The Thirteenth Session of the Scientific Advisory Committee
on the Acid Deposition Monitoring Network in East Asia
25-27 September 2013, Xiamen, China

Preliminary Final Draft of the Third Report for Policy Makers (RPM3)

I. INTRODUCTION

1. The Report for Policy Makers (RPM1) on "Goals, Achievements, and Way Forward" was adopted at the Seventh Session of the Intergovernmental Meeting (IG7) on the Acid Deposition Monitoring Network in East Asia (EANET) in November 2005 and the Second Report for Policy Makers (RPM2) on "Clean Air for a Sustainable Future" was launched at the Eleventh Session of the Intergovernmental Meeting (IG11) on the EANET in November 2009 after approval by the National Focal Points (NFPs) of the EANET.

2. In line with the Medium Term Plan for the EANET (2011-2015) adopted at the Twelfth Session of the Intergovernmental Meeting (IG12) on the EANET in November 2010 and the Work Program and Budget of the EANET in 2013 approved at the Fourteenth Session of the Intergovernmental Meeting (IG14) on the EANET in November 2012, the Secretariat in collaboration with the Network Center (NC) will develop the Third Report for Policy Makers (RPM3) on the EANET, aiming to raise awareness of the policy makers of the countries in the East Asian Region on the importance of addressing acid deposition and other related atmospheric environment issues.

II. DEVELOPMENT OF THE DRAFT RPM3

3. In the development of the draft RPM3, the Secretariat has engaged a consultant, Ms. Leong Chow Peng, former Deputy Director General of the Asia Center for Air Pollution Research (ACAP) in charge of the NC, to prepare the draft RPM3. The Secretariat in consultation with the NC proposed that the RPM3 should focus on the theme of “Clean Air and Climate Protection for Sustainable Development” and should gear towards an integrated approach for air quality management including co-benefits/co-control approach, strengthen awareness and knowledge on the inter-linkages of acid deposition and air pollution with other atmospheric environment issues, including climate change, and will promote timely actions by integrating prevention and mitigation of acid deposition, air pollution, and other related atmospheric environment issues.

4. The Secretariat circulated the provisional annotated outline of the RPM3 to the NFPs of the participating countries in March 2013. Views and comments on the proposed theme and the provisional annotated outlines of the RPM3 were received from some participating countries which were subsequently taken into account in the development of the RPM3.

5. Current situation and development of the EANET, such as the Second Periodic Report on the State of Acid Deposition in East Asia (PRSAD2) of the EANET recently published in early 2012, the on-going consideration on the future expansion of the scope of the EANET, etc., the discussion at and the outcomes of the United Nations Conference on Sustainable Development (Rio+20) which took place in June 2012, in Rio de Janeiro, Brazil, and other related activities, issues and developments on atmospheric environment, such as climate change issue, the Joint Forum on Atmospheric Environment in Asia and the Pacific, the Atmospheric Brown Clouds (ABC) Programme, the Regional Ministerial Forum on Environment and Health, the Asian Co-benefit Partnership (ACP), the proposed Asia Science Panel on Air and Climate (ASPAC), the Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CACC), etc. were considered and taken into account in the development of the draft RPM3.

6. The Secretariat in collaboration with the NC and the consultant were in consultation with the NFPs and resource persons for views and comments on the first, second, and preliminary final drafts of the RPM3 from which views and comments from the NFPs were taken into account for further refinement of the preliminary final draft of the RPM3 for review and discussion at the Thirteenth Session of the Scientific Advisory Committee (SAC13) held here on 25 – 27 September 2013, as presented in Annex 1. Views and comments received by the Secretariat are included in Annex 2.

III. ACTIONS REQUIRED

7. The SAC13 is invited to review the preliminary final draft of the RPM3 and may wish to discuss, comment, and provide guidance and recommendations, if any, for further refinement of the preliminary final draft to be subsequently reviewed and discussed at the Twelfth Session of the Working Group on Future Development (WGFD12) of the EANET to be held on 14 – 15 October 2013. The final draft of the RPM3 will then be developed taking account of views, comments and recommendations of the WGFD12 for subsequent consideration and endorsement at the Fifteenth Session of the Intergovernmental Meeting (IG15) on the EANET to be held on 16 – 17 December 2013.

Third Report for Policy Makers

CLEAN AIR AND CLIMATE PROTECTION FOR SUSTAINABLE DEVELOPMENT

(Appropriate picture, etc.)

December 2013

Acid Deposition Monitoring Network in East Asia (EANET)

This report has been prepared based on the available reports, scientific data from the EANET monitoring, assessment and research, supplemented by information obtained from various sources which are duly acknowledged.

The contents of the report do not necessarily reflect the views, policies or opinions of any participating country and organization.

The term East Asia used in this report refers to Northeast Asia and Southeast Asia unless otherwise stated.

PREFACE

Emissions of air pollutants from combustion of fossil fuels continue to increase in Asia due to increasing energy demands. From past experience in Western countries, substantial increases in the combustion of fossil fuels for power generation and transportation can improve economic conditions but can also, if not controlled, have important negative consequences for human health and environmental quality through transboundary transport of pollutants. Effective approaches to controlling and reducing pollution is crucial to avert increased environmental degradation and associated health impacts while reducing poverty and providing economic stability for the population.

