner and others, "IPBES-IPCC co-sponsored workshop report on biodiversity and climate change" (2021). Available at: https://doi.org/10.5281/zenodo.4920414

50 Food and Agricultural Organization of the United Nations (FAO), Voluntary Guidelines for the Conservation and Sustainable Use of Farmers' Varieties/Landraces (2019). Available at: https://reliefweb.int/report/world/voluntary-guidelines-conservation-and-sustainable-use-farmers-varietieslandraces

The hidden costs of mortality and non-communicable diseases linked to current food consumption patterns are growing. Globalization and internationalization of food markets have helped 'standardize' dietary patterns. In Asia and the Pacific, some 1 billion people are overweight and obese, roughly 40 per cent of the global total. Increasing per capita consumption of animal products and processed foods that are high in salt, sugar and saturated fats are outstripping expansion of healthy eating habits. Costs are projected to exceed US$ 1.3 trillion globally per year by 2030. Current diets have an even higher climate-related cost of some USD 1.7 trillion per year – for a total of US$ 3 trillion per year. Meat consumption is an important contributor to these costs.

High-profile food safety incidents have prompted interest in healthy eating and demand for organic or sustainably grown foods. However, certification systems that would allow traceability, empower consumers and reward responsible farmers remain fragmented, and in some markets, irrelevant.
The sustainability of food systems will rely on trends across different subsystems of the food supply chain and sectors that drive demand. Farming operations, processing and production of farming inputs, and the support provided to farmers by extension services can all influence sustainability of the food system. However, economic incentives for the production of industrial monocultures are often more potent than those for sustainable production modes. The systems with which the food system interacts, such as innovation, transportation, energy, trade and health systems, and sectors that drive demand, including tourism and education, also need alignment towards inclusion, resilience and sustainability of food production.

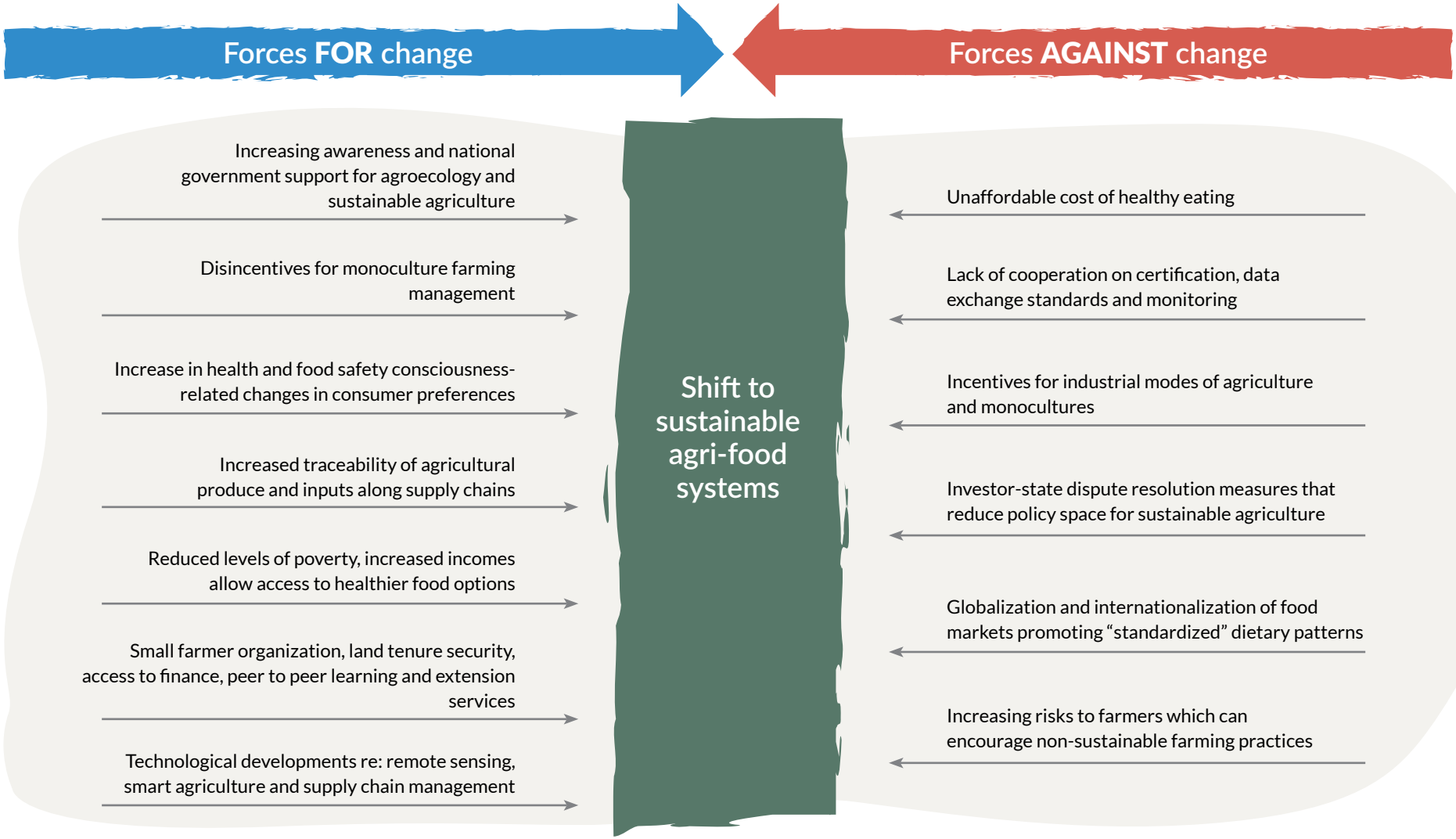
The preparatory consultations for the Food System Summit organized in the Asia-Pacific region underlined the complexity of the responses needed, ranging from the need to increase food access and utilization in both urban and rural areas, to financing.[51]

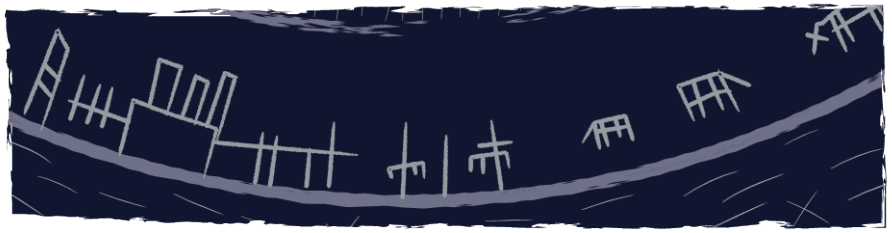
Food and water are intimately connected. Effective, collaborative and transparent governance of water and reversing ecosystem degradation are essential for ensuring that food security and ecosystem health are not compromised by water shortages. Global campaigns setting high-level targets and calling for multi-stakeholder approaches through the UN Decade on Ecosystem Restoration, the "4 per 1000" Initiative, and the UN Decade on Family Farming reflect the urgency of the changes needed.

Is a broad shift to "circularity", agroecology, climate-smart agriculture and other sustainable agricultural practices on the horizon, and will this be significant enough to change the picture of food systems and foster shared prosperity in 2040? Some of the complex forces 'for' and 'against' positive change in the important drivers of the scenarios developed for this report are outlined in Figure 2.2.

51 ESCAP (2020). "Transforming Food Systems: Regional policy brief." Available at: https://www.unescap.org/sites/default/d8files/knowledge-products/21-00460-%20FSS-Report-EN.pdf

Figure 2. 2 Forces for and against shifts to sustainable agri-food systems





Demand for natural resources and shifts in ownership and control

Natural resource extraction is projected to more than double from 2015 to reach 190 billion tonnes per year in 2060.[52] In addition to providing food, minerals and fibre, natural areas provide water, recreation and aesthetic beauty, and other ecosystem services, including disaster risk reduction and climate regulation.

Resource-use pressures are direct drivers of climate change, ongoing and accelerated biodiversity losses, water crises and geopolitical tensions. Competing needs for land – for human settlements, as a support to rural livelihoods including of indigenous people, and for food, energy and water production – mean that the potential for conflicts around resource use is increasing. Evidence suggests that "as the climate crisis intensifies, violence against those protecting their land and our planet also increases."[53] Who owns and controls natural resources, and for what purposes can either worsen inequality and social conflict or foster inclusive prosperity.

In Asia, two thirds of the farmland belongs to only 6 per cent of landowners with this trend set to worsen.[54] An ongoing 'rush' for land is driven by long-term trends, including commodity and water scarcity. Transnational land deals are noted to significantly impact water consumption and forested lands in target countries. The deal makers often come from private sector entities in wealthy, food importing countries, with a strong preference for investing in their own regions. The impact on employment tends to be limited, as these investments are usually more capital intensive than labour intensive.[55] In more than half of the land deals for which data has been recorded, conflicts have resulted, along with forced displacement of rural communities.

PAN Asia-Pacific links the rise of authoritarianism, foreign infrastructure investment and agro-industry to the eviction of forest dwellers in India, militarized internal conflict in South-East Asia and displacement of communities and landless farmers in hotspot countries. A spike has been observed in 2020. The Land and Rights Watch 2019 annual report shows that some 108 farmers, indigenous people and land activists were killed in land conflict and struggles in 14 countries in 2019.

52 Bruno Oberle and others, "Global Resources Outlook 2019: Natural Resources for the Future We Want" IRP, 2019. Available at: https://www.resourcepanel.org/reports/global-resources-outlook

53 Global Witness, "Last Line of Defence" (2021). Available at: https://www.globalwitness.org/en/campaigns/environmental-activists/last-line-defence/

54 GRAIN, "Asia's agrarian reform in reverse: laws taking land out of small farmers' hands" (2015). Available at: https://grain.org/article/entries/5195-asia-s-agrarian-reform-in-reverse-laws-taking-land-out-of-small-farmers-hands

55 Ward Anseeuw and others, "Transnational land deals for agriculture in the global south: Analytical report based on the LAND Matrix database", CDE (2013). Available at: http://citeseerx.ist.psu.edu/viewdoc/citations?doi=10.1.1.432.7830

The Philippines has been identified as one of the three deadliest countries in the world for farmers, farm workers, indigenous people and land activists, with India, Indonesia and Cambodia named as other top countries.[56]

Of the 502 transnational land deals that were recorded in the region, one quarter were for environmental purposes – producing biofuel feedstock, renewables or projects that enable payments to secure forest carbon.[57] Market-based solutions to allocate rights to resources have been used to increase equity in resource access. Regulated market solutions, such as water rights markets, have effectively managed water demand but have been found to disadvantage local communities, small farmers and indigenous people due to their lower ability to purchase resource rights.

Market-based instruments for managing water scarcity may become commonplace sooner rather than later. In Australia's Murray Darling basin, water entitlements are administered by the state and territory water regulating authorities, and allocations are based on availability, with trading allowed. Water flows through the expansive but over-extracted system have increased.[58] However, there are questions regarding the participation in local markets of international investors[59] and the ability of indigenous communities to be allocated water flows.[60] Elsewhere, some are advocating for the use of financial instruments to address water scarcity along the lines of the introduction of water futures in the NASDAQ.

At the same time, the region is home to leading examples of community management arrangements that strengthen land tenure rights, human security and environmental outcomes. Important paradigm shifts that recognize the legal personhood of environmental systems such as rivers, and emphasize a worldview that humans are part of nature have been initiated in India and New Zealand.[61] In Australia, nearly 400,000 acres of land have been returned to Aboriginal people, recognizing their rights as traditional owners.[62] These approaches all define an equitable path for securing multiple ecosystem services.

56 PAN Asia Pacific, "Land Rights Watch 2019 Year End Report", 2019. Available at: https://files.panap.net/resources/Land-and-Rights-Watch-2019-Yearend-Report.pdf

57 The Land Matrix Initiative database (2021). Available at: https://landmatrix.org/list/deals

58 Linden Whittle and others, "Economic effects of water recovery in the Murry-Darling Basin", ABARES Insights, Issue 7, 2020, Australian Government Department of Agriculture, Water and the Environment. Available at: https://daff.ent.sirsidynix.net.au/client/en_AU/search/asset/1030661/0

59 Paul Farrell and Alex McDonald. "Chinese state-owned company buys up water in the Murray-Darling" (2020). Available at: https://www.abc.net.au/news/2020-05-06/chinese-state-owned-companies-buy-up-water-in-murray-darling/12215548

60 Clint Jasper. "Traditional owners say missing out on rare opportunity to access water rights is a step backwards". ABC Rural, 24 May 2021. Available at: https://www.abc.net.au/news/2021-05-25/traditional-owners-miss-out-on-victorian-water-rights/100159640

61 Julia Hollingsworth. "This river in New Zealand is legally a person. Here's how it happened" CNN, 2020. Available at: https://www.cnn.com/2020/12/11/asia/whanganui-river-new-zealand-intl-hnk-dst/index.html

62 Daniel Victor, "Daintree Forest in Australia Is Returned to Indigenous Owners", The New York Times, 29 September 2021. Available at: https://www.nytimes.com/2021/09/29/world/australia/daintree-rainforest-indigenous.html

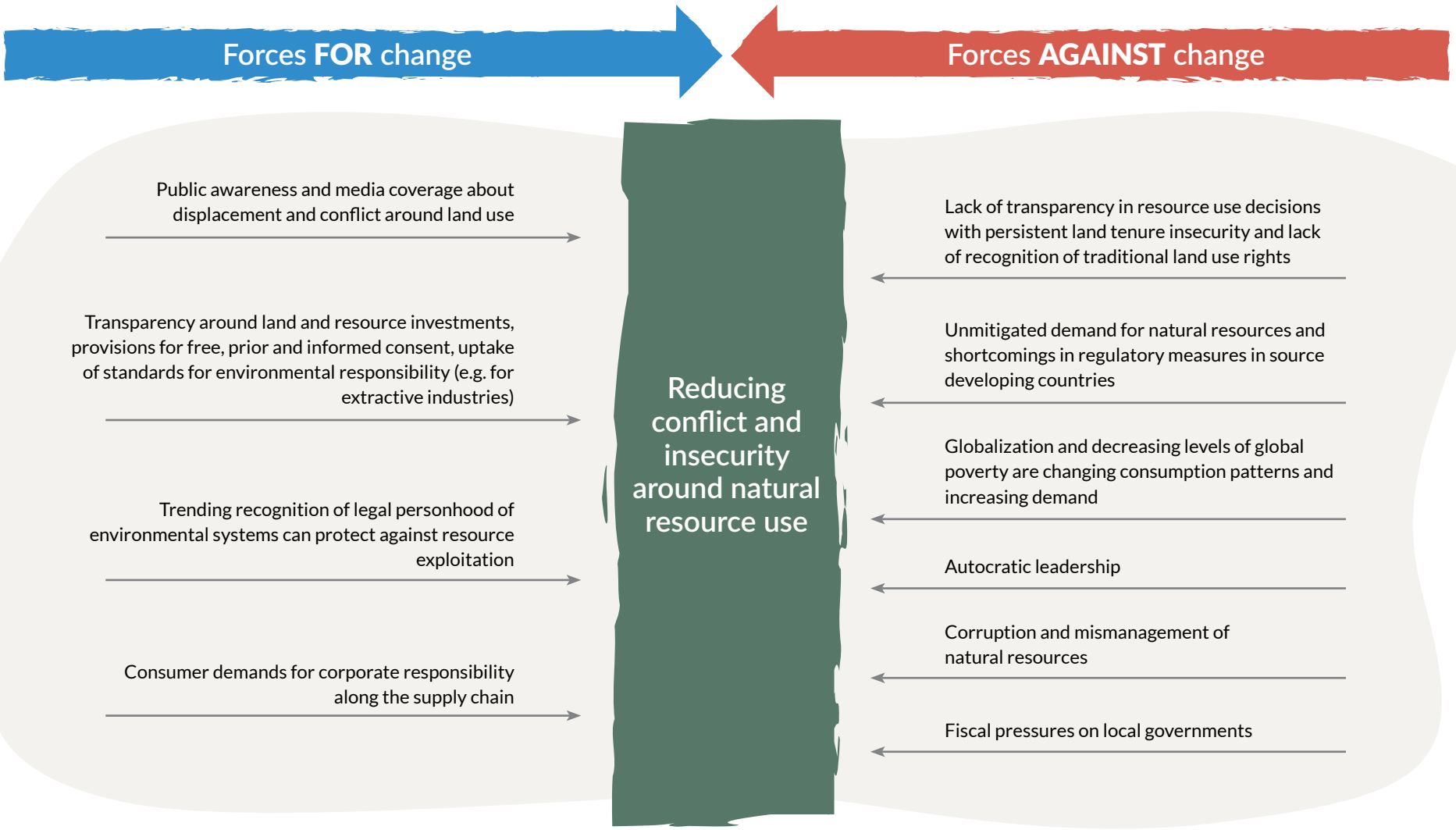
As geopolitical tensions around resource use increase, multilateral systems to govern access to and use of natural resources are being tested. Water-related tensions in South Asia, Central Asia and South-East Asia, as well as territorial disputes in the South China Sea and other parts of the region will require skilful diplomatic and multilateral cooperation and environmental governance measures.

Five inter-related factors (among others) have been found to increase the risk of societal collapse in the past – population growth, climate change, water scarcity, agriculture and energy. Two other important conditions for collapse are now converging – the "stretching of resources due to the strain placed on ecological carrying capacity" and "economic stratification of society into the rich elites and the masses."[63]

In light of the growing hunger for resources and its consequences, the region is faced with several questions. What do these trends mean for Asia and the Pacific in 2040 – in particular, with respect to social stability, and access and benefit-sharing regarding ecosystems services? In line with increasing environmental consciousness, could a shift to a dominant worldview of 'resource stewardship' help to protect critical resources? What worldviews will dominate the approaches taken by multilateral systems, governments and people in managing resources – will market-led competition and private ownership models trump resource stewardship in future generations? Figure 2.3 Forces for and against reducing conflict and insecurity around natural resource use.

63 Safa Motesharrei and others. "Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies." Ecological Economics, Volume 101, 2014, Pages 90-102, https://doi.org/10.1016/j.

Figure 2. 3 Forces for and against conflict and insecurity around natural resource use



Changes in rural-urban dynamics

The Asia-Pacific region is urbanizing quickly. The movements of people, ideas, knowledge, skills, food, other goods and capital across metropolitan areas, intermediary cities and small towns and villages are shaping the region's territorial development and connecting urban and rural economies, societies and environments.

The fastest growing settlements are intermediary cities with populations of less than 500,000 people. Still, around 30 per cent of the region's population is currently projected to be living in rural areas in 2050.[64] Urban centres of all sizes are likely to remain important economic hubs due to continued population growth and shifting rural populations seeking economic opportunity, better education and other services, and improved quality of life. Human development indicators often show stark differences in between rural and urban areas. However, rural-urban divides are narrowing in some countries, including China, India, Thailand and Viet Nam.[65]

Urbanization has been driving much of the demand for natural resources. The growth of cities is a key contributor to environmental degradation and climate change. Cities use water, energy, food and land resources intensively, and produce human and municipal waste and pollution. Almost 40 per cent of global energy-related carbon emissions come from building and construction, including operational emissions, and some 11 per cent from emissions embodied in materials and construction processes.[66] Reducing the environmental footprint in cities will determine the success of climate mitigation and adaptation measures, and broader environmental outcomes. City planning, building standards, and the promotion of recycling, reusing and reducing will be crucial to the sustainability of urban developments.

Ensuring equitable outcomes in resource sharing will play an important role in the health of both urban and rural communities, and migration pressures. Competition for freshwater between cities and agriculture is projected to grow as both agricultural and urban water demands grow.[67]

64 ESCAP, UN-Habitat and others, The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development (Bangkok, ESCAP and UN-Habitat, 2019). Available at: https://www.unescap.org/publications/future-asian-and-pacific-cities-2019-transformative-pathways-towards-sustainable-urban

65 Katsushi S. Imai and Bilal Malaeb, "Asia's rural-urban disparity in the context of growing inequality", International Fund for Agricultural Development (IFAD) Research Series 27 (2018). Available at: https://www.ifad.org/documents/38714170/40704142/27_research.pdf/86ff7619-8814-48d0-a232-fc694fcc55ce?eloutlink=imf2ifad

66 World Green Building Council. "New report: the building and construction sector can reach net zero carbon emissions by 2050" (2019). Available at: https://www.worldgbc.org/news-media/WorldGBC-embodied-carbon-report-published

67 Julie C Padowski and Steven M Gorelick, Global analysis of urban surface water supply vulnerability (2014), in Environmental Research Letters, volume 9, number 10. Available at: https://iopscience.iop.org/article/10.1088/1748-9326/9/10/104004

Managing the rural-urban interface through cooperation and coordination between urban and upstream rural communities to deal with scarcity, flood risk and pollution will be essential.[68] Re-allocation of water from rural to urban areas is a common strategy for dealing with scarcity, with water reallocation projects in Asia constituting the majority of these arrangements (called dyads) implemented in the last 20 years. Evidence that these arrangements are effective, equitable and sustainable is limited.[69] Similarly, energy infrastructure developments for power-hungry cities have long displaced rural communities.

People commute, or migrate permanently, temporarily or in 'circular' migration. Populations also shift due to climate change, natural disasters, and other aspects of environmental change. Across Asia and the Pacific there is a direct relationship between internal displacement and international migration, and extreme weather events and declining agricultural yields. Climate migration is one of the most important adaptation pathways enabling communities to recover and adapt through remittance transfers and development of skills and networks[70] – where migration is well managed and within limits that can be successfully absorbed. Coastal communities and SIDS are particularly vulnerable.

The COVID-19 pandemic has triggered "reverse migration" as migrant workers return to rural areas of origin in response to lockdowns and loss of employment. The long-term impacts of these movements are yet to be understood. Increasing vulnerability, joblessness, food insecurity, pressures on natural resources, and challenges to local governments are major concerns and provide insights into making response measures more effective in future situations.[71] On the other hand, there are also some reports that as migrant workers who sustain the region's megacities were pushed back to the hinterlands by their disproportionate exposure to COVID-19 and decreasing work opportunities, new ideas and resources were brought to rural areas.

The challenges faced by municipal administrations to improve the liveability, economic dynamism and well-being in both rural and urban areas should not be underestimated. Effective climate mitigation and adaptation strategies in rural and urban areas are essential to mitigate future refugee and humanitarian crisis resulting from climate migration.

Planning cities holistically means making cities liveable for the most vulnerable. This is ever more important for intra-urban inequalities given that the Asia-Pacific region is home to

68 Filippo Civitelli and Guillaume Gruère, Policy options for promoting urban–rural cooperation in water management: a review (2017), in International Journal of Water Resources Development, 33:6, 852-867. Available at: https://doi.org/10.1080/07900627.2016.1230050

69 Dustin Garrick and others, Rural water for thirsty cities: a systematic review of water reallocation from rural to urban regions (2019), in Environmental Research Letters, volume 14. Available at: https://iopscience.iop.org/article/10.1088/1748-9326/ab0db7

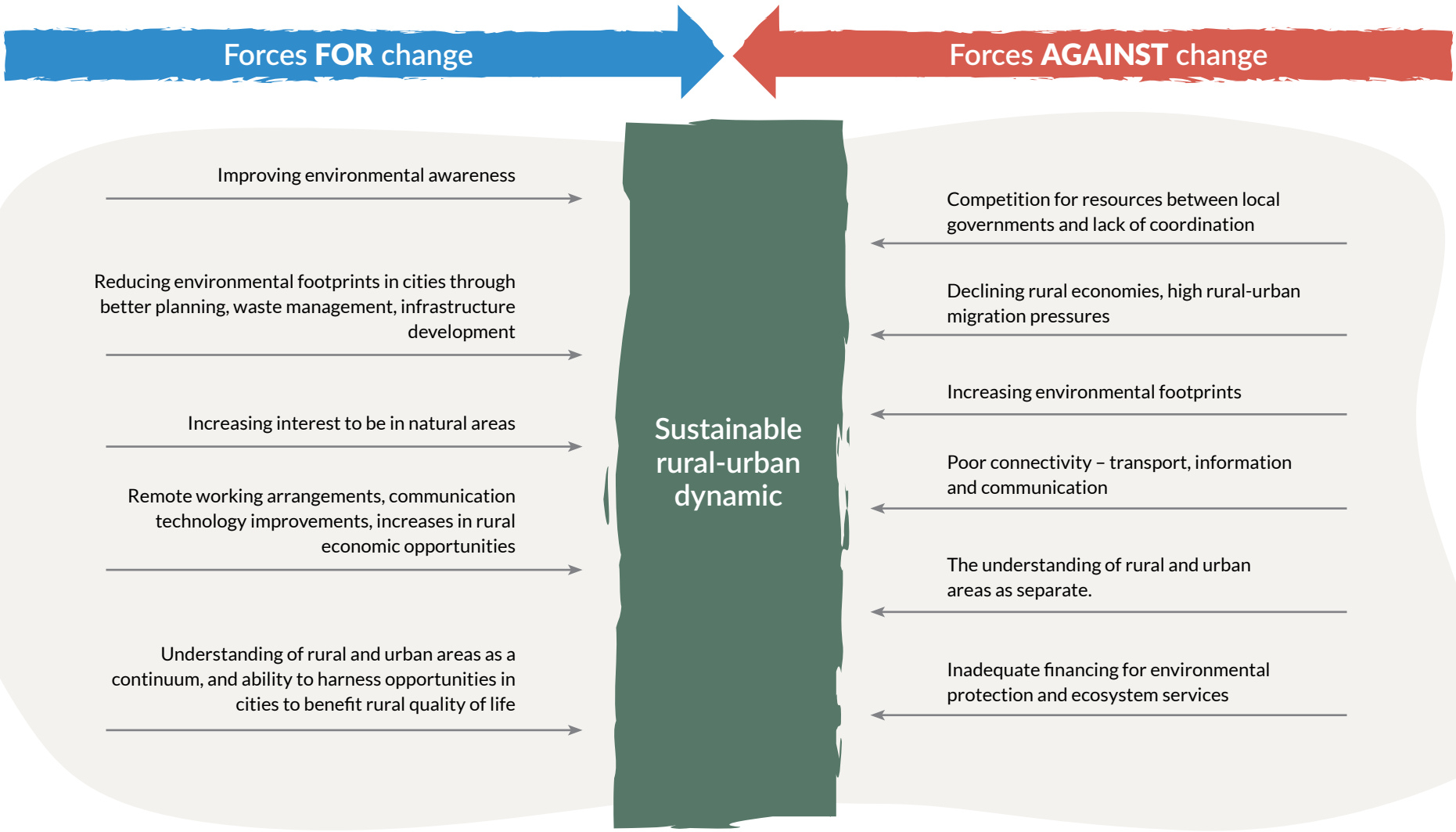
70 United Kingdom Government Office for Science and Foresight, Migration and Global Environmental Change: Future Challenges and Opportunities – Final Project Report (2011). Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/2877/11-1116-migration-and-global-environmental-change.pdf

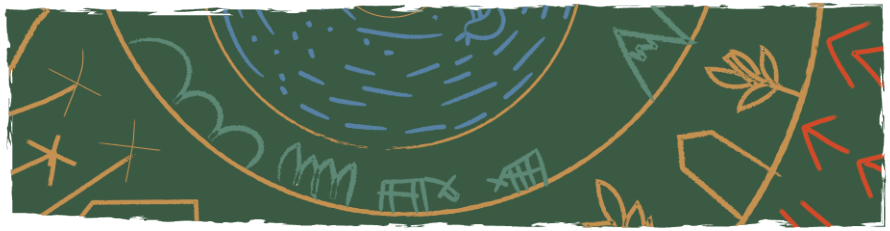
71 Food and Agricultural Organization of the United Nations (FAO), Reverse migration to rural areas of origin the context of the COVID-19 pandemic. Information note (2021). Available at: https://www.fao.org/3/cb4712en/cb4712en.pdf

the largest number of people in informal settlements globally. The growth of informal settlements emphasizes the importance of housing and tenure security and will significantly impact land-use planning and infrastructure development.

A number of questions emerge regarding urban-rural dynamics. Will cities of the future be overwhelmed and under siege by converging challenges, or will a picture of balanced territorial development emerge through well managed rural-urban dynamics – in particular with respect to the flow of people? What does this mean for land-use planning and infrastructure development in the fastest growing intermediary cities as well as in peri-urban and rural areas? Figure 2.4 identifies some of the factors that will shape a sustainable rural-urban dynamic as a positive contributor to a preferred future for Asia and the Pacific.

Figure 2. 4 Forces for and against a sustainable rural-urban dynamic





Environmental governance

Environmental governance encompasses the multi-level norms, formal and informal laws, policies and institutions that define human interaction with the natural environment. Managing access to and use of ecosystem services that support economic activity (such as agriculture and tourism), health and sustenance (such as those provided by clean water, green areas and clean air), and aesthetic, cultural and traditional dimensions of human and social needs.

Climate change, environmental scarcities, and natural disaster bring a host of environmental governance challenges. Rebalancing power dynamics and recognition of environmental degradation as a contributor to inequality are integral to these challenges. COVID-19 has tested the capacity of governments to balance public and private interests and to manage short-term recovery efforts while keeping long-term objectives in sight. Strengthening the social contract so that equality and inclusion are kept in focus is increasingly important. Inclusion and adaptiveness are also significant assets, responding to the demands for stakeholders to be heard and to contribute to decisions that directly impact them, with safe spaces to support meaningful engagement.

Delivering on substantive and procedural environmental rights tests government competence. Environmental crimes are no longer perceived as "victimless."[72] More than 155 States now recognize the right to a healthy environment in some form. Resolution 48/13 of the Human Rights Council recognizes a clean, healthy and sustainable environment as a human right. Being able to deliver on both the substantive and procedural aspects of these rights – for all people – will be a test of legitimacy in a time of environmental scarcity and social change. Being able to deliver on this right means reversing current trends of declining civic space, balancing power dynamics between different actors and the public, and aligning sometimes widely polarized interests. The public's right to access to participation, justice and decision-making in environmental matters are enshrined in the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.[73] These procedural rights have been discussed in the context of Association of Southeast Asian Nations (ASEAN) human rights processes.[74]

Healing the relationship with nature to secure critical ecosystem services. Strengthening environmental protection will mean more than just better laws and policies. It requires a shift in framing of the relationship between people and nature.

72 Kim McQuay and others, "Covid Lays Bare the Flaws in Asia's Booming Megacities" (2020). Available at: https://asiafoundation.org/2020/08/19/covid-lays-bare-the-flaws-in-asias-booming-megacities/

73 United Nations Interregional Crime and Justice Research Institute, "Environmental Crimes" webpages. Available at http://www.unicri.it/topics/environmental

74 Association for Southeast Asian Nations (ASEAN) Secretariat, "AICHR convenes meeting with UN on human rights, environment, climate change" (2021). Available at: https://asean.org/aichr-convenes-meeting-with-un-on-human-rights-environment-climate-chang

In 2019, Bangladesh's rivers' personhood was enshrined in law, in an effort to reverse pollution and damaging use. Two years earlier New Zealand legal personhood was similarly granted to the Whanganui River, one of the country's longest, with indigenous people and the national government as legal custodians.

Revitalizing multilateral cooperation. COP26 of the UNFCCC ended on a hopeful note, having seen progress on emission reduction pledges and new agreements. The limit of 1.5°C has become the rallying point for stakeholders across the world. Eliminating the North-South divide on climate action and rebuilding trust on issues of financing are persistent barriers to unlocking deeper action. In addition to the formal outcome, there were also declarations on forest and land use, global methane, global coal to clean power transitions, and electric vehicles. In other multilateral arenas, governments have now committed to restore over 210 million hectares of forest landscapes in two years via the 2020 Bonn Challenge. The United Nations Decade on Ecosystem Restoration aims to prevent, halt and reverse the degradation of ecosystems on every continent and every ocean. The "4 per 1000" Initiative was launched by France to sustainably manage soil for food security and climate.

Existing multilateral arrangements need close review for their sustainability impacts, in particular those governing trade and investment. As an example, investor-State dispute settlement mechanisms embedded in international investment treaties and free-trade agreements grant foreign entities the possibility to sue for compensation for losses, including those resulting from environmental and social protection measures that might impact the investments.[75]

Lessons can be learned from prominent examples of successful multilateral environmental agreements including the Montreal Protocol on Substances that Deplete the Ozone Layer, which supports a ban on ozone depleting halocarbons and has placed the once-declining ozone layer on the path to recovery. Another is the Convention on Long-Range Transboundary Air Pollution, the first multilateral agreement addressing transboundary air pollution, which has reduced the emissions of harmful substances by some 40 to 80 per cent with co-benefits such as reduced lead pollution (almost 80 per cent between 1990 and 2012).[76]

Harnessing the data revolution and remote-sensing technology for multilateral management of shared environmental systems. Climate change, resource scarcity and demand for natural resources are recognized as risks to global stability and security.[77] Territorial disputes, resource use and access disagreements, energy developments impact the relations between communities, stakeholder groups and countries make effective co-management difficult to achieve. Strengthening the science policy interface remains an important priority. Legal

75 Columbia Center on Sustainable Investment, Primer: International Investment Treaties and Investor-State Dispute Settlement, (2019).Available at: https://scholarship.law.columbia.edu/sustainable_investment_staffpubs/181

76 Economic Commission for Europe, Air Pollution and Climate Secretariat, "The Convention on Long Range Transboundary Air Pollution" (webpage, undated). Available at: https://www.airclim.org/convention-long-range-transboundary-air-pollution

77 Instituto Español de Estudios Estratégicos, Panorama of geopolitical trends: Horizon 2040. (Government of Spain, 2019). Available at: https://publicaciones.defensa.gob.es/media/downloadable/files/links/p/a/panorama_of_geopolitical_trends_horizon_2040.pdf

and regulatory vacuums challenge the capacity of multilateral institutions to manage new frontiers such as deep-sea mining, marine pollution, and new seas opened by artic melt.

Citizen-led science, transparent data sharing and information management is key to effective co-management – where information on resource use is one-sided, co-management is weakened. Remote sensing and modelling technologies can now help track the impact of management arrangements and calibrate and assess the impact of multi-partly management agreements in a wide range of environments. Promising data-sharing platforms incorporate artificial intelligence to better manage marine plastics, freshwater use and landscape restoration, as examples. Agreeing on joint monitoring and standards for data exchange will be essential.

Governing new technologies. Some of the most debated climate action technologies include geo-engineering technologies such as for solar radiation modification. Digital technologies and the information transmitted over digital networks creates tension between the right to privacy and the ability of governments and other actors to leverage digital technology potentials, including for the development of smart and secure cities.

Meanwhile, the growing adoption of blockchain, other distributed ledger and digital technologies open a wide range of possibility in sectors from finance, renewable energy and agriculture to education and healthcare, among others – but have concerning carbon footprints. The emergence of bioengineering and its numerous disciplines from bioprinting to bioprocess engineering poses immense opportunities to improve human wellbeing but also ethical challenges. These technologies will have global impact beyond national jurisdictions and will need multilateral approaches.

Sustainable management of water, land and other environmental resources requires cooperation and financing at multiple levels. Local-level interventions must be scaled up to landscape level, while financing at the local level requires effective institutional support and agreed monitoring.

Managing human security impacts of environmental change. Governments are increasingly challenged to mount an integrated response to ensure that no one is left behind, staving off deprivation and instability that results from environmental risk and vulnerability. ESCAP identified four regional 'hotspots', where fragile environments "are converging with crucial socioeconomic vulnerabilities with disastrous consequences." These hotspots are in the transboundary river basins of South and South-East Asia where poverty, hunger, floods and droughts affect hundreds of millions; the Pacific Ring of Fire; the Small Island Developing States that are vulnerable to sea level rise and extreme weather events; and the sand and dust storm corridors that are the source of devastating storms arising from environmental fragility, land degradation, desertification and climate change.[78] The shrinking of the Aral Sea and the impacts across the Aral Sea basin is one of the greatest environmental, human health and livelihoods disasters. The retreat of the sea is showing promise of promise of reversal, with considerable multilateral intervention and investment. Similar disasters are now threatening.