Policy makers have an important role to play in safeguarding the environment through the implementation of sufficient legislative and policy tools and ensuring that there is compliance of environmental laws and regulations. The Acid Deposition Monitoring Network in East Asia (EANET) is a scientific initiative, established to promote regional cooperation in addressing acid deposition and other related atmospheric pollutants. Since the commencement of its regular phase activities in 2001, the EANET has been providing many valuable scientific inputs to policy makers to assist them in decision making on mitigation of air pollution and other related environmental protection issues. Reports specifically for the policy makers have been published once in every four years in order to convey important scientific information directly to the decision makers of the participating countries.

The first issue of the Report for Policy Makers published in November 2005 announced the EANET's goals, its achievements during the first 5 years of operation and future plans. The second Report for Policy Makers published in November 2009 reported promotion of timely action to attain better air quality management by integrating prevention and mitigation of air pollution and acid deposition. The objectives of the third Report for Policy Makers of the EANET are to update on current state and trends of the regional atmospheric environment, new emerging issues concerning the environment and climate, and the results of the relevant scientific studies, and to provide them to the participating countries of the EANET and other relevant organizations. This report also highlights the recent achievements of the network. It is hoped that the report would provide policy makers in East Asia with a sound scientific basis for decision making to improve local and regional air quality, climate stability and ensure sustainable development of the region.

EANET – A BRIEF INTRODUCTION

The Acid Deposition Monitoring Network in East Asia (EANET) is an intergovernmental regional network established for promoting cooperation among countries in East Asia to address acid deposition problems.

Objectives:

1. To create a common understanding of the state of acid deposition problems in East Asia
2. To provide useful inputs for decision-making at local, national and regional levels aimed at preventing or reducing adverse impacts on the environment caused by acid deposition
3. To contribute to cooperation on the issues related to acid deposition among the participating countries

Acid deposition as defined in the Instrument for Strengthening the Acid Deposition Monitoring Network in East Asia (EANET) means deposition of major acidifying species and related chemical substances. Presently ozone and particulate matter (PM) are included in the monitoring components of the EANET under "related chemical substances".

Thirteen countries in the East Asian region are participating in the EANET activities, namely Cambodia, China, Indonesia, Japan, Lao P.D.R., Malaysia, Mongolia, Myanmar, Philippines, Republic of Korea, Russia, Thailand and Vietnam. Currently the United Nations Environment Programme (UNEP) has been designated as the Secretariat for the EANET. The Regional Resource Centre for Asia and the Pacific (RRC.AP) in Pathumthani, Thailand carries out the Secretariat functions as agreed by the Chair of the Intergovernmental Meeting (IG) and UNEP. The Asia Center for Air Pollution Research (ACAP) in Niigata, Japan has been designated as the Network Center for the EANET.

Since 2001 the EANET has been conducting monitoring, analysis, and evaluation and assessment of data and information from the network of monitoring sites in the participating countries. The network also promotes scientific research, conducts capacity building and public awareness programmes, and facilitates the exchange of information related to acid deposition and air pollution to assist policy makers in decision making to mitigate atmospheric pollution and its impacts. The EANET has gained international recognition for its success in promoting regional cooperation on acid deposition in East Asia.

The IG meets annually to make decisions on the implementation of the Network's activities while the Scientific Advisory Committee (SAC) has been established to provide advice on the scientific and technical aspects to the IG and develop the periodic assessment reports. The activities of the EANET are funded by voluntary financial contributions from the participating countries.

The EANET publishes a Data Report annually, Periodic Reports on state of acid deposition in the region once in five years and the EANET Science Bulletins biennially which reports the results of recent scientific research conducted on acid deposition and related air pollutants and their impacts.


The Twelfth Session of the Intergovernmental Meeting on EANET
23-24 November 2010, Niigata Japan

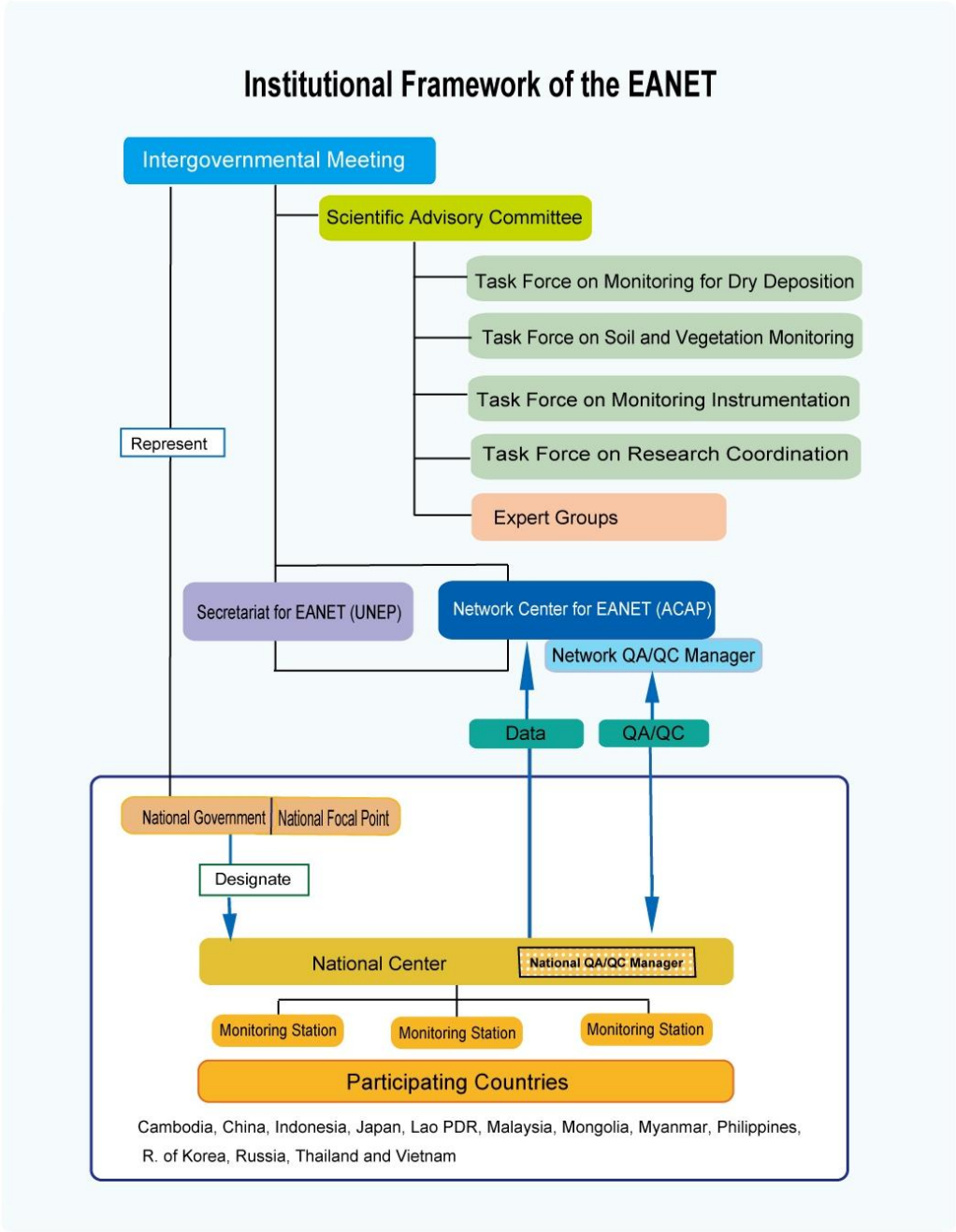

Institutional Framework of the EANET
Intergovernmental Meeting
Scientific Advisory Committee
Task Force on Monitoring for Dry Deposition
Task Force on Soil and Vegetation Monitoring
Task Force on Monitoring Instrumentation
Task Force on Research Coordination
Expert Groups
Represent
Secretariat for EANET (UNEP)
Network Center for EANET (ACAP)
Network QA/QC Manager
Data
QA/QC
National Government
National Focal Point
Designate
National Center
National QA/QC Manager
Monitoring Station
Monitoring Station
Monitoring Station
Participating Countries
Cambodia, China, Indonesia, Japan, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines,
R. of Korea, Russia, Thailand and Vietnam

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Clean air is critical for life. Even small amounts of pollution make air unhealthy to breathe. Air pollution is recognized as a major health risk affecting mainly the very young, elderly and people suffering from heart and respiratory disease. Millions of premature deaths occur each year as a result of exposure to air pollutants, in particular ambient fine particulate. In addition to the impacts on human health, air pollution also causes degradation of the environment. The yield loss of crops due to air pollution, particularly vegetation damage from exposure to high levels of tropospheric ozone, affects the income of the farming community. Remedying environmental disasters such as air pollution, acidification, eutrophication and loss of biodiversity require actions that are costly, complex and often difficult to implement. Thus diligent continuous monitoring of the state of our environment and taking early and effective preventive measures are of the utmost importance.

As a result of the rapid rate of economic development in Asia, the air quality, as determined by the concentrations of the major pollutants in the atmosphere, has further deteriorated in recent years and is projected to further decline over the next 40 years. The situation is more serious in the urban cities where the levels of PM_{10} had significantly exceeded the WHO annual mean guideline in the past decade. It is estimated that 2.1 million people die prematurely each year in Asia due to exposure to unhealthy air quality. Based on the projections by the United Nations, the total population in Asia will exceed 5 billion by the year 2050 andapproximately65% of the population will be living in the cities. This will result in a growing number of people at risk of premature death.

Climate change is occurring at a much faster rate than predicted. From recent measurements, it was found that the concentration of carbon dioxide in the atmosphere had exceeded a key threshold early this year which could lead to more rapid global warming and its negative impacts. While reducing carbon dioxide should be urgently and aggressively pursued, scientists have proposed implementation of immediate measures to mitigate the short-lived climate pollutants (SLCPs), namely black carbon, tropospheric ozone, methane and hydrofluorocarbons, which could slow near-term climate change significantly.

The challenges of improving air quality and mitigating climate change are inextricably linked. Policy paths that integrate air quality and climate change concerns can bring mutual payoffs. There are co-benefits if the approaches to controlling and reducing air pollutants are integrated with those for stabilizing the climate. Strategies for reducing the SLCPs directed towards climate protection could also have direct impacts on local and regional air quality resulting in substantial reduction in premature deaths annually. Policy makers are urged to adopt a co-benefit and co-control approaches for “win-win” benefits for climate protection and improvement of public health.