78 ESCAP, The Disaster Riskscape Across Asia-Pacific: Pathways for resilience, inclusion and empowerment. Asia-Pacific Disaster Report 2019 (Bangkok, United Nations, 2019). Available at: https://www.unescap.org/publications/asia-pacific-disaster-report-2019

Climate change lays bare the role of effective adaptive governance in shaping resilient societies. This is particularly the case in SIDS where the effects of climate change are most pressing.[79]

Accelerating inclusion in governance structures needed for responding to environmental change – and its associated social pressures. While the gender gap is closing, the evidence is that it is not closing quickly enough, especially in relation to the participation of women in government. The current participation of women in leadership stands at some 20 per cent representation in national parliaments, against 25 per cent globally. South and South-West Asia have only 17 per cent representation, and the fastest improvements are in North and Central Asia.[80] Youth agency as citizens in urban areas is evolving in different ways across the region.[81]

Policymaking processes that manage complexity better. Governments will need to become better at managing complexity in the policy landscape. Integrative thinking, systems analysis, the application of behavioural science, foresight and finding ways to engage the public will be increasingly explored by governments to upgrade long-standing policy processes.

Several questions are still open for debate: Will effective and targeted multilateral solutions around the governance of the oceans, ecosystem restoration, air pollution, freshwater systems and migration issues emerge? What role will digitalization and connectivity play in shaping the future, and will institutions be ready to enter a digital future? To what extent will technology power the ability of society to adapt to coming challenges with better information, better tools and better collaboration? How will governments respond to expectations of greater voice and participation, and demand greater accountability for sustainable results? Figure 2.5 outlines some factors that can help shape inclusive and sustainable environmental governance for better outcomes for the region.

The present chapter has addressed the five thematic drivers of change: the rise of environmental consciousness, evolving food systems, demand for natural resources and shifts in ownership and control, changes in rural-urban dynamics, and environmental governance; and presents the forces for and against change in relation to each of these.

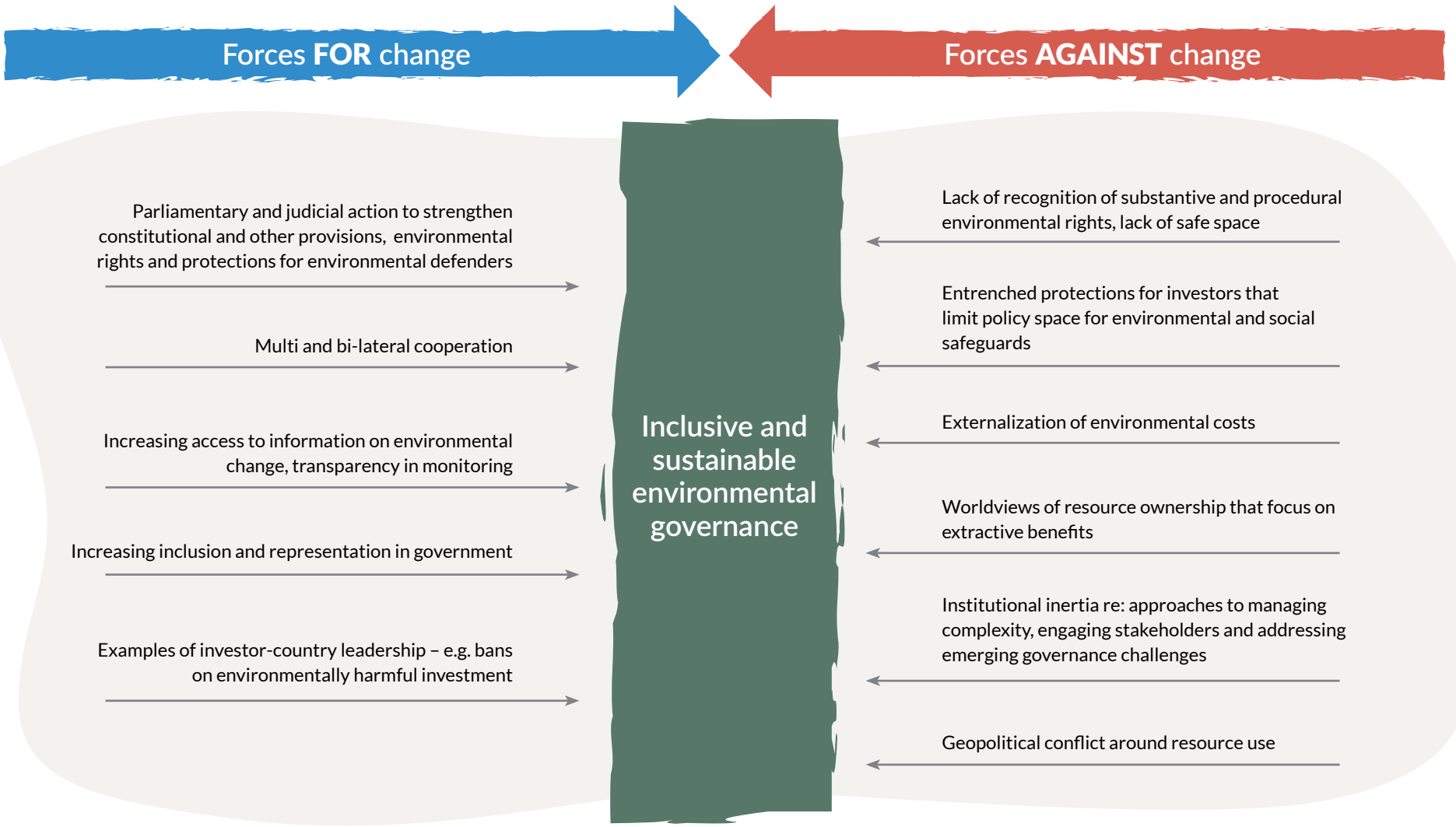
Identifying these forces for change helps to localize responses to the challenge of creating a more sustainable pathway forward. Exploring the systemic challenges that each presents, has helped shape the alternative futures presented in Chapter 3.

79 Stacy-ann Robison, Climate change adaptation in SIDS: A systematic review of the literature pre and post the IPCC Fifth Assessment Report (2020). Available at: https://doi.org/10.1002/wcc.653

80 UN Women, "Snapshot of women's leadership in Asia and the Pacific" (2021). Available at: https://asiapacific.unwomen.org/en/news-and-events/in-focus/csw/snapshot-of-womens-leadership-in-asia-and-the-pacific.

81 Sonia Lam-Knott and Yi'En Cheng, Youth politics in urban Asia: an introduction (2019), in Space and Polity, 24:1, 1-11. Available at: https://doi.org/10.1080/13562576.2020.1732200

Figure 2. 5 Forces for and against inclusive and sustainable environmental governance

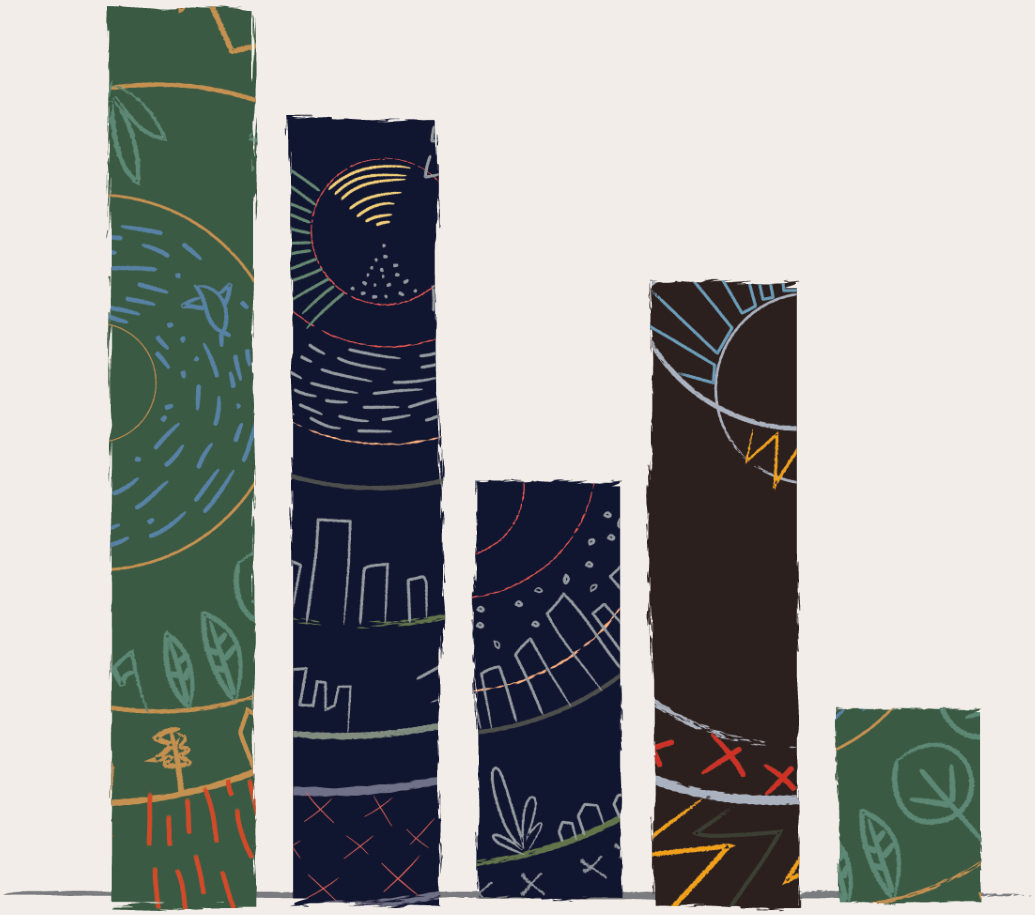


INSIGHTS: Regional trends and sustainability

The scenarios of environmental futures which are presented in the next chapter (3) of this report look at the possibilities through four environmental domains:

Healthy ecosystems (HE)
Climate action (CA)
Sustainable urbanization (SU)
Clean air (CIA)

Insights into each of those four domains are shared in this special section to raise awareness of the challenges and opportunities for strengthening sustainable outcomes. Metadata and sources of the information for each figure are listed in the annex.



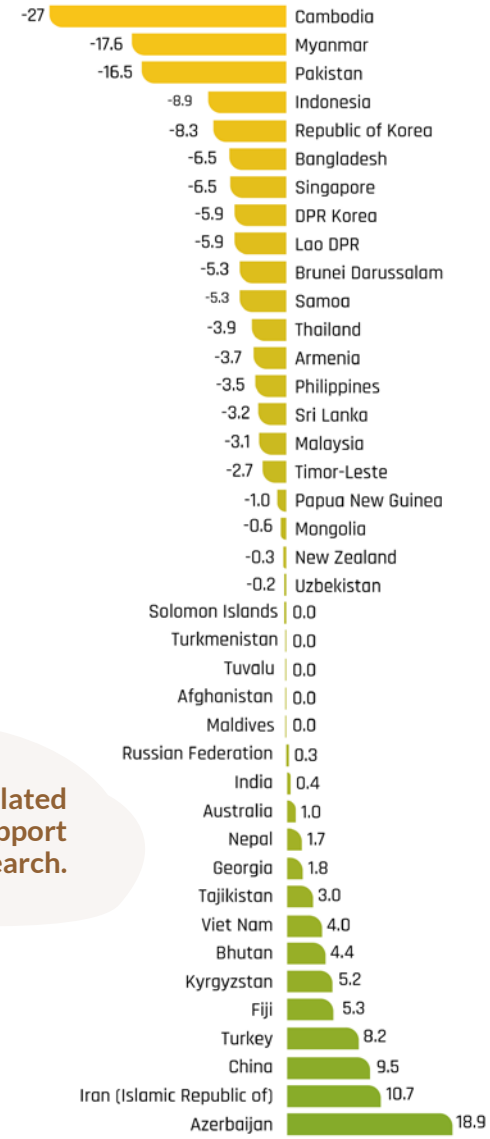
Healthy ecosystems

The evolution of food systems lies at the heart of planetary and human health. While agricultural production drives land-use change and loss of biodiversity, the resilience of food systems depends, in large part, on the health and biodiversity of freshwater, terrestrial and marine ecosystems. Sustainable food systems are planned for the most environmentally and socially sustainable outcomes, to produce safe, nutritious, diverse and affordable food with low environmental and carbon footprints. Agriculture, forestry and other land use are responsible for just under a quarter of all global anthropogenic carbon emissions. Forests absorb one third of carbon released by burning fossil fuels. Forests also harbour most of the planet's terrestrial biodiversity.[82]

HE-1

Shifting forests

% change in naturally regenerated forests (2000-2018)



Source: FAO (2021)

Naturally regenerating forests provide unique biodiversity-related ecosystem services, cultural value, and food security. They support tourism and provide potential stock for biomedical research.

82 See the International Union for Conservation of Nature at: www.iucn.org/resources/issues-briefs/forests-and-climate-change and the Secretariat of the Convention on Biological Diversity at: www.cbd.int/forest/

HE-2

Few products are behind most of the Forest Loss

Drivers of deforestation

Data for Asia and the Pacific
Source: Pendril and others (2019)

Production of oil palm for cosmetics and food industry and biofuels and the demand for wood drives more than half of forest loss.

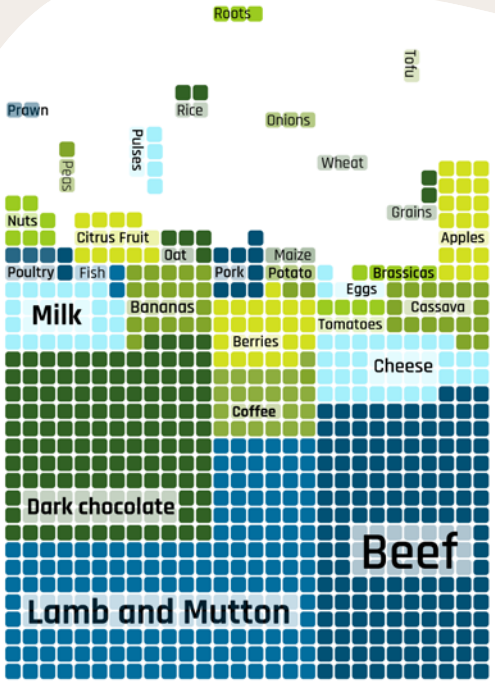
HE-3

Turning rainforests into oil palm forests halves biodiversity and biomass*

Data collected in a study in Sumatra, Indonesia
Source: Barnes and others (2014)

UNDERSTANDING THE IMPACT OF FOOD CHOICES

HE-5



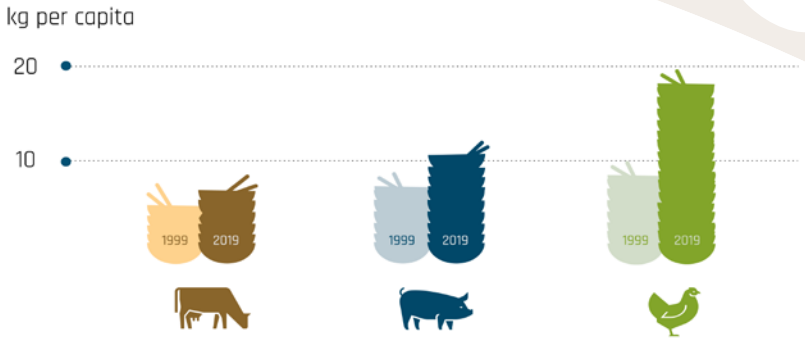
The space our food takes

Land needed to produce 100g of protein

□ 1 m² per year

Global averages
Source: Poore & Nemecek (2018)

HE-4



Growing appetite:

Average beef, pork and chicken consumption per person, 1990 and 2019

Data for selected Asia-Pacific countries: Japan, Republic of Korea, New Zealand, China, India, Indonesia, Iran (Islamic Rep of), Kazakhstan, Malaysia, Pakistan, Philippines, Russian Federation, Thailand and Viet Nam

Source: ESCAP calculation based on OECD data

Livestock production represents almost 15 per cent of all greenhouse gas emissions from human activity.

Meat consumption has increased in the last 20 years – a key target for sustainable food system interventions.

Nutritional value is essential factor in planning for sustainable food systems.

The land needed to produce 100 g of protein from beef, lamb or mutton is roughly equal to the land needed to produce 1 kg (ten times as much) of protein from a diverse food base of nuts, oats, cassava, maize, brassicas, grains, tomatoes, onions pulses and peas, berries, coffee and bananas.

WHERE TO TARGET FOOD SYSTEM INTERVENTIONS?

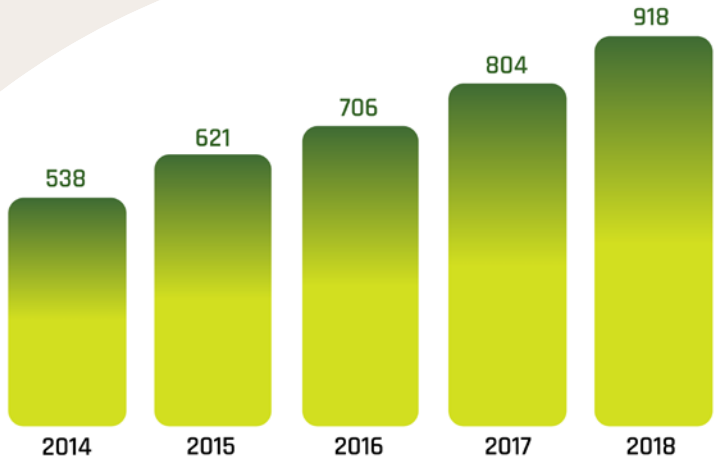
HE-6

Food carbon footprints

GHG emissions from producing one kg of food*
Source: Poore & Nemecek (2018)

Each food item has its own carbon footprint. Understanding where emissions are largest can help prioritize greenhouse gas mitigation efforts by food sector.