There are a number of successful on-going initiatives and emerging networks within Asia working to reduce regional atmospheric pollution. Enhanced strategic cooperation between these initiatives building closer relationships with the governments of countries within East Asia is important for policy action to ultimately reach agreement on effects-based emission reductions of air pollutants in East Asia.

Although EANET has progressed and achieved considerable success in the last decade, the current environmental issues present an opportunity for the EANET to play a bigger role in the region. It would appear timely for the EANET to consider expanding of its scope as provided for in the Instrument for Strengthening the Acid Deposition Monitoring Network in East Asia (EANET) by adopted a step-wise approach. The vision is to progress from monitoring and assessment of acid deposition to include the high priority atmospheric pollutants; joining forces with other regional

initiatives for a cleaner atmospheric environment, stable climate and sustainable development in East Asia.

1. OVERVIEW OF AIR QUALITY IN ASIA

1.1 CURRENT STATE OF GLOBAL AND REGIONAL AIR QUALITY

Due to growing awareness of the serious effects of air pollution, countries throughout Asia have taken action to address the problem of air pollution over the past two decades. Many countries have adopted National Ambient Air Quality Standards for several air pollutants such as SO_2, and PM_{10}, implemented measures to reduce emissions from specific sources, notably motor vehicles, industries and power plants, and taken action to relocate industries away from populated areas.

While Europe and North America have witnessed success from their efforts to reduce air pollution, the actions and policies implemented so far in East Asia appears to be less effective in improving regional air quality to healthy levels and achieving sustainable development. The 2010 Clean Air Initiative for Asian Cities of Clean Air Asia report on status and trends revealed that in 2008, only two cities had annual average PM_{10} levels within the WHO Air Quality Guidelines (AQG) of 20 µg/m^3 while about 58% of the cities had annual PM_{10} levels exceeding even the WHO Interim Target-1 (IT-1) of 70 µg/m^3. The average of annual average PM_{10} concentration for 230 cities is 89.5 µg/m^3, i.e. approximately 4.5 times higher than the WHO AQG. As there is no existing AQG set by WHO for annual average SO_2, when the 24-hr WHO AQG for SO_2 was used as a comparison with the annual average SO_2 concentrations of the cities, and it was found that 24% of cities did not even meet the 24-hr WHO AQG. 27% of the cities surveyed had annual average NO_2 concentrations above the WHO AQG (Figure 1).

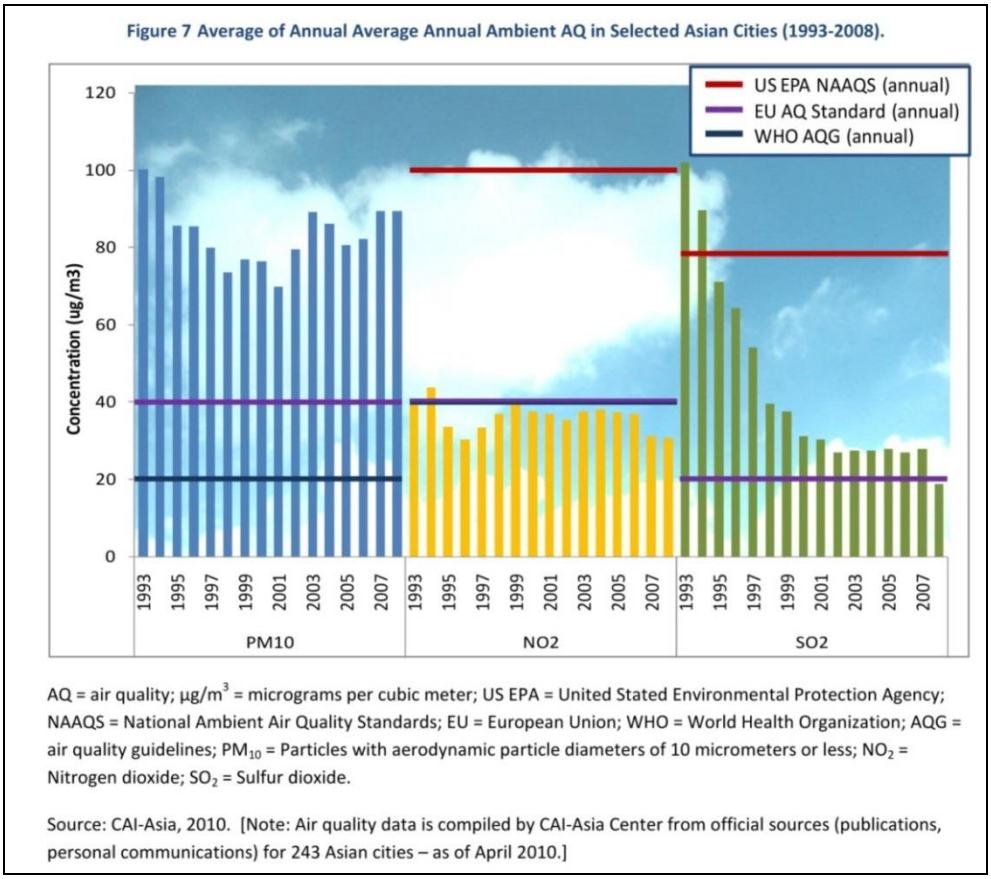


Fig. 1: Average of Annual Average Ambient Concentrations of PM_{10}, NO_2 and SO_2 in Selected Asian Cities (1993-2008)
Source: Clean Air Asia, 2010
Note: The USEPA annual standard of 78 µg/m^3 for SO_2 was revoked after 22 June 2010. The EU AQS annual standard of 20 µg/m^3 for SO_2 is for protection of vegetation.

In a more recent study by Clean Air Asia, it was reported that urban air quality has further worsened. Based on the annual average PM_{10} levels in 310 Asian cities in 2010, seven out of 10 cities in developing Asia have poor air quality levels (Figure 2). This study also revealed that average concentration of PM_{10} which have stabilized in recent years, is again on the rise. Concentrations of SO_2 which were on the decline in the last decade now show an increasing trend (Figure 3). The levels of PM_{10} in the cities of Asia well exceeded the WHO health-based daily guidelines.

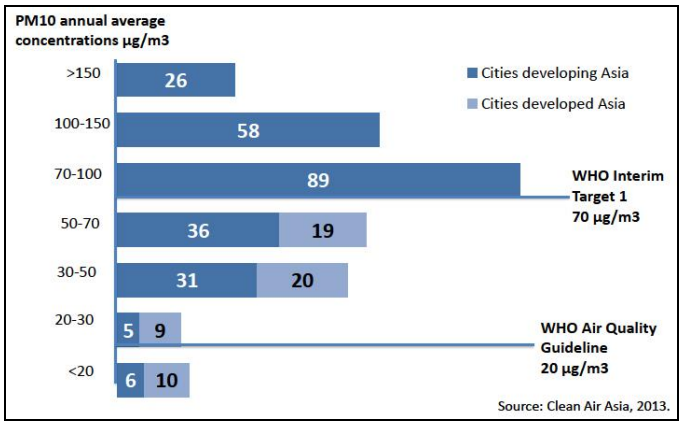


Fig.2: Number of cities in Asia with poor air quality for PM_{10} in 2010
Source: Clean Air Asia, 2013

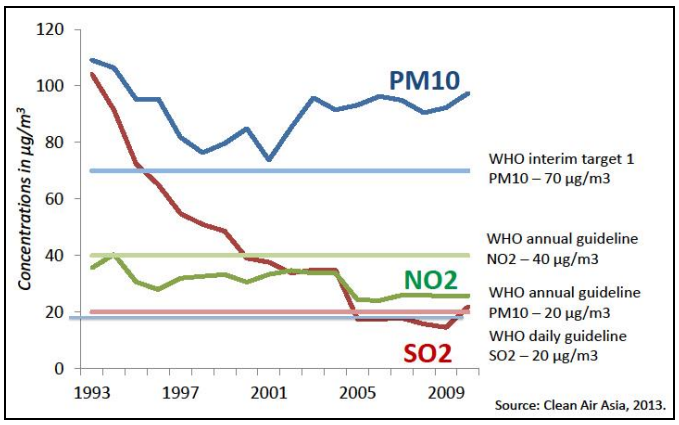


Fig.3: Trend of major pollutants in Asian cities during 1993-2010
Source: Clean Air Asia, 2013

From air pollution studies conducted by the Task Force on Hemispheric Transport Report, HTAP 2010, it was revealed that anthropogenic NO_x emissions from East Asia (as defined in the caption) in the year 2005 was comparable to levels recorded in Europe and in North America (Figure 4).

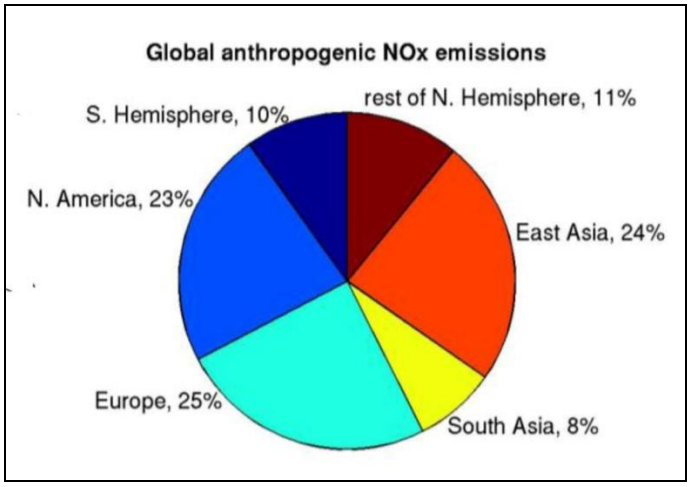


Fig. 4: 2005 Global Anthropogenic NOx Emissions
Note: East Asia is the area bounded by (approximately) latitude 15˚N-50˚N and longitude 90˚E-160˚E
Other parts of Southeast Asia are included in S. Hemisphere
Source: HTAP, 2010

1.2 **URBAN AIR QUALITY – A RISING CONCERN**

Based on statistics from the United Nations, 45% of the population in Asia currently live in cities (Figure 5). The total population in Asia is projected to increase more rapidly than other regions in the world exceeding 5 billion by the year 2050. Demographic trends indicate that the urban/rural ratios will continue to increase with more than 65% of the population living in the urban centres by 2050(Figure 6).