HE-7



Emerging alternatives:

Plant based protein production value in China (million USD)

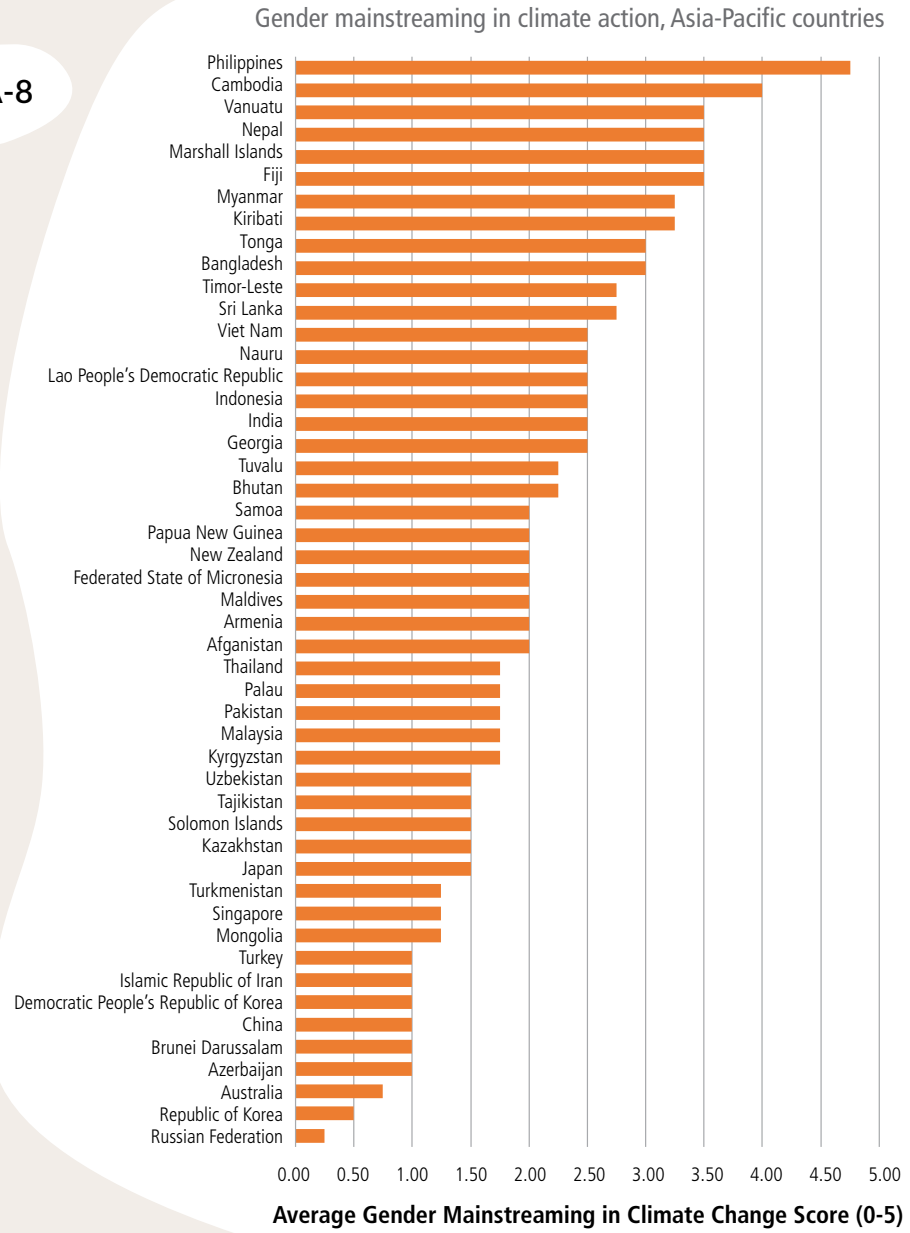
Source: Good Food Institute (2018)

Plant-based proteins mostly have lower carbon footprints than do animal proteins and are becoming big business.

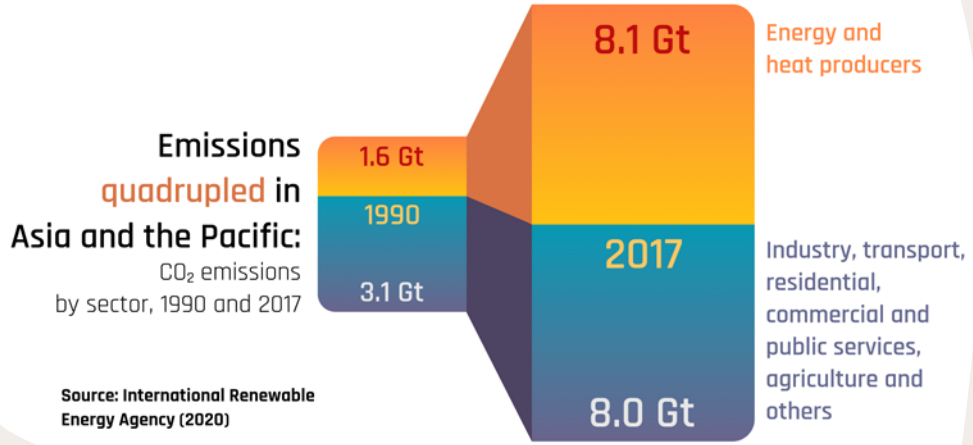
Climate action

Climate action encompasses the range of actions needed to keep planetary warming within targeted increase of 1.5 degrees Celsius of warming in the 21st century. It also means ensuring readiness to adapt to the environmental, economic and social changes that are already underway.

CA-8



CA-9



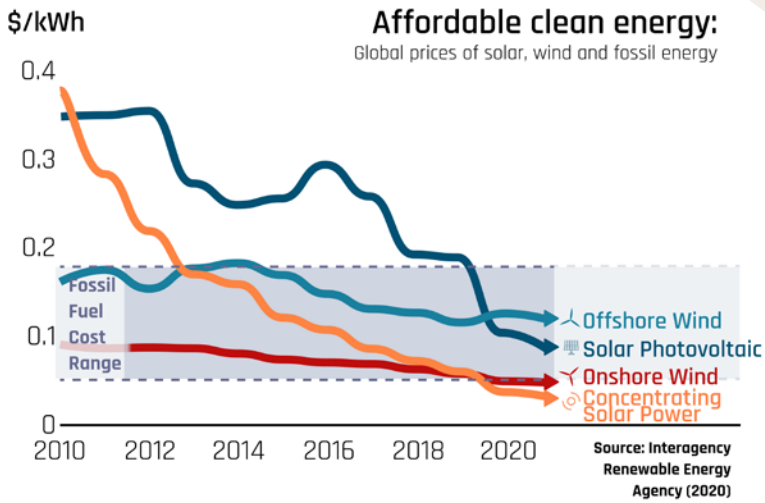
Energy and heat production is the most important source of greenhouse gas emissions in Asia and the Pacific.

Successful adaptation and mitigation strategies need all perspectives to be included. Women are key in this effort.

Source – ESCAP and others (2021)

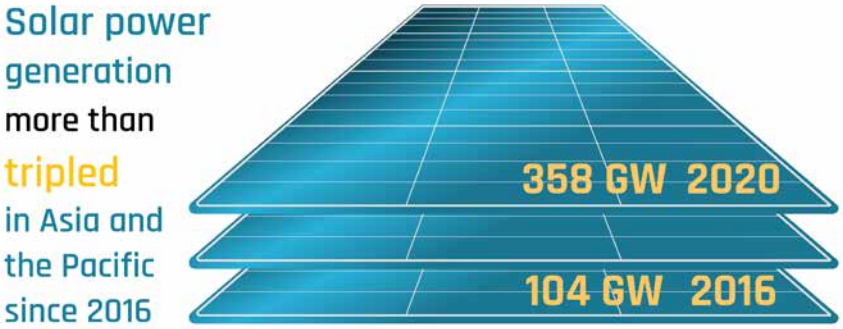
TRENDS IN ENERGY USE

CA-10



Renewable energy prices are falling below the cost of using fossil fuels in generating electricity. That is changing the economics of the green economy.

CA-11

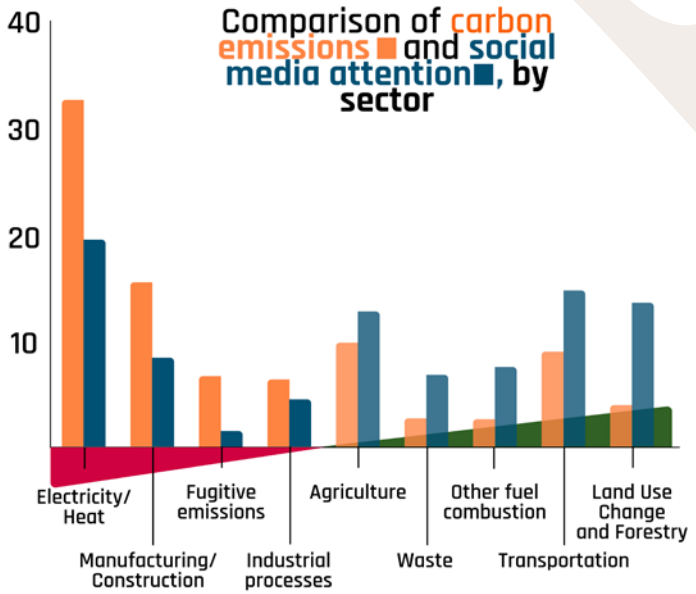


Source: IRENA (2020)

Solar power uptake responds to falling prices.

PAYING ATTENTION

CA-12

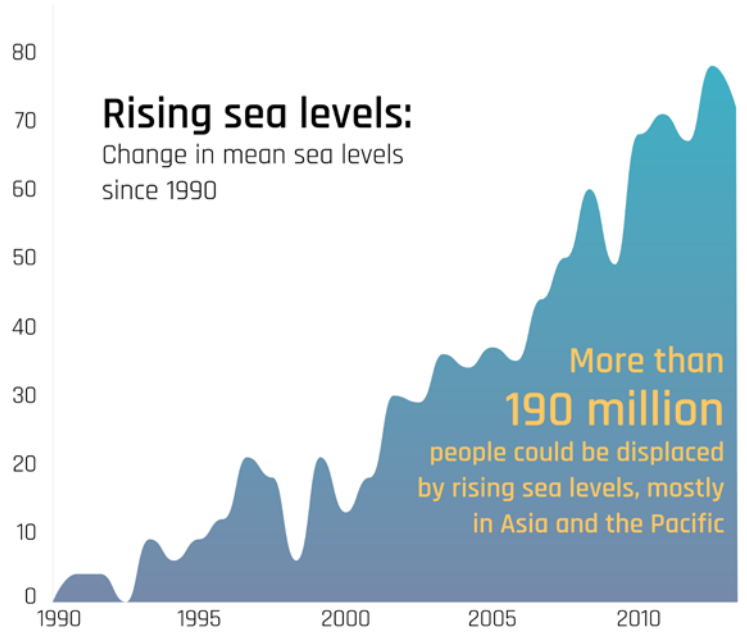


*Social media attention is defined by the frequency of Twitter interactions (retweets and likes) on a given post

Source: World Resources Institute (2015) and ESCAP

Some important sources of carbon emissions such as land use change, transportation, other fuel combustion and waste receive attention from social media that reflects their relative climate impact. However attention to other source with even more impact, such as heat, manufacturing and fugitive emissions receive much less attention than their impact warrants.

CA-13



Source: Commonwealth Scientific and Industrial Research Organization, Kulp and Strauss (2019)

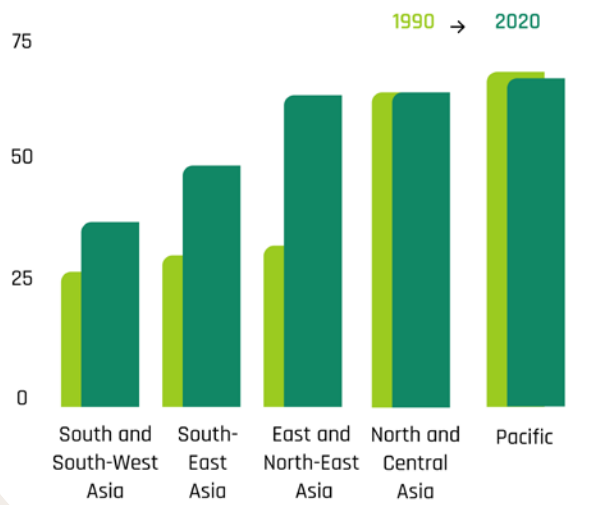
Attention and financing to secure the futures of the people who will be displaced by rising sea levels, is needed.

Sustainable urbanization

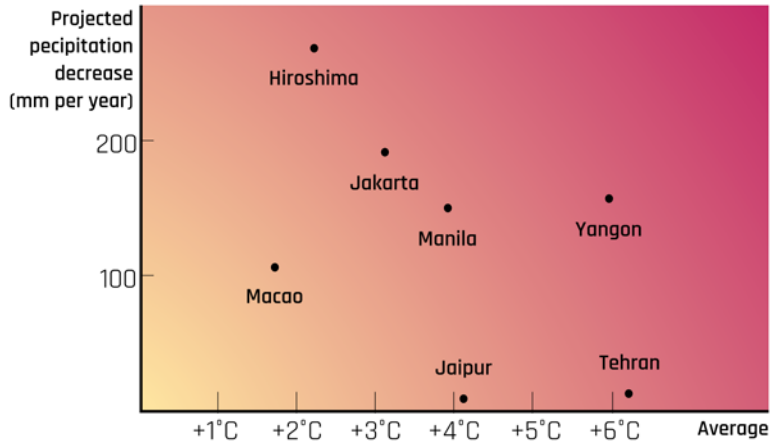
By 2050, an estimaed 70 per cent of the region's population will live in cities.[83]

Meeting the needs of new settlers and adapting to climate change will mean significant investment in infrastructure. However, meeting these infrastructure needs will impact the demand for water and energy, and the production of greenhouse gases. Almost 39 per cent of greenhouse gas emissions are produced by the built environment. The environmental footprint of the region's cities will also impact environmental and socio-economic conditions outside of cities.

SU-14



Source: ESCAP, based on data from United Nations Population Division 2019



Warmer and drier cities:
Projected change in precipitation and temperatures for selected cities by 2050

Source: Bastin and others (2019)

SU-15

Some cities will face challenges of decreasing precipitation, rising temperatures and fast-growing populations. For them, careful attention to sources of water stress and the way in which infrastructure is developed is especially important.

83 ESCAP, UN-Habitat and others, The Future of Asian and Pacific Cities 2019: Transformative Pathways Towards Sustainable Urban Development (Bangkok, United Nations, 2019). Available at: https://www.unescap.org/publications/future-asian-and-pacific-cities-2019-transformative-pathways-towards-sustainable-urban

CIRCULARITY IN THE CITY

SU-16

Doubling waste:

Urban waste generation in Asia and the Pacific, 2016 and 2050

(Million tons per year)

Data for East Asia and Pacific and South Asia

Source: World Bank (2012)

Municipal waste is a major source of greenhouse gas emissions. However, it is under-exploited as a resource of energy and recyclable industrial materials.

The energy behind cement

In 2020, 10% of the energy required to produce cement came from waste and biomass incineration

Data for Asia and the Pacific

Source: Global Cement and Concrete Association (2020)

SU-17

If the cement industry were a country, it would be the third largest emitter in the world, accounting for about 8 per cent of global anthropogenic emissions.

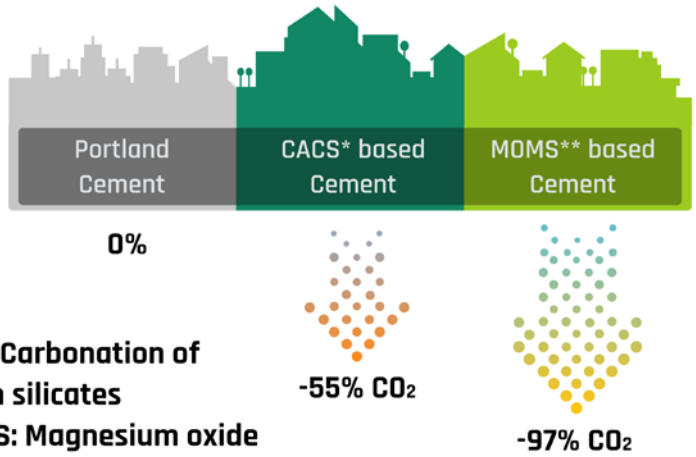
Source: Economist. "Set in green concrete: How cement may yet help slow global warming. 6 November 20201.

RETHINKING CEMENT

SU-18

Greener cement?

Altering the **cement mix** could help cut the CO_2 emissions from cement by up to **97%**

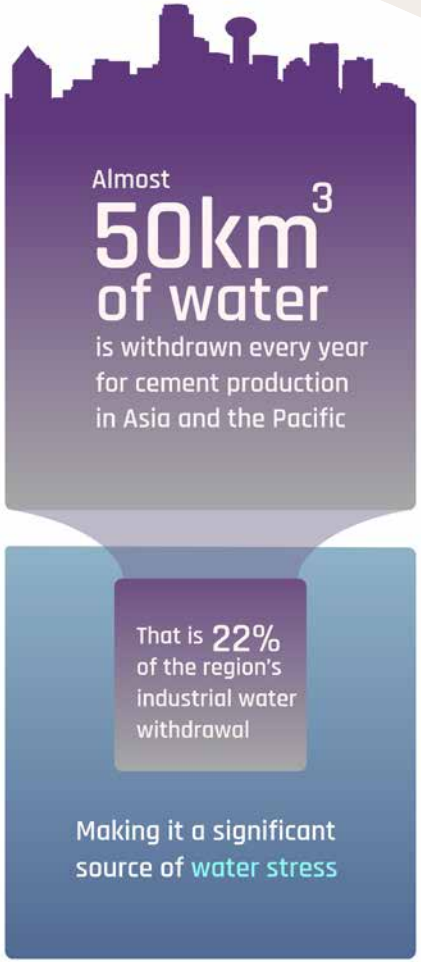


***CACS: Carbonation of calcium silicates**
****MOMS: Magnesium oxide derived from magnesium silicates**

Source: International Energy Association (2018)

Cement is both the second largest direct source of industrial CO_2 emissions and a material that makes our cities hotter and less drought-resistant. There are ways to reduce the climate impact of cement production.

SU-19



Source: Miller and others (2018) and FAO AQUASTAT (2020)

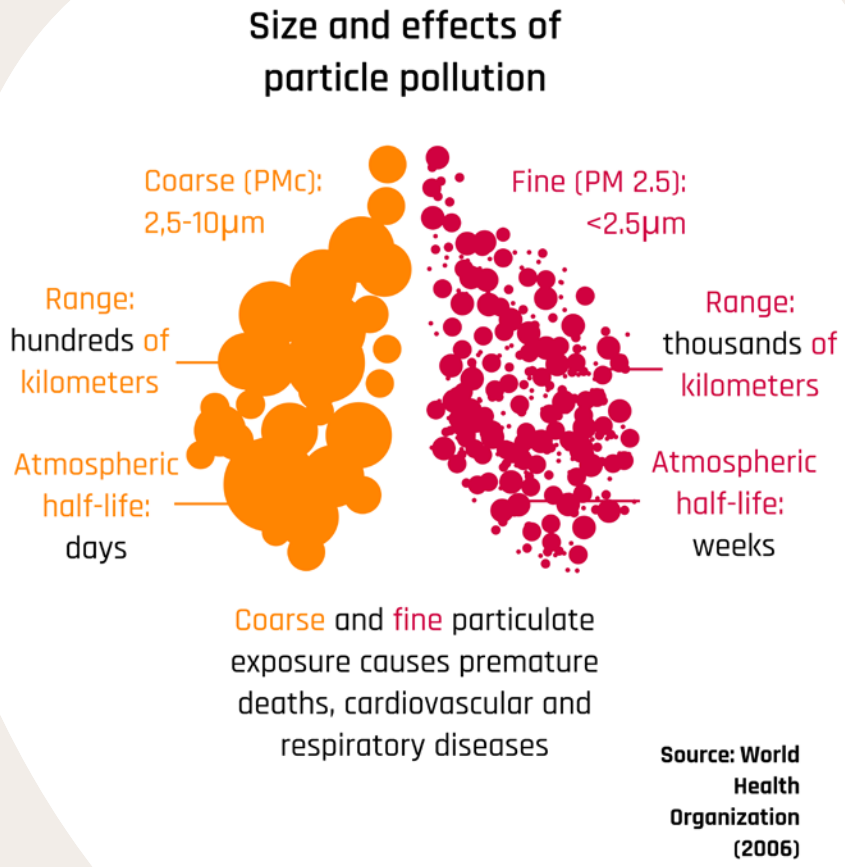
Industry is the second largest user of water (after agriculture). Industrial water use directly competes with household water and agricultural needs.

Clean air

Air pollution is a leading cause of the global disease burden. Breathing clean air is now a luxury in some parts of the Asia-Pacific region – 92 per cent of the population is exposed to levels of air pollution that pose a significant health-risk.[84] Of the world's cities with the worst air pollution in 2020, the top 148 are all in the Asia-Pacific region. Air pollution is estimated to be responsible for the loss of over 1 billion person-years due to lowered life expectancy in South-East Asia alone. In South Asia, life-expectancy is lowered by some 5 years, on average.[85]

Air pollution is estimated to have contributed some 15 per cent of the COVID-19 mortality worldwide,[86] while also leading to lower birthweights and related health risks in the first months of life.[87] Air quality also has significant impact on agriculture and other economic activity. Discussions on an Asia-Pacific agreement on air pollution are being initiated as this report is published.

CIA-20



84 Climate and Clean Air Coalition, United Nations Environment Programme (UNEP) (2018), "Summary - Air Pollution in Asia and the Pacific: Science-Based Solutions." Available at: https://www.ccacoalition.org/en/resources/air-pollution-asia-and-pacific-science-based-solutions-summary-full-report

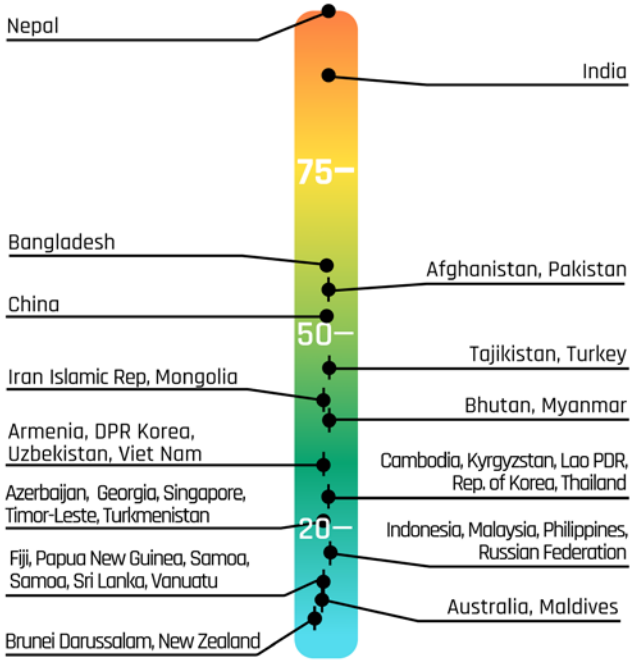
85 Ken Lee and Michael Greenstone (2021), "Air Quality Life Index, Annual Update" (Energy Policy Institute at the University of Chicago). Available at: https://aqli.epic.uchicago.edu/wp-content/uploads/2021/08/AQLI_2021_Report_-English.IndiaVersion.pdf.

86 Andrea Pozzer and others, "Regional and global contributions of air pollution to risk of death from COVID-19", Cardiovascular Research, Volume 116, Issue 14, 1 December 2020, Pages 2247–2253, https://doi.org/10.1093/cvr/cvaa288

87 Health Effects Institute (2020),"State of Global Air 2020. Special Report" (Boston, MA, Health Effects Institute). Available at: https://www.healtheffects.org/announcements/state-global-air-2020-reports-air-pollutions-impact-neonatal-mortality

AIR POLLUTION IN CITIES

CIA-21



Rising risks for young people:

Population weighted mean PM2.5 exposure, 2017

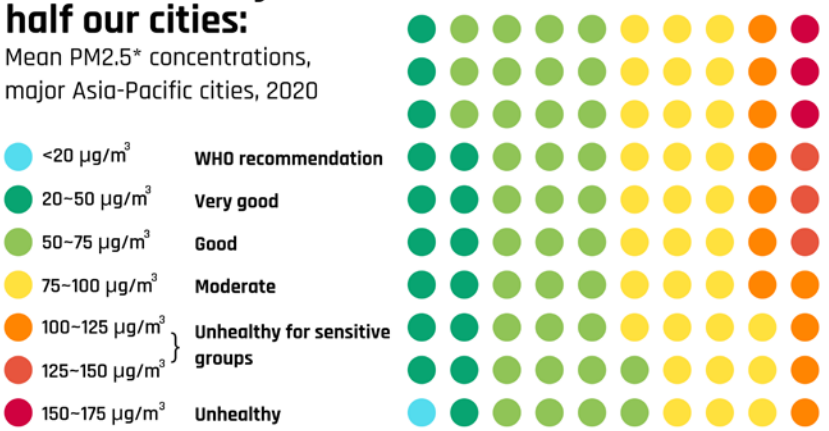
Source: World Bank Data (2017)

The risks of ischemic heart disease and lower respiratory infection rise more quickly in young adults than older people, as the mean PM2.5 exposure levels increase.
Brauer et al, 2017.

CIA-22

Air is unhealthy in half our cities:

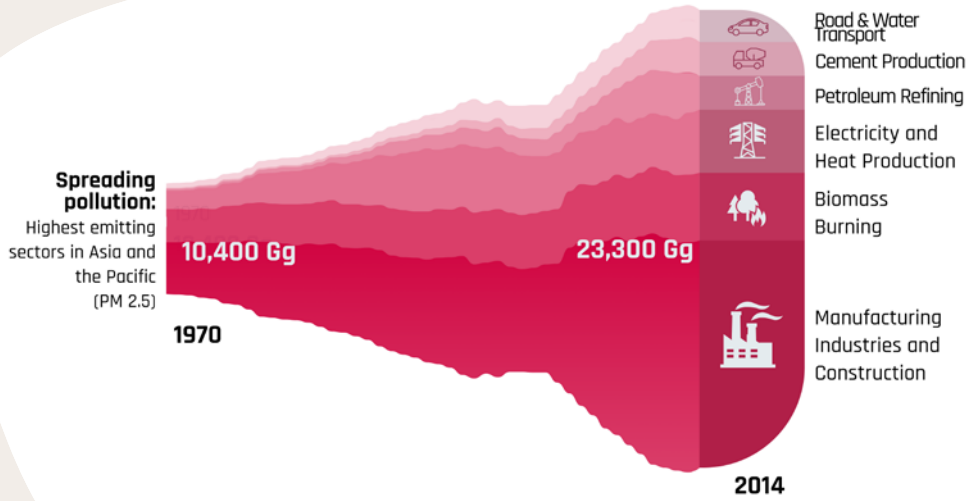
Mean PM2.5* concentrations, major Asia-Pacific cities, 2020



***Air quality scale as defined by the US-EPA 2016 standard**
Source: Air Quality Open Data Platform (2021)

AIR POLLUTION SOURCES

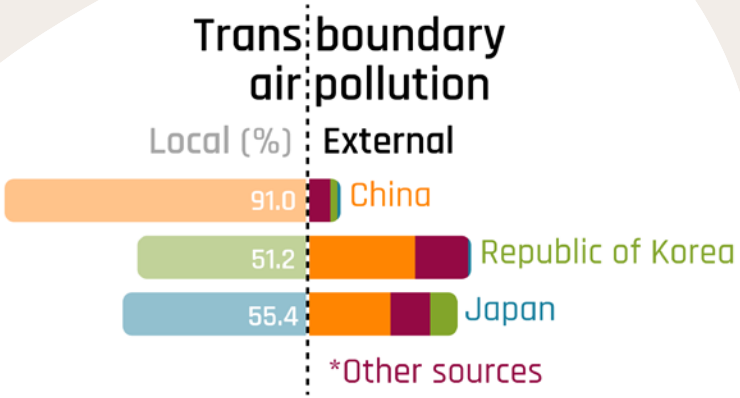
CIA-23



Source: EDGAR Database (2020)

Air pollution loads have more than quadrupled since 1970.

CIA-24



2017 PM2.5 self and external contribution in major cities of China, Republic of Korea and Japan

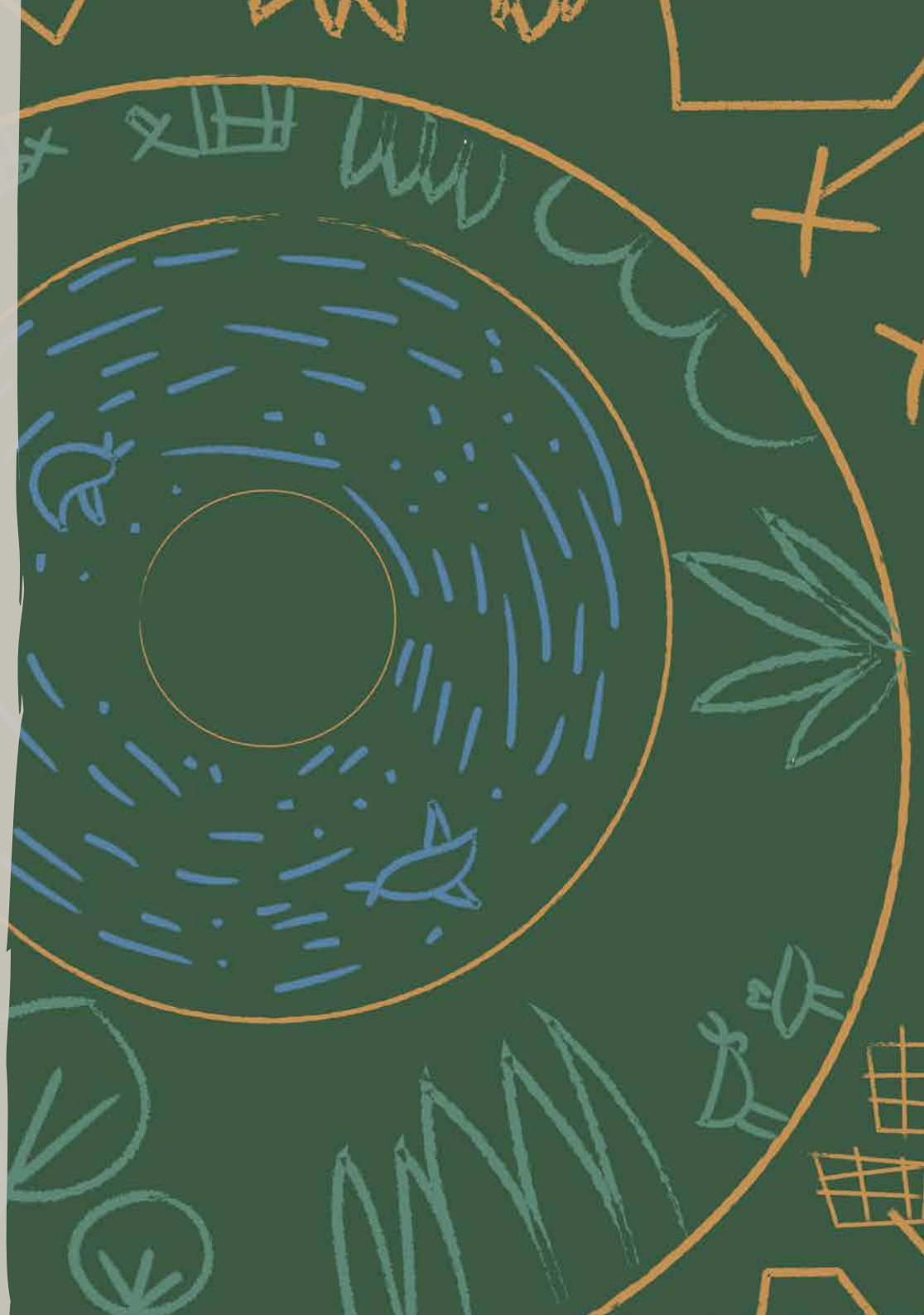
Source: Joint Research Project on Long-range Transboundary Air Pollutants in Northeast Asia (2019).

Discussions on an Asia-Pacific modality on transboundary air pollution are being initiated as this report is being published.

While most air pollution is locally generated, air pollution is a pressing transboundary issue requiring regional solutions. The Convention on Long-Range Transboundary Air Pollution works to reduce and prevent air pollution and is considered to have created an effective framework for multilateral action. Technology to track and assess air pollution is improving.

3

Scenarios for Asia and the Pacific in 2040



Chapter 3
Scenarios for Asia and the Pacific in 2040

Chapter 1 outlined the looming crisis facing the region, while Chapter 2 provided insights for targeting action. It presents the use of transformative futures approaches to strengthen the pull of the future with a vision of a greener, inclusive and more resilient Asia and the Pacific.

More than 100 experts from government, civil society, the private sector academia, and other groups have helped shape the scenarios presented in this chapter. Box 1.1 (Chapter 1) describes the process.

Why alternative futures? While policy analysis and planning weigh the viability of specific policies, they fail in challenging fundamental systems that define the present state. Futures studies differ from foresight and planning processes by testing basic assumptions and worldviews against alternative options.[88]

Narrative foresight supports an exploration of the worldviews and myths that underlie "possible, probable and preferred futures."[89] Shifting narrative is "critical to advancing transformational change in systems, policies, and practices."[90] Futures studies allows exploration of the changes that are possible when power shifts — whether that power resides in a dominant narrative, economic strength, ideology, or "knowledge hierarchies." Dominant narratives define the important boundaries between what we imagine is possible, probable, practical, or desirable.[91]

Exploring possible futures helps to access layers of reality where the most powerful engines of change reside. Workshops organized to shape the alternative futures presented in this report considered practices, worldviews and narratives that are no longer useful, or even harmful, to the goal of a green, inclusive and resilient Asian and Pacific community. (See box 3.1.)

This report identifies four alternative future scenarios for Asia and the Pacific in 2040 (figure 3.1).

88 Sohail Inayatullah, "Futures studies: theories and methods," in Fernando Gutierrez Junquera, ed., There's a future: Visions for a better world. Madrid, BBVA, 2013, 36-66. Available at: https://www.bbvaopenmind.com/wp-content/uploads/2013/03/03_estudios_futuro1.pdf

89 Ivana Milojevic and Sohail Inayatullah, "Narrative foresight" In Futures Vol.73, October 2015, pages 151-162, https://doi.org/10.1016/j.futures.2015.08.007

90 The Narrative Initiative, "Toward New Gravity", 2017. Available at: https://narrativeinitiative.org/wp-content/uploads/2019/08/TowardNewGravity-June2017.pdf

91 A narrative is a mental model of the way the world works that (a) frames the interpretation of any situation, challenge or opportunity; (b) determines attitudes and alignment with other groups of people; and (c) defines self-identity, sense of belonging and understanding of our place in the world. Narratives that dominate within a society are aligned with deeply held beliefs and attitudes that shape a person's actions, emotions and intuitive responses to the world, or "worldviews". See The Narrative Initiative, Toward New Gravity, 2017.

Box 3. 1 Thinking about shifting narratives

"Used" narratives

- "Asia is not good enough"
- "Technology will fix everything"
- "Economic growth can continue without regard for nature"
- "Traditional knowledge is non-scientific and not useful"
- "Humans are masters of nature"
- "Resource ownership as opposed to resource stewardship"
- "All are equal, but some are more equal than others"
- "Consumerist society"
- "Participation in decision making stops with election"
- "Urban vs. rural dichotomy"
- "Migration (and the migrant) is a threat"

"Used" systems

- Fossil fuel-based energy systems
- Food systems based on intensive chemical inputs and soil degrading practices
- Education systems narrowly focused on economic productivity and knowledge specialization
- Information and communication systems that rely on oligarchic mass media, propaganda, and "fact-free" social media

SOURCE: Participant feedback from the ESCAP transformative futures workshop: "Pathways to a green, resilient and more equal Asia-Pacific", 18 September 2020.

Figure 3. 1 Alternative Asia-Pacific Future, 2040

A Green Anthropocene

The lessons of Covid-19 were heeded. It's 2040 and the economies and societies of Asia and the Pacific are thriving, green, dynamic, healthy – and peaceful.

This is the preferred, best-case (and somewhat "utopian" scenario). This helps set the tone for all four scenarios, ensuring that the picture of a desirable future, is clear.