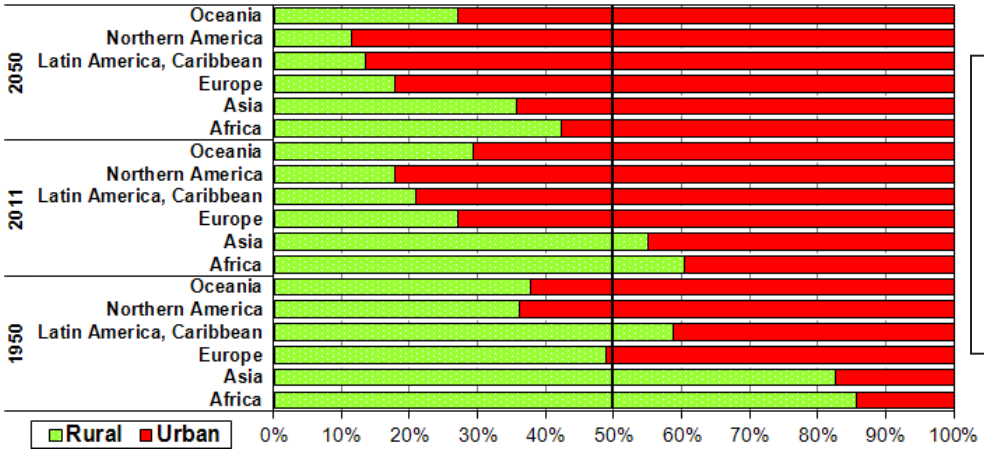


Fig. 5: Urban and rural population by development regions, 1950, 2011 and 2050 (per cent of total population) Source: UN, 2012

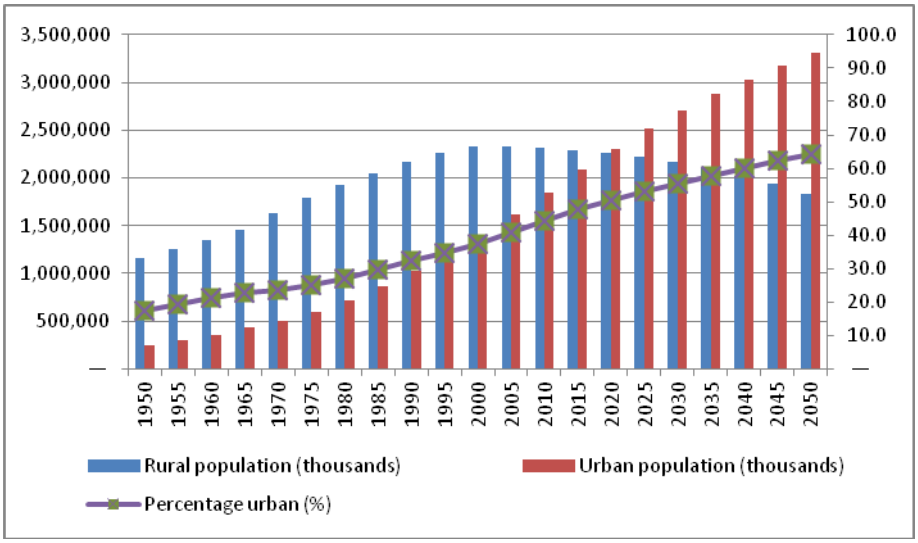


Fig. 6: Rural and Urban Populations in Asia Data source: World Urbanization Prospects, the 2011 Revision, United Nations Department of Economic and Social Affairs

Despite the implementation of aggressive legislative and policy tools, air pollution in the urban centres of East Asia remains a serious concern. Photochemical smog frequently obscures the city skyline. The smog could linger for days in the absence of strong winds or rain enabling dispersal. During the dry season, severe haze from widespread forest and land fires affect the livelihoods of the population in Southeast Asia. In the cities, the problem is compounded by traffic and industrial pollutants exposing the urban population to higher health risk. In countries where traditional methods of cooking are still practised by poorer households, black carbon and ozone contribute to indoor air pollution and are considered major environmental issues. The urban centres are also the highest emitters of greenhouses gases from man-made sources.

The World Health Organization (WHO) International Agency for Research on Cancer (IARC) has recently classified diesel exhaust as a known human carcinogen. Since the majority of the population in the megacities live within 50 meters of a major road, exposure to particulate matter and NOx from diesel exhausts is expected to cause more respiratory infections, reduced lung function, and asthma which may lead to death.

Urban air can influence regional air quality since the longer-lived pollutants emitted from urban centres are mixed in the ambient air and transported by the wind to other areas and beyond national boundaries.

1.3 **PROJECTIONS OF AIR POLLUTION TRENDS**

Emissions of most anthropogenic air pollutants including greenhouse gases have been increasing globally and are expected to continue to rise in the coming years due to escalating fossil fuel consumption (Figure 7). Many studies have been conducted on future trends of emissions from various regions in the world using various scenarios. Among the most comprehensive results are the findings from the Task Force on Hemispheric Transport of Air Pollution as reported in HTAP 2010.