The Rivers Run Dry

It's 2040. The children of the pandemic are now adults and living in a world of degraded lands and dry rivers. 20 years later, ecosystems are failing, resources depleted and some cities recall a post-apocalyptic movie. The threat of open warfare over resources overhangs a divided region.

This "disowned" scenario is the future that is uncomfortable, going against the ideal view and what might happen if the worst aspects of "business as usual" are not corrected. This helps stakeholders understand the implications of staying the current course.

Great Collapse

This outlier scenario in four parts shapes a future where "blind spots" have had a major disruptive impact: A future where (a) agrobiodiversity collapses (b) Day Zero comes to Asia-Pacific cities (c) Intergenerational divisions around climate change come to a head and (d) Runaway air pollution and a new virus chokes the region.

These unlikely, but possible futures are shaped by what we know, but also strongly influenced by a "blind spot" about an issue or driving force, the influence of which could strengthen over time to become an important disruption. These scenarios widen sensitivity to risk and raise awareness.

The Yangtze River Dolphin Returns

In 2040, the Asia-Pacific has achieved the green, inclusive and sustainable recovery much discussed in the wake of the COVID-19 pandemic. In this scenario a thriving Yangtze River Dolphin population is symbolic of the myriad iconic species revived through ecosystem restoration and rolling back of environmental pressures. A tightly woven mosaic of multilateral environmental agreements, technological collaboration and shared values support the countries and people furthest behind, helping the region climb higher. The Asia-Pacific leads the globe in clean energy, and in the trade in safe, nutritious, affordable and sustainably-produced foods.

This integrated scenario brings together key elements of the "ideal" and "disowned" scenarios and aims to present an ambitious, but actionable vision of the future. It becomes the basis for identifying transformative actions via backcast and causal layered analysis in (Chapter 4).

The Rivers Run Dry

(A disowned scenario for 2040)

The year is 2040. The children of the COVID-19 era are now adults. Almost half of the region's population lives in cities under siege in a landscape of degraded soils and dry rivers. Ecosystems are failing, resources are depleted. Post-pandemic cities are under siege of climate migrants and hint of a world destroyed. The region is divided — cities from rural areas, the rich from the poor, and the powerful from the vulnerable.

The year 2040 was the first ever when no snowpack was seen on Himalayan rivers. The decline over the years meant that deep drought had afflicted the subregion, triggering large-scale internal and international migration. Harvests had failed for the five previous years across most countries.

Food insecurity is at an all-time high in more than half of the region's developing countries. Following decades of over-fishing and ocean acidification, the region's seas are finally barren. On land, climate factors, water shortages, disrupted supply chains and the decline in insect population have crippled humanity's ability to grow and distribute sufficient food supplies.

Competition for resources, along with mismanagement of agro-ecosystems and farming have compounded the impacts of environmental change, leaving soils depleted and crops needing to be pollinated artificially. Up to 90 per cent of land is now owned by large investors and aimed at profitable overseas demand for conservation, carbon sequestration and high-tech agriculture, leading to further declines in agrobiodiversity. Community management of ecosystems have been dismantled as demand for wood and food ramps up.

Fiscal and policy space has narrowed post-COVID. Not all countries have chosen their options with a long-term view. Upgrades in governance systems to enable navigation of an increasingly complex policy landscape, leaves the essentials under-invested, the vulnerable behind and ecosystems unprotected.

Dealing with natural disasters, hunger, the burdens of non-communicable disease, and security needs has overwhelmed national and household budgets. As the fiscal and policy space of the least developed countries have diminished, so has their negotiating power, multinational corporations have ultimate power, formalized through trade agreements that tie governments' hands.

People of landlocked countries in Central and South and South-West Asia's highly agrarian and rural economies are among the most affected. Growing populations face climate change impacts.

The pull to cities and mega-urban developing regions becomes a strong push as rural livelihoods and agroecosystems fail. Rural communities and indigenous peoples have dispersed. The numbers living in marginal areas have swelled silently. with access to only the most basic services. Some electric vehicle-charging stations built two decades earlier have since become shelters for climate refugees as the electrification of transport never happened.

Cities become overwhelmed with the influx of climate and economic migrants, and social conflict increases. In 2040, most large cities are in a state of siege, with climate refugees and other internally displaced people at their doors. Barriers go up around cities. City dwellers fare better than others, but not by much. After a series of unprecedented multi-year droughts, years of protests and social upheaval, people's movements are "stabilized" with force across most countries, adding fuel to the deepening frustrations, and to the rural–urban and inter-generational divides.

At least 100 cities face "Day Zero" every year, with residents queuing for their daily ration of water. This creeping disaster that captured global attention in South Africa, has become commonplace in South Asia and many other parts of the region. Up to 50 per cent of city budgets are now spent to just supply safe drinking water, provide health services, and for coastal cities, keep back rising tides and manage disaster, leaving little fiscal or physical space for dealing with the needs of an influx of climate migrants and conflicts between beleaguered residents.

Water prices are now out of reach, as private owners control access to ecosystem services that supply freshwater. In about half of the region, internal conflicts over resource use and access are restrained by private security forces, barely managing to prevent the spread of lawlessness.

Health burdens also mount. Mental health impacts of COVID-19 were the start of a new mental health epidemic. Depression and substance abuse growing in tandem with hopelessness and a collapse in creativity and productivity in academia and arts.

Multilateral systems and diplomatic approaches have failed to adapt to the times. Tensions between countries are unleashed and international relations are now a minefield of broken relations between countries, fuelled by mistrust, gaps in technology access and use, and diminished policy space. Economic diversification and innovation are dampened, crippling the potential for growth.

Pollution-intensive industry continues to grow, as does biomass burning, shipping and air transport emissions, and the expansion of polluting transport networks. All is driven by private profit-making at the expense of everything else. The emergence of zoonoses (where diseases jump from animals to humans), accelerates and the incidence of disease surges, with cities at the epicenter. Poor urban planning, large informal settlements and congestion foster frequent health crisis.

Under these conditions, only a few Asian and Pacific countries can follow up on their ambitious pledges toward climate neutrality made in the wake of COVID-19. The global push to avoid the worst of the climate crisis fails. Exclusive Economic Zones are rigorously guarded. Conflicts in the open seas over fisheries and deep sea mining erupt and affect trading routes, slowing global trade to a crawl.

Transboundary challenges of disputed water systems and crippling air pollution, dust and sandstorms, and climate refugees, have been met with half-hearted responses by the international community. Regional tensions have deterred neighbouring countries from setting up much-needed transboundary agreements. Currently, all of the world's most

air-polluted cities are in Asia and the Pacific whose long-range air pollution affects Oceania.

By 2040, in more than half of the countries of the region, governance systems have finally broken under the pressure of climate and other environmental change, mismanaged migration, misinformation, rolling crises, corruption, and elite capture.

A Green Anthropocene

(An ideal scenario for 2040)

The lessons of COVID-19 were heeded. In 2040 the economies and societies of Asia and the Pacific are thriving, green, dynamic, healthy — and peaceful. A tight mosaic of multilateral agreements, technological collaboration and shared values support the countries and people furthest behind, helping the region climb higher.

By the end of the COVID-19 pandemic, clearly the societies that had stood together and had understood that their future depends on a symbiosis with nature, also enjoyed the best chance of weathering future crises. The regeneration of some ecosystems which had started with the lockdowns also showed tantalizing glimpses of a better future.

Facing narrowed fiscal and policy space and time to act, countries and stakeholders have set ambitious targets, mobilized partnerships and worked to revitalize multilateralism. Recovery actions and investments post-COVID-19 have been laser-focused on building green, inclusive and resilient economies. Successfully tackling the tide of misinformation and manipulation has been key in public relations.

How did we get here? The pandemic was the transformative event that inspires Generation Alpha's hunger for connectedness and truth. Governments invested in reforming education systems. With information and technology at hand, young people became more involved in civic life than ever. More than half of the region's young people are actively engaged in citizen science, monitoring environmental pressures and supporting international targets.

A decade of witnessing political struggle shapes a generation ready to contribute and lead a much-needed shift away from crippling socio-cultural norms. Women have led the shift. A balance of genders and perspectives represented in government, more effective policies, and balanced resource allocation resulted by 2030 in a new social contract with a focus on human and environmental health and eliminating vulnerability.

The region benefits from successfully ramping up investments in mitigation and adaptation and narrowly averts a climate crisis. With mutual support and revived multilateral cooperation, countries have raced to meet ambitious carbon neutrality targets ahead of time, rolling back environmental pressures. Their engagement prompts the widespread recovery of marine, fresh water and terrestrial systems and the rebound of biodiversity.

Early successes in securing a regional agreement on air pollution, massive mobilization on ecosystem restoration, and an agreement on ocean protection were secured by deploying digital and satellite technology to target point sources and pollution flows. The agreement strategically protects the most valuable ocean and coastal zones, securing blue carbon and eliminating outflows of plastic to the oceans. Fish stocks rebound and are maintained at a sustainable level supported by aquaculture. These early successes played a critical role in mitigating, and even reversing migration pressures, along with slowing climate change.

People and ecosystems are healthier than ever, living a good quality of life to over 80 years everywhere. Consumers demand safe, high quality and nutritious food, boosting rural economies and regional trade, and partnerships and technology make traceability and cross-certification possible through the supply chain. The majority of consumers follow a vegetarian or vegan diet. The burden of non-communicable disease has been lifted, and along with it, poverty traps that had especially suppressed low-income countries. People understand that being healthy requires healthy ecosystems. Now all people have access to safe, nutritious, and affordable food.

The way to prosper these days is by "going green," and a high degree of consumer education prevents greenwashing. Financial systems are also aligned for sustainability, as global and regional carbon prices/taxes/credits generate new investments in decarbonization and technological innovation that dramatically boost mitigation.

The delivery of environmental health as a public good makes leaders accountable for health and inclusion, inspiring city planning. Fifteen minutes of travel can provide access to most services. Fast- growing intermediary cities are among the most liveable, safe and inclusive urban places in the region. At least half of these cities are networked with multi-modal electrical systems, walkable neighbourhoods, and urban land and infrastructure that produces renewable energy and contributes to food security and livelihoods in rural areas. No matter the scale of the city, exciting examples of sustainability, social innovation and solidarity can be found in these welcoming spaces, connecting the generations, new-comers and long-standing residents.

Cities are at the forefront of a clean energy economy. Transformation of energy grids drives 90 per cent of the region's economic activity, providing universal access to energy and enabling innovation. Communities and households become energy "prosumers", accessing new income streams. Electric-vehicle-based public and private transport play key roles in decentralized, digitalized systems, which in the coming decades can help to transform how energy is produced, distributed and consumed, and help to access finance for climate action. Petrol stations are now only to be found in movies as all of them have been transformed to EV charging stations.

An economy that is sustainable, that harnesses new urban design and supply chains, drives efficiency and ensures that nothing is wasted. Employment growth is fastest in sectors focused on greening. Fully electrified transport systems and digital technologies keep the region on the move. The biggest surprises are that the former leaders in fossil fuel production

have led the clean energy transition and climate mitigation, using abandoned wells for carbon capture and solid rock production, and repurposing them in other novel ways.

The Yangtze River dolphin Returns

(An "integrated" scenario for 2040)

In 2040, the Asia-Pacific region is on its way to building thriving, green, healthy and tightly knit societies. The region leads the world in clean energy and trade in safe, nutritious, affordable, and sustainably produced foods. It shares its advances with the rest of the world.

A thriving Yangtze River Dolphin population is emblematic of the revival of iconic species and rolling-back of environmental pressures throughout Asia and the Pacific. People and ecosystems are healthier than ever. Ten years have been added to the average person's life-span. Seventy per cent of consumers follow a vegetarian or vegan diet appropriate for their geographic contexts. A "One Health" approach has changed the way health is managed, and these days, all people understand that being healthy requires healthy ecosystems.

Green is the new gold. Some 70 per cent of energy is produced renewably, spurring innovation and providing universal access to affordable clean energy. More than 15 million jobs have been created by growth in sectors focused on greening and harnessing of digital technologies. People in both rural and urban areas benefit from this transformation. Communities and households become energy prosumers, accessing new income streams. An economy that is sustainable, harnessing tech and new urban design and supply chains, drives efficiency and ensures that nothing is wasted. Most countries have electrified at least 60 per cent of their transportation systems.

Technology is strategically deployed as a top priority by leading governments to efficiently and fairly manage the environmental commons. The four most important public environmental goods are targeted by new multilateral agreements — clean air, fresh water, forests, and oceans. A Live Oceans Agreement deploys digital and satellite technology to protect the most valuable ocean areas and eliminate outflows of plastic to the oceans. Fish stocks rebound. The burdens of ill-health are lifting, especially for the poorest and most vulnerable communities who have always been most affected.

Air is clean all year as a result of cooperation focused on technology and win-win outcomes for all countries. Sources of pollution are identified, and information shared real-time and action taken to address the drivers. Circular economy approaches have helped boost agricultural productivity and avoid biomass burning, which is significantly reduced with scaling up of readily available biotechnologies. Adoption of mechanized and/or other affordable and efficient waste management, agricultural practices, regulations, and incentives and/or transitional support for small farmers also add to the sectoral stimuli.

A five-year initiative that started in 2025 has mobilized communities and technology partnerships to build a green wall spanning South and South-West Asia and Central Asia,

connecting the Islamic Republic of Iran's national tree planting scheme, Pakistan's 10 billion Tree Tsunami, and China's "Great Green Wall", halting deforestation, rehabilitating degraded lands and ecosystems, mitigating dust storms, and targeting at risk and depleted watersheds and resilient indigenous flora. In each country, at least 30 per cent of terrestrial areas are managed to secure biodiversity and other ecosystem functions and reverse degradation. The restoration of biodiversity and healthy micro-climates for farming, along with robust and inclusive agrarian reform, supports farmer self-organization and access to technology, enabling even smaller farm-holders to earn a fair share of the profits and value-added.[92] Urban farming helps reduce the pressure on rural areas. Food supply chains are also considerably shortened and democratized. Empowered and self-organized farmers in urban areas are thriving and include young and women farmers who are closely linked with their consumers.

In 2040, access to safe, affordable, nutritious, and diverse food is almost universal. Consumers demand it, and technology and cooperation makes it possible. Regional trade is supported by agreements on agri-chemical use and safe food between the largest food exporters. The trade also complements dynamic national and local markets that make farm-to-table options available to almost everyone, even in large cities.

A tipping point in favour of sustainable food systems has been reached. Although highly land-intensive, the low resource-input (sustainable intensification) farms ensure that food demand can be met. Production is balanced, following principles of sustainable agriculture and agroecology across 80 per cent of the global food value chain. Rural-urban divides are narrowed or closed as rural communities enjoy the benefits of smart, sustainable farming and shorter supply chains are rewarded financially for the carbon sequestered. Nature-based and eco-system-based climate solutions contribute to generating energy and food are fully mainstreamed. Cities have fully embraced restoration of biodiversity and the technological advancement allowed for urban agriculture at scale.

How did we get here? Powerful lessons have been learned about inclusion and leadership from the harrowing years of battling the global pandemic. However, it took a series of severe weather events and the seventh hottest year which triggered a severe multi-year drought across the region, to precipitate actions in 2025.

Facing widening inequality and deepening vulnerability post-COVID-19 and with fiscal and policy constraints, the region comes together to ramp up investments in innovations to support environmental sustainability and inclusion. Fiscal constraints have forced creative partnerships and rely heavily on community participation. A revitalized approach to multilateralism forges new voluntary agreements which are open, inclusive and networked and in which technology drives science- and evidence-based decisions. Climate action, resource stewardship and transboundary environmental issues, technological development and managing migration are among the most immediate targets for action to deliver environmental health as a public goods. The UN Decade on

92 Neeta Lal, "Water Scarcity: India's Silent Crisis", 2018. Available at: http://www.ipsnews.net/2018/03/water-scarcity-indias-silent-crisis/

Ecosystem Restoration played a critical role in framing global actions.

These new approaches promote solidarity between people, and work towards a reimagined social contract that includes future generations. High-impact partnerships based on aligned values and a clear policy direction have helped to close resource gaps left in the wake of the pandemic. Key stakeholders in the financial sector, across industries and supply chains have reached significant milestones in relation to data sharing, standards and transparency.

Engaging young people and the public becomes a priority. Creating seats for young parliamentarians and lowering the voting age to 16, and creating citizens assemblies with equal representation for youth, are helping to bridge the intergenerational divides that have been widening post-pandemic. With youth having a larger say, community pressure has helped in significantly eroding socio-cultural barriers. Gender balance in government and decision-making leads to better balance in decision-making. A strengthened social contract emerges.

Fifteen years later, the ambitious carbon neutrality targets set by the majority of the region's governments in 2020 and 2021 have been exceeded or are on their way to being met ahead of time. Although these efforts may not completely reverse the trajectory of climate change, the investments yield economic and social benefits that build resilience. A regional agreement on carbon taxation and pricing and investment in ecosystems underpin a "clean energy economy."

National confidence, once seen only among the larger countries, has spread to almost every country. Trust that a better future is within reach, is widely shared.

By contrast, the countries that took their own roads, entrenching divides between countries based on old rivalries, are now struggling to find their place in this new era. The sheer scale of demand for natural resources is the hardest challenge to overcome. While the pandemic slowed the use of materials and waste production, the demand for minerals, land, fish and water continued to rise. The trust established through the successes of regional cooperation is tenuous; geopolitical conflict around resources is still on the horizon. The improvements in governance will take some years beyond 2040 to secure benefits for the entire population. Change came step by step, involving numerous stakeholders. Partnerships took time to build. The negative pressures of geo-political tensions and near disasters nearly stalled progress. By staying focused on the goal, not on their immense differences, citizens, states and businesses could in time prevail.

The Great Collapse

(An outlier scenario in four parts)

Four elements of an outlier scenario are described here. Each calls attention to an environmental "blind spot" which, like the global pandemic, can disrupt and destabilize economies and societies across the region.

Thirsty cities

The year is 2040. Reliable supplies of clean, fresh drinking water are almost impossible to access, leading to migration away from the most densely populated areas of South and South-West Asia.[93] Central Asia, now home to almost 100 million people and severely impacted by climate change, faces growing tensions around water.[94] Localized conflicts expand and deepen as fresh water in the Asia-Pacific has decreased dramatically. Rising sea levels, floods, storms, and other natural disasters occur frequently. They act to degrade the land through increasing salination and reducing effectiveness of water infrastructures in vulnerable coastal areas.[95] The simultaneous impacts of unchecked population growth and up to a 50 per cent increase in middle-class citizens in the region[96] have led to a demand for water that is impossible to meet.

Water scarcity in Asia and the Pacific in 2040 impacts almost every industry. Economies are beginning to shrink owing to unsatisfied dependence on fresh water. The energy and agricultural sectors suffer the most, since countries had failed to invest in improving water-efficient infrastructure 20 years ago. Some farms and power generation facilities had to be abandoned. A spreading water crisis has evolved into an energy crisis. Years of continued investment in thermal power plants, traditionally cooled by fresh water, can no longer operate, and the demand for power has outstripped supply. Water pollution from high economic growth activities from 20 years ago persists and continues to cause avoidable deaths. Urbanization is accelerated as farms can no longer thrive in most rural areas; water refugees seek the more heavily-invested water systems of large cities. Many Asia-Pacific cities, however, suffer from water scarcity and already high urban populations and can offer no additional security. Water for hygiene is a luxury, and disease begins to spread in urban centres.

When water crises deepened to touch even the wealthy some 10 years previously, in 2030, there was a rush to secure lands that would provide strategic access to water. Water became one of the primary reasons for "land-grabbing". Water-rich economies found new wealth in selling off water rights at high prices.

93 Neeta, L. Water Scarcity: India's Silent Crisis. http://www.ipsnews.net/2018/03/water-scarcity-indias-silent-crisis/ (2018)

94 See Ronny B, and others. The Future of Water Management in Central Asia. https://www.mdpi.com/2073-4441/12/8/2241 (2020) and Aibek Z and others. Water in Kazakhstan, a key in Central Asian water management. Available at https://www.tandfonline.com/doi/full/10.1080/02626667.2018.1447111 (2018)

95 UNDP. Climate change in Asia and the Pacific. What's at stake? https://www.asia-pacific.undp.org/content/rbap/en/home/presscenter/articles/2019/climate-change-in-asia-and-the-pacific.html (2019)

96 Statistica. Forecast of the global middle-class population from 2015 to 2030, by region. https://www.statista.com/statistics/255591/forecast-on-the-worldwide-middle-class-population-by-region/ (2021)

There was also a push to manage demand and consumption via market approaches. The high-water waste practices of Asia-Pacific smallholder farmers, along with inefficient or corrupt water uses in other sectors, justified the commoditization of water. Foreign players quickly positioned themselves in the regional market, and corporations began investing and trading in the AAA+ -rated investment opportunity of water. Following the introduction of water futures in the NASDAQ, water joined gold, oil and other commodities traded on regional capital markets.

Despite the constitutions of many countries enshrining the access to water as a right, populations begin to pay increasingly higher sums for smaller quantities of water. Water mafias step in to fill the gaps in water services, tapping into government systems illegally, simultaneously undercutting and driving up the market price and undermining human security and trust in government.

Box 3.2 Regional water challenges

As of 2018, some 3.6 billion people, or 47 per cent of the global population, live in areas that suffer water scarcity at least one month each year. According to 2050 projections, experts expect that over 5 billion people will be living in areas with poor access to water.[a] The region has less fresh water than any other continent (other than Antarctica), at an estimated 3,920 cubic meters per person, per year.[b]

Some 3.6 billion people, or 30 per cent of the Asia-Pacific population, are facing water scarcity today. In the latest IPCC report on climate change, researchers predict with high confidence that a warmer climate (caused by anthropogenic climate change) "will intensify very wet and very dry weather and climate events, with implications for flooding or drought", which would result in increased water scarcity for many Asia-Pacific countries.[c]

By 2050 water withdrawals are projected to increase by 50 per cent on 1995 levels, and by 71 per cent per capita for domestic use. Narrowed fiscal space post-pandemic has constrained the ability to invest in critical and aging water infrastructure, so water continues to be lost. Against a background of a changing climate, Day Zero, when water supplies run dry, already recurs for some cities in South Asia — a situation that is projected to spread. Dependence on water from transboundary freshwater systems creates interdependencies, and challenges for shared management.

SOURCES:

a. UN-Water, World Water Development Report, 2018. (New York, United Nations, 2018). Available at https://www.unwater.org/publications/world-water-development-report-2018/

b. Leadership Group on Water Security in Asia, Asia' Next Challenge: Securing the Region's Water Future, April 2009. Available at https://asiasociety.org/files/pdf/WaterSecurityReport.pdf

c. Intergovernmental Panel on Climate Change, 2021. Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change

Generations divided

Future generations will shoulder the environmental debt created by years of investment in fossil fuels and carbon intensive infrastructure. Young people are optimistic that they can change the future, but express frustration with their elders' failure to act. Intergenerational divides have always existed, but could this be different, more serious?

The year is 2040. The world is already 2.5°C warmer than it was 20 years earlier. After the doors of COP 26 closed, not much changed global warming prevailed and reached a threshold of no return. The Asia-Pacific region is in an economically paralyzed state, focusing entirely on damage control and mitigation. The youth from 2020, finally in political positions capable of implementing the right climate policies, are bitterly engaged in a fight for their future. They know that if the current political landscape and agenda they created was implemented just 20 years ago, the Asia-Pacific region could be thriving as opposed to nearing collapse.

Asia-Pacific leaders strictly and transparently promote spending on climate action and mitigation, and steer spending away from social protection, including health care for the elderly. The youth of 2021 now have direct control of budgets that impact the well-being of the latter and justify their cruelty with a simple statement: "you had the power to halt climate change, but you prioritized economic growth over our future". Those same youth now prioritize making the world liveable again, but at a high social price.

From factory to table

Maintaining agrobiodiversity is essential in building climate-resilient agriculture. More than 20 years ago, the FAO sounded the warning: 90 per cent of crop varieties had disappeared from farmlands and 75 per cent of the world's food was being generated from only 12 plants and 5 animal species. The loss of agrobiodiversity is a risk to food security and nutrition globally. What are the new ways in which food needs will need to be met, and what does this mean for food supply, nutrition and society at large?

The year is 2040. Access to healthy food has dramatically declined as farms have collapsed under varying weather patterns and disease far more quickly than expected. An added complication has been the loss of on-farm labour as people migrate to a better life elsewhere. The price of food is at the top of the government's agenda. The lack of investment in agrobiodiversity means that climate adaptation has had limited success, and the region has had to turn to "manufactured" nutrition to meet its needs, investing heavily in technological interventions to feed a hungry population. Now, people's main source of protein is a factory, rather than a farm.

Healthy alternatives produced with smart technology, on urban farms or produced overseas, carry an enormous price tag that 90 per cent of the regional populations cannot afford. The most affordable and accessible foods are highly processed, and lead billions of people to shortened lifespans. Non-communicable diseases as a result of lifestyle and unhealthy diets proliferate, and regional healthcare systems are burdened by the sheer volume of cases.

Social divides have deepened by the issue of food — those with resources can afford a healthy diet and enjoy good health, while those without face a losing battle to climb out of poverty. Following the collapse of monoculture in farming as means to avoid predicted desertification and soil degradation, the availability of arable land has decreased to one third of what it was in 2020. The typical smallholder farmer has disappeared. A depleted rural economy has not been able to meet food needs as billions in the region join the poor and extreme poor.

The region can barely satisfy its domestic food demand and has ceased almost all food export activities due to civil unrest from this important policy issue which tops the political agenda. Inter-country trade in food has collapsed due to the escalating disputes over land access and rights, leaving the region divided in its struggle to feed 5 billion people.

A choking region

Air pollution is already a leading cause of death globally, and has contributed significantly to COVID-19 mortality. Some of the most worrying pollutants (black carbon and methane, a precursor to ground-level ozone) are also among the top contributors to global warming. Some development programmes are strengthening cooperation in air pollution, in particular in North-East Asia. Can these actions come together quickly enough to make a difference? What could happen when pollution meets a new, more deadly virus?

The year is 2040. Almost every Asia-Pacific nation has closed its borders and declared a lockdown. This is the third global pandemic to occur since the coronavirus pandemic in 2019, and Asia-Pacific populations are well aware of the increased levels of danger they face relative to the rest of the world. This new respiratory syndrome arrived suddenly, and also targets the lungs, like its predecessor. But this is where similarities cease.

It seems that this new coronavirus is far more sensitive than its predecessor to air pollution. As the pandemic advances to its second year, people living in the most polluted megacities and rural areas alike know they are 10 times more likely to perish from this pandemic than people in other regions, due to the simple act of breathing. In areas with good air quality, the mortality rate is 2 per cent, but in Asia, the mortality rate is 20 per cent. The exceedingly high levels of PM2.5 particles in the air have weakened the lungs of lungs of Asia populations, making

them more susceptible to death from this new coronavirus, and the transmissibility of this virus is also considerably higher in the region.

How did that happen? The push to recovery from the pandemic of 2020 faced fiscal constraints and pushed aside important investments in pollution control, resulting in the most toxic levels of pollution in modern history. Some 80 per cent of the region is impacted by poor air quality for at least half of the year, even in places with previously pristine air, due to transboundary pollution. The population-weighted annual mean concentration of PM2.5 is now 75 μg/m3 in the region, a 30 per cent increase from 2020 levels, and megacities such as Tokyo, Jakarta, Shanghai, and Bangkok rarely experience blue skies.

Currently however, the regional economy is barely breaking even, due to the economic toll of decreasing air quality over the previous 5 years. Cardiovascular and pulmonary diseases caused by air pollution cost the region billions of dollars annually, and the excess death rate is at an all-time high.

While the rest of the world begins to manage the pandemic, the death toll in Asia is rising. People are scared and unproductive. Those with the means stay inside with air filters working 24/7. Since the regional economy depends on high polluting activities, policymakers are in a tight place, with the public starting to agitate for action.

Much air pollution is transboundary in origin and local action can only go part-way towards clearing the air. But a decade of tense economic and political relationships between Asia-Pacific nations both big and small stymies cooperation. The lack of data and analysis that are recognized by all parties lead to finger-pointing and raise questions as to who is accountable for the poor air quality.

The demand for clean air reaches new peaks. The privileged in the region decide that this pandemic is to be their last in Asia, and a mass exodus of people and investment is set to occur in the coming years. For the underprivileged, the term “clean air refugee” is coined, and immigration infrastructures and platforms of favoured destination countries break down under the spike in demand.

4

How did we get to the desired future?

Chapter 4
How did we get to the desired future?

This chapter targets the scenario "the Yangtze River Dolphin returns" (see Chapter 3). In this scenario the Asia-Pacific region is on its way to building thriving, healthy and tightly knit societies. Although some challenges still persist, the outlook for the coming years is positive.

The worst impacts of climate change have been averted and mitigated, through reducing the harmful footprints of the region's cities, sustainably managing natural ecosystems, and in other ways respecting environmental limits. The Asia-Pacific region leads the world in technology-led collaboration and data sharing for managing the global commons, access to clean energy and sustainable production of safe, nutritious and affordable foods. And it shares its advances with the rest of the world. A tight mosaic of multilateral agreements, technological collaboration, and shared values support the countries and people furthest behind and help the region climb higher.

But how can the Asia-Pacific region get from critical tipping points observed in 2021, to its 2040 ambitions? A roadmap to the "integrated" 2040 scenario points to steps toward transforming the outlook for the future.

The roadmap is formulated and presented to support social and institutional dialogue on the pathways forward. It focuses on multilateral action: what governments and stakeholders can do together. *Our Common Agenda*, the report of the United Nations Secretary-General, calls for a "new deal at the global level". It underlines the purpose of international cooperation in twenty-first century: "to achieve a set of vital common goals on which our welfare, and indeed survival, as a human race depends." Reinvigorated multilateralism, anchored in a stronger, more networked, and inclusive multilateral system is at the core of this call for a development agenda that seek a renewed social solidarity and social contract, an end to the ongoing "infodemic" and "war on science" — and a change in the way prosperity is measured, among other transformations.

Based in transformative futures approaches, the road map outlined in this chapter is not a plan for controlling the future, but rather a path to open the opportunity for alternative futures,[97] promoting worldviews and narratives highly influential in attaining our ideal future.

Possible milestones are defined in four "phases" in a pathway to strengthen human security and health, prosperity and equality through ecosystem health.

2021 to 2024
Building the infrastructure for change

The COVID-19 pandemic brought powerful lessons about the need for solidarity and collaboration — and also the benefits of positive disruption. Health has become a key priority for all governments. During this phase, the "infrastructure" for partnership and collaboration is built. Scientific and technology-led cooperation focus on delivering a healthy environment as a public good, for all people.

2025 to 2029
Confidence raises ambition

Following the establishment of more effective regional cooperation on transboundary air pollution in 2023, the ambitions for cooperation have grown. Relying on the scientific and technology communities and actors has depoliticized environmental issues. During this second phase, additional agreements are made and become operational. Alliances of like-minded governments and stakeholders drive action, and multilateral agreements are effectively framed to make substantial progress.

2030 to 2034
Consolidating the gains

During this third phase, partnerships strengthen and start to show results. The emphasis on transparency pays off. Countries are on track to meet or exceed net zero targets. The environmental limits set through multilateral cooperation have spurred innovation and protected people's livelihoods – a double dividend results as greenhouse gas emissions start to slow for the first time. As 2030 comes to a close, the Asia-Pacific countries lead the post SDG negotiations.

2035 to 2040
Rising to new levels

The region is enjoying the gains of a green economy and improved health. Early climate action avoided the worst aspects, but warming is about to peak and stakeholders are getting ready for it. A high degree of preparedness and resilient ecosystems means a highly resilient region. Frontrunner cities have already achieved carbon neutrality but energy and resource demand from urban areas continues to increase. The regional agreement on air pollution is delivering noticeable improvements in air quality. The region is now ready to aim for higher impact.

1 2021 to 2024 — Building the infrastructure for change

The COVID-19 pandemic brought powerful lessons about the need for solidarity and collaboration — and also the benefits of positive disruption. Health has become a key priority for all governments. During this phase, the "infrastructure" for partnership and collaboration is built. Scientific and technology-led cooperation focus on delivering a healthy environment as a public good, for all people.

- The **One Health concept gains currency**, promoting the worldview that human and planetary health are entwined. Public support for "One Health" helps accelerate delivery on the right to a healthy environment including its gender dimensions, and reshapes educational curriculum.

- A proposal for **radical transparency of environmental data to be leveraged for the public good** comes from the region's scientific and technological community, including the private sector, and partnerships are established to enable that. **Citizen science** standards are agreed in relation to water, air, biodiversity and ecosystem health in order to boost accountability mechanisms for multilateral environmental agreements. These steps **open the way for discussions on three other critical social-ecological systems:** landscapes (targeting the conservation and sustainable restoration of degraded landscapes), oceans and seas (focused on coastal zones, plastic pollution and fisheries), and freshwater systems, including transboundary rivers.

- **All countries have now set ambitious net-zero emissions targets** that are reference points for mitigation and adaptation actions. **International financing ends for coal-fired power plants.**

- Realizing that global risks of climate change were most keenly felt in the Asia-Pacific region, fiscal and economic policymakers acceleratedd and deepened technical collaboration and agreement on key principles for financing sustainable development. Strengthened multilateral action built important regional and global momentum. Major steps towards carbon taxation and pricing multiplied investment in climate action and raised ambition and delivery on NDCs. Committment to working through difficult issues in collaboration with think tanks, academia, parliamentarians and civil society in the process leads to innovative investment in resilience-building measures that ensure that no-one is left behind.

- The **Green New Deal Alliance** of countries bent on green recovery **teams up with the regional development banks and the financial sector to roll out clean energy and water technology** involving partnerships between local governments and technology providers.

- A **regional agreement on sharing and use of satellite data** for environmental monitoring makes remote sensing for environmental monitoring accessible, and a powerful tool for transparency. The private sector is a major partner in this effort.

- **A voluntary modality on air pollution mobilizes countries across the region** to strengthen cooperation on transboundary air pollution and to adopt national policies to improve air quality.

- A legally-binding **regional agreement on access to information, public participation and decision-making, and access to justice on environmental matters**, enters into force in record time. Following the initial ratification by 10 governments, others join. Drawing from the lessons of the Aarhus Convention in Europe and the Escazú Agreement in Latin America, the agreement helps to increase civic space, to protect environmental defenders and to better manage the social and environmental disruptions of a changing risk landscape.

- **Cities emerge as drivers of progress** in the 2030 Agenda for Sustainable Development, with an increasing number across Asia Pacific having engaged their communities to undertake Voluntary Local Reviews, enhancing accountability and participation and strengthening multilevel governance.

2 2025 to 2029 — Confidence raises ambition

Following the establishment of more effective regional cooperation on transboundary air pollution in 2023, the ambitions for cooperation have grown. Relying on the scientific and technology communities and actors has depoliticized environmental issues. During this second phase, additional agreements are made and become operational. Alliances of like-minded governments and stakeholders drive action, and multilateral agreements are effectively framed to make substantial progress.

- A regional voluntary agreement on building **networked "green walls"** focused, in its first phase, on restoring degraded watersheds. By 2030, more than 50 billion trees, appropriately selected and planted, and at-risk freshwater ecosystems restored. These actions have targeted the most degraded, vulnerable areas via remote sensing and climate models. These Asia-Pacific "green walls" help bridge intercountry tensions across borders, promoting sustainable land management practices including restoration of degraded lands and other steps to avoid or minimise the impact of further conversion.

- A regional voluntary agreement on **food safety and sustainable agricultural production is reached – including a ban on harmful agrochemicals**. The ban sends a clear signal about the priorities attached to food safety, boosts consumer awareness and creates new opportunities. Regional public–private partnerships of food suppliers, governments, farmer cooperatives, and technology providers reach agreements on data sharing and cross-certification measures.

- **A regional voluntary agreement on carbon taxation and pricing** is launched, capitalizing on the technical foundations built in the previous period and trends in digitalization.

- A framework for **Sustainable Partnership Agreement** is developed by Asia-Pacific countries in collaboration with stakeholder groups to ensure equality and policy space for sustainability in trade agreements. The power balance between investor countries and recipients is thus restored.