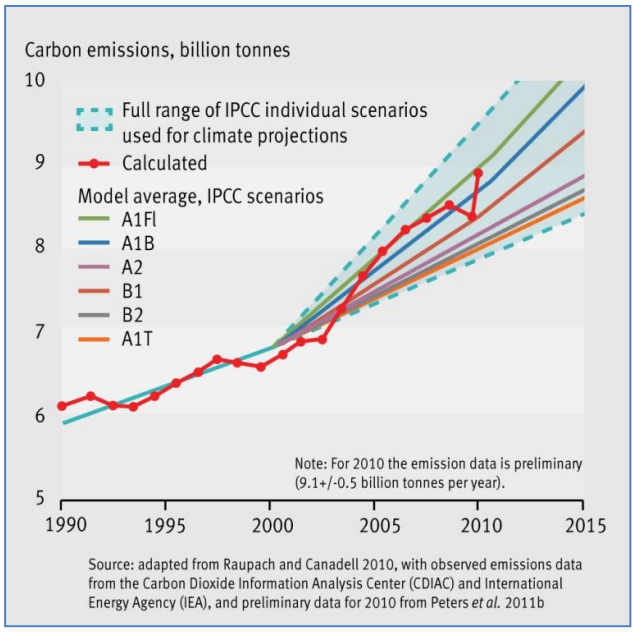


Fig. 7: Trends in fossil fuel emissions calculated and IPCC scenarios, 1990-2015
Source: UNEP, 2012

The HTAP 2010 assessment on emission trends of SO_2 from 1850-2000 with four Representative Concentration Pathway (RCP) scenarios from 2000 – 2050, developed using hemispheric transport models shows a general declining trend for SO_2 concentrations in East Asia (Northeast Asia) although emissions from some countries in Asia increased during the period 2000-2005. It is projected to further decline (Figure 8).

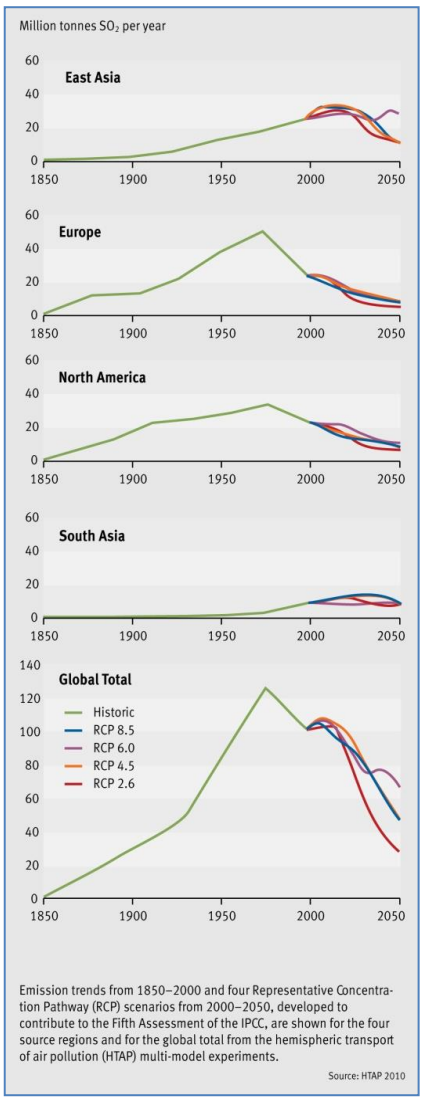


Fig. 8: Regional trends in sulphur dioxide emissions, 1850 – 2050
Source: HTAP, 2010