- The **Forum of Mayors is formalized** to further raise the voice of local authorities in international dialogues on sustainable development. Twenty of the **region's largest cities set carbon neutrality targets** for 2035, to be implemented in partnerships with provincial administrations/rural areas surrounding these cities. Priority investments in building standards, transport, urban and sustainable agriculture practices, and waste and water management are identified to achieve targets. Cities across Asia and the Pacific develop and adopt local climate action and resilience plans aligned with their respective countries' Nationally Determined Contributions.

3 2030 to 2034 — Consolidating the gains

During this third phase, partnerships strengthen and start to show results. The emphasis on transparency pays off. Countries are on track to meet or exceed net zero targets. The environmental limits set through multilateral cooperation have spurred innovation and protected people's livelihoods – a double dividend results as greenhouse gas emissions start to slow for the first time. As 2030 comes to a close, the Asia-Pacific countries lead the post SDG negotiations.

- A major technology partnership rolls out citizen science networks in every subregion. A partnership of technology providers, schools and local governments **launches a major multi-country citizen science initiative to monitor air quality**, providing granular data on sources, health risks, and health impacts to improve local action. **Mobilization via schools** helps to dramatically boost youth engagement in this initiative in more than 40 countries.

- **A regional modality on air pollution** is modelled on the Convention on Long-Range Transboundary Air-Pollution, adopting management, monitoring and financing mechanisms that capitalize on the mutual benefits of air quality measures for health, climate change and climate-resilient agriculture.

- **Environmental "personhood"** is declared for major rivers in most of the region, including major transboundary rivers.

- The **"Live Oceans" Regional Voluntary Agreement** completes the implementation of the **Decade of Action for the Oceans**. The largest international marine protected area in the world is established, and member States in the region ratify the international, legally binding instrument under the United Nations Convention on the Law of Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction.

- A new **global poverty eradication and adaptation push** originates in the Asia-Pacific region, encompassing protections and measures to enable climate adaptation by households and businesses.

- **Local carbon neutrality commitments** expand to double the number of cities, including secondary cities, fostered by enhanced city networks and local mechanisms such as the regional Mayors Forum, and city-to-city peer exchanges help to extend and deepen its impact.

4 2035 to 2040 — Rising to new levels

The region is enjoying the gains of a green economy and improved health. Early climate action avoided the worst aspects, but warming is about to peak and stakeholders are getting ready for it. A high degree of preparedness and resilient ecosystems means a highly resilient region. Frontrunner cities have already achieved carbon neutrality but energy and resource demand from urban areas continues to increase. The regional agreement on air pollution is delivering noticeable improvements in air quality. The region is now ready to aim for higher impact.

- A **comprehensive voluntary framework for carbon rationing** works to keep carbon footprints within manageable limits.

- The **international justice system for the environment** is established, including provisions for restitution and compensations for loss and damages, as well as the protection and safeguarding of environmental defenders.

In conclusion

In keeping with the times, or perhaps as a reaction to the times, the milestones on the roadmap to 2040 highlight environment and development interventions that strengthen solidarity, cooperation and transparency. They provide opportunities for mobilizing stakeholders to improve decision making in land-use planning, cooperative management arrangements, and prioritizing action based on social and scientific considerations.

The proposed milestones harness the positive technological developments that make information available at lightning speed almost everywhere. Harnessing this technological power in the collaborative ways described above, can accelerate the delivery of a healthy environment as a public good. Information currently leveraged for private gain by the private sector, can then be better leveraged for public benefit- shifting current paradigms. The roadmap also hints how the thematic drivers identified in chapter 2 may be drawn on to steer the region towards the preferred vision of Asia and the Pacific in 2040.

Each government, stakeholder group and development actor, whether state, non-state or development partner is invited to consider these proposals, explore the forces for change in their own contexts and help work with others towards a reinvigorated, networked, multilateralism and new partnerships for an alternative, preferred future for Asia and the Pacific in 2040.

ANNEX
Metadata, sources and explanatory notes for “Insights”

HE-1	Shifting forests: Changes in naturally regenerated forests, 2000-2018	Forests predominantly composed of trees established through natural regeneration. Includes forests which cannot be determined whether planted or naturally regenerated; forests with a mix of naturally regenerated native tree species and planted or seeded trees, wherein the naturally regenerated trees are expected to constitute the major part of the growing stock at stand maturity; coppice from trees originally established through natural regeneration and naturally regenerated trees of introduced species. SOURCE: Land use data, FAOSTAT Food and Agriculture Database. Available at: www.fao.org/faostat/en/
HE-2	Drivers of deforestation	The method used for attributing deforestation to agricultural and forestry production, trade, and consumption, as well as the main data sources draws on (1) a land balance model; (2) crop attribution; (3) embodied deforestation footprint calculations; and (4) a trade model that links deforestation footprints to bilateral commodity trade data; and draws on general data sources as well. SOURCE: Florence Pendrill and others, Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition, Environmental Research Letters 14 055003 (2019). Available at: https://iopscience.iop.org/article/10.1088/1748-9326/ab0d41#erlab0d41s2
HE-3	Converting forests to oil palm halves biodiversity and biomass	The authors quantified the impacts of the transformation from tropical secondary rainforest, jungle rubber. and intensively managed planted rubber, to oil palm, utilizing data gathered from 32 sites in Sumatra, Indonesia, comprising 2,415 populations of 871 species. SOURCE: Andrew Barnes and others, Consequences of tropical land use for multitrophic biodiversity and ecosystem functioning, Nature Communications 5, 5351 (2014). Available at: https://doi.org/10.1038/ncomms6351
HE-4	Food carbon footprints: Carbon emissions in producing one kilo	“Data was derived from a comprehensive meta-analysis, identifying 1530 studies for potential inclusion, which were supplemented with additional data received from 139 authors. Studies were assessed against 11 criteria designed to standardize methodology, resulting in 570 suitable studies with a median reference year of 2010. The data set covers ~38,700 commercially viable farms in 119 countries and 40 products representing ~90% of global protein and calorie consumption.” The study covers five environmental indicators including land use and greenhouse gas emissions. Land use is expressed in square meters per 100 grams of protein. Greenhouse gas emissions are expressed in kilograms of carbon dioxide equivalent. SOURCE: J. Poore and Th. Nemecek, Reducing food’s environmental impacts through producers and consumers, Science, 360, 6392, 987–992 (2018). Available at: www.science.org/doi/10.1126/science.aaq0216

HE-5	The space our food takes: Land needed to produce 100g of protein, different food crops	"Data was derived from a comprehensive meta-analysis, identifying 1530 studies for potential inclusion, which were supplemented with additional data received from 139 authors. Studies were assessed against 11 criteria designed to standardize methodology, resulting in 570 suitable studies with a median reference year of 2010. The data set covers ~38,700 commercially viable farms in 119 countries and 40 products representing ~90% of global protein and calorie consumption." The study covers 5 environmental indicators including land use and GHG scores. Land use is expressed in square metres per 100 grams of protein. GHG scores are expressed in kilograms of carbon dioxide equivalent. SOURCE: J. Poore and Th. Nemecek, Reducing food's environmental impacts through producers and consumers, Science, 360, 6392, 987–992 (2018). Available at: www.science.org/doi/10.1126/science.aaq0216
HE-6	Average beef and chicken consumption	Meat consumption is measured in thousands of metric tons of carcass weight (except for poultry, which is expressed as ready-to-cook weight) and in kilograms of retail weight per capita. SOURCE: Organization for Economic Cooperation and Development, Meat consumption, OECD Data (2021). Available at: https://data.oecd.org/agroutput/meat-consumption.htm
HE-7	Emerging alternatives: Plant based protein production value in China	SOURCE: The Good Food Institute, China Plant-Based Meat Industry Report 2018. https://mcusercontent.com/0921092d6da96ed8667bfb2d8/files/921a6fbf-a384-4f81-876e-1c2f6d5686a3/GFI_China_Plant_based_Meat_Industry_Report_2018.pdf
CA-8	Gender mainstreaming in climate action, Asia-Pacific countries	SOURCE: ESCAP, UN Women, UNEP, and the greenwerk, Is 1.5°C within Reach for the Asia-Pacific Region? Ambition and Potential of NDC Commitments of the Asia-Pacific Countries (Bangkok, United Nations, 2021). Available at: www.unescap.org/kp/2021/15degc-within-reach-asia-pacific-region-ambition-and-potential-ndc-commitments-asia-pacific
CA-9	CO2 emissions by sectors, 1990 and 2017	The full documentation, including detailed definition of sectors and emission calculation methods, is available from the International Energy Association (IEA) data portal. SOURCE: IEA (2020). CO2 Emissions from Fuel Combustion 2020 Edition: Database Documentation (2020). https://iea.blob.core.windows.net/assets/474cf91a-636b-4fde-b416-56064e0c7042/WorldCO2_Documentation.pdf

CA-10	Affordable clean energy: Global cost of solar, wind and fossil energy	Using the IRENA renewable capacity and generation database (www.irena.org/Statistics), this image visualizes generation from solar PV, concentrated solar power, and off-shore and on-shore wind in Asia and the Pacific from 2011 to 2020. See the source reference for detailed methodological insights on the database. SOURCE: International Renewable Energy Agency, Off-grid Renewable Energy Systems: Status and Methodological Issues (2015). Available at: www.irena.org/publications/2015/Feb/Off-grid-renewable-energy-systems-Status-and-methodological-issues
CA-11	Asia-Pacific solar power generation, 2016 and 2020	Using the IRENA renewable capacity and generation database (www.irena.org/Statistics, this image visualizes generation from all solar sources in Asia and the Pacific in 2016 and 2020. See the source reference for detailed methodological insights on the database. SOURCE: International Renewable Energy Agency, Off-grid Renewable Energy Systems: Status and Methodological Issues (2015). Available at: www.irena.org/publications/2015/Feb/Off-grid-renewable-energy-systems-Status-and-methodological-issues
CA-12	Comparison of CO_2 emissions by sector, and social media attention by sector	Details of emission calculations and sectoral definitions can be found in the WRI source paper. SOURCE: World Resources Institute, CAIT Country Greenhouse Gas Emissions: Sources & Methods (2015). Available at: http://cait.wri.org/docs/CAIT2.0_CountryGHG_Methods.pdf Social media exposure was calculated from a random sample of 10,000 Tweets generated in English in the Asia-Pacific region. The Tweets were collected using the Twitter API and filtering for the keywords “climate” and “carbon emissions” over a time frame of the two months between 01/01/2021 and 01/03/2021. They were weighted based on “retweets” and “likes” to reflect their level of public exposure. The frequency of topics was estimated through a topic modelling of WRI main sectors — linking specific keywords to each of the sectors. The keywords were chosen using the WRI definition of sectors, when necessary adapted to more common language.

CA-13	Rising sea levels: Changes in mean sea levels since 1990	This visualization relies on high quality measurements of (near)-global sea level that were made available since the early 1990s by satellite altimeters; in particular, TOPEX/Poseidon (launched in August 1992), Jason-1 (launched in December 2001), Jason-2 (launched in June 2008) and Jason-3 (launched in January 2016). The data have shown a more-or-less steady increase in Global Mean Sea Level (GMSL) of around 3.2 ± 0.4 mm/year over that period. "This is more than 50% larger than the average value over the 20th century." SOURCE: Commonwealth Scientific and Industrial Research Organization of Australia, Historical sea level changes, Sea Level Rise; Sea level, Waves and Coastal Extremes (n.d.). Available at: www.cmar.csiro.au/sealevel/sl_hist_last_decades.html Most estimates of global mean sea-level rise this century fall below 2 m. This population displacement estimate is based on calculations from CoastalDEM, a digital elevation utilizing neural networks to reduce SRTM error. CoastalDEM has assessed that 190 million people currently occupy global land below projected high tide lines for 2100 under low carbon emissions, up from 110 million today, for a median increase of 80 million. SOURCE: Scott Kulp and Benjamin Strauss, New elevation data triple estimates of global vulnerability to sea-level rise and coastal flooding, Nature Communications 10, 4844 (2019). https://doi.org/10.1038/s41467-019-12808-z
SU-14	Mushrooming cities	This indicator tracks the population living in areas classified as urban or rural according to the administrative criteria used by each country or area, in thousand and as a percentage of the total population. The change per annum of the urban population refers to the average exponential rate of change of the urban percentage over a given period. United Nations Population Division, World Urbanization Prospects - 2018 Revision. last retrieved on 19 October 2020, downloaded at https://www.unescap.org/stat/data.
SU-15	Warmer and drier cities: Projected change in precipitation and temperatures for selected cities by 2050	This visualization relies on data made available in a 2019 study by Bastin and others. The study evaluates the global shifts in the climate conditions of cities by taking current climate data for the world's 520 major cities (Current Cities), and projects what they will most closely resemble in 2050 (Future Cities). It quantifies city climate analogs at a global scale i.e. assessing which current cities will most closely resemble the climate conditions of future cities. This modelling uses 19 bioclimatic variables, to include climate variability and seasonality in addition to climate averages. SOURCE: Bastin J-F, Clark E, Elliott T, Hart S, van den Hoogen J, Hordijk I, et al. (2019) Understanding climate change from a global analysis of city analogues. PLoS ONE 14(7): e0217592. https://doi.org/10.1371/journal.pone.0217592

SU-16	Doubling waste: Urban Waste Generation in Asia and the Pacific	The model uses the World Bank's World Development Indicator's GDP per capita, PPP (constant 2011 international $) for the waste per capita regression model, the OECD GDP per capita projections, PPP (constant 2005 international $) for the waste per capita projection estimates, and the United Nations (UN) population growth rates to calculate future waste production. Projected waste generation is arrived at by first estimating a projected waste generation rate. SOURCE: Kaza, Silpa; Yao, Lisa C.; Bhada-Tata, Perinaz; Van Woerden, Frank. 2018. What a Waste 2.0 : A Global Snapshot of Solid Waste Management to 2050. Urban Development;. Washington, DC: World Bank. © World Bank. https://openknowledge.worldbank.org/handle/10986/30317 License: CC BY 3.0 IGO.
SU-17	The energy behind cement	This visualization draws on the indicator "Alternative fossil fuels and mixed fuel consumption" from the dataset provided by the "Getting the Numbers Right" project of the Global Cement and Concrete Association. SOURCE: Global Cement and Concrete Association (2020). Getting the Numbers Right (GNR)project reporting CO2. https://gccassociation.org/gnr/
SU-18	Greener cement?	CACS: carbonation of calcium silicates ; MOMS: magnesium oxide derived from magnesium silicates. Commercial compositions of CACS clinker were not available at the time of publication of the source study. The CACS clinker in this assessment is considered to primarily consist of wollastonite, but commercial composition is likely different, and possibly higher in process CO2 emissions. Process CO2 emissions generated in CACS clinker making are, in principle, re-absorbed during the curing process. MOMS are sourced from magnesium silicate rocks. Given the wide range of mix designs, sources and doses, it is not possible to provide a single value or even a well-defined range to describe the CO2 footprint of alkali-activated binders. The figure shows two possible extreme examples ranging from 97% to 10% CO2 savings compared to Portland cement. SOURCE: IEA (2018). Technology roadmap – low-carbon transition in the cement industry. https://www.iea.org/reports/technology-roadmap-low-carbon-transition-in-the-cement-industry

SU-19	Asia-Pacific water withdrawals for cement production	Total water use was aggregated from the data collected by Miller et al (2018) available in the supplementary information of their publication. The authors explain: "Aggregates and water were modeled as being produced locally; their consumption, with regard to mixture proportions was based on requirements for concrete properties." To calculate the water used in cement production relative to total industrial water withdrawal, we divided by the industrial water withdrawal as estimated in the most recent FAO AQUASTAT industrial water withdrawal data. SOURCES: Miller, S.A., Horvath, A. & Monteiro, P.J.M. Impacts of booming concrete production on water resources worldwide. Nat Sustain 1, 69–76 (2018). https://doi.org/10.1038/s41893-017-0009-5 and FAO (2020) and FAO AQUASTAT, Accessed at: https://www.fao.org/aquastat/statistics/query/results.html
CIA-20	Size and effects of particle air pollution	SOURCE: World Health Organization. Regional Office for Europe & Joint WHO/Convention Task Force on the Health Aspects of Air Pollution. (2006). Health risks of particulate matter from long-range transboundary air pollution (Copenhagen, WHO Regional Office for Europe). Available at: https://apps.who.int/iris/handle/10665/107691.
CIA-21	Unequal exposure to PM2.5	Population-weighted mean exposure to ambient PM2.5 pollution is defined as the average level of exposure of a nation's population to concentrations of suspended particles measuring less than 2.5 microns in aerodynamic diameter, which are capable of penetrating deep into the respiratory tract and causing severe health damage. Exposure is calculated by weighting mean annual concentrations of PM2.5 by population in both urban and rural areas. SOURCE: Brauer, M et al (2017), for the Global Burden of Disease Study 2017, in The World Bank Database. Available at: https://data.worldbank.org/indicator/EN.ATM.PM25.MC.M3
CIA-22	Air is un-healthy in half our cities: Mean PM2.5 concentra-tions, major Asia-Pacific cities, 2020	Calculations for this visualization relied on a dataset generated by the Air Quality Open Data Platform. The dataset, updated 3 times a day, covers about 182 Asia-Pacific cities from January 2020 until now. SOURCE:AQI (2021). Air Quality Open Data Platform, Worldwide COVID-19 dataset. Accessed at: https://aqicn.org/data-platform/covid19/

CIA-23	Spreading pollution: Highest emitting sectors in Asia and the Pacific	SOURCE: European Commission, Joint Research Centre (EC-JRC)/Netherlands Environmental Assessment Agency . Emissions Database for Global Atmospheric Research (EDGAR), release EDGAR v5.0 (1970 - 2015) of April 2020. Accessed at: https://edgar.jrc.ec.europa.eu/dataset_ghg50
CIA-24	Transboundary air pollution: Contribution of local and regional sources to PM2.5 concentration in 2013	SOURCE: Joint Research Project for Long-Range Transboundary Air Pollutants in Northeast Asia (2019). "Summary Report of the 4th stage (2013-2017) LTP Project. Available at: https://www.me.go.kr/home/file/readDownloadFile.do?fileId=184686&fileSeq=1

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