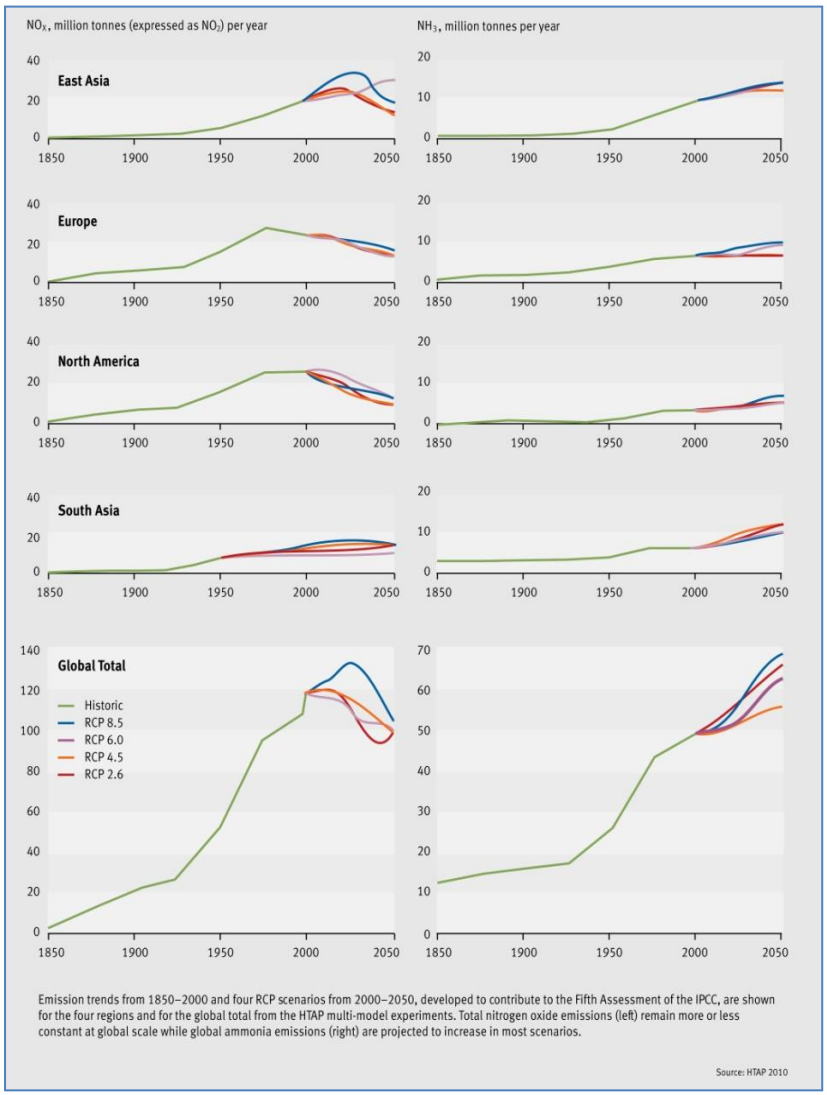


Fig. 9: Regional trends in emission of nitrogen oxides and ammonia, 1850 - 2050
Source: HTAP, 2010

In the HTAP 2010 assessment on trends of nitrogen oxides emissions it was found that globally total emissions increased until around 2000 and is expected to remain more or less constant after. In East Asia (Northeast Asia) however, emissions have continued to increase rapidly in the past two decades and the projections show that both nitrogen oxides and ammonia emissions are likely to increase further (Figure 9).

In the same assessment, the use of six global photochemical models to assess the implications of emission changes between 2000 and 2050 for a variety of emission scenarios has produced variable results on future changes in tropospheric ozone (Figure 10). It shows that the outlook for ozone concentrations is heavily dependent on global and regional emission pathways.

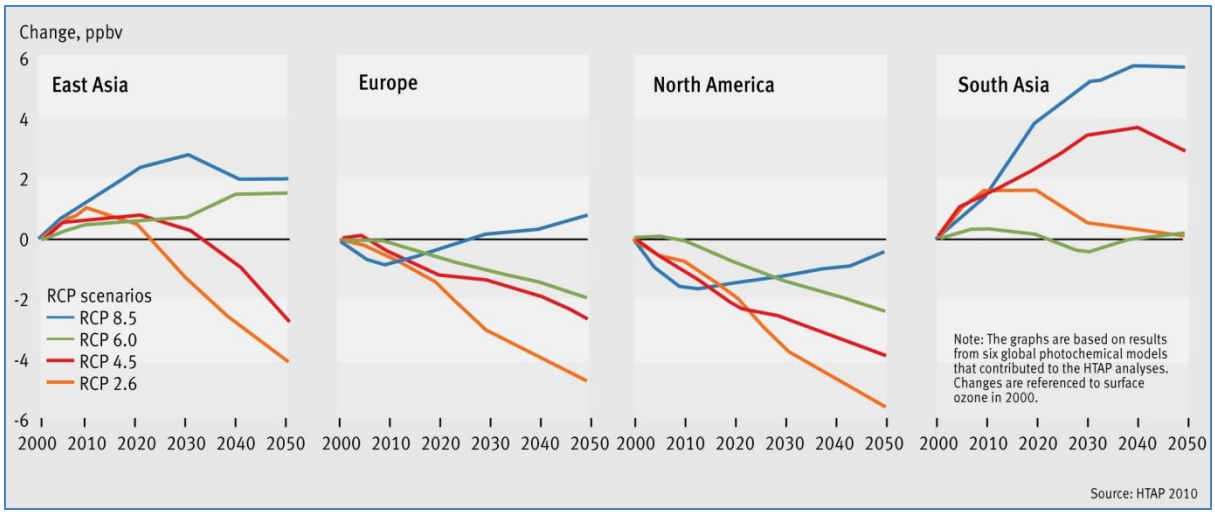


Fig. 10: Projected changes in surface ozone concentrations over polluted regions of the northern hemisphere, 2000 - 2050
Source: HTAP, 2010

2. POLLUTANTS OF CONCERN AND THEIR POTENTIAL ADVERSE EFFECTS

2.1 AIR POLLUTION THREATS TO HUMAN HEALTH AND CROP PRODUCTION

Very large populations in developing Asia are exposed to high concentrations of air pollution, mainly from combustion of fossil fuels. The combustion products consisting of a mixture of pollutants - fine particulate matter and gases (such as O_3, SO_2, NO_2), have been found to adversely affect human health causing chronic cardio-vascular disease, respiratory infections and lung cancer.

The Health Effects Institute (HEI) recently announced (HEI, 2012) that a new systematic analysis, the 2010 Global Burden of Disease (GBD), which looks at all major global health risks, has found that outdoor air pollution in the form of fine particulates annually contribute to over 3.2 million premature deaths worldwide and over 74 million years of healthy life lost (Table 1). Outdoor air pollution now ranks among the top 10 risks factors globally. The GBD 2010 also estimated that 0.2 million deaths worldwide can be attributed to outdoor ozone pollution in 2010 mostly in the developing countries.

In developing counties of Asia where air pollution levels are the highest, GBD 2010 estimates over 2.1 million premature deaths and 52 million years of healthy life are lost in 2010 due to ambient fine particulate air pollution, accounting for 2/3 of the burden worldwide. In the developing countries of East Asia (China and North Korea) outdoor air pollution contributed to 1.2 million premature deaths in 2010 and ranks 4th in mortality and health burden (Figure 11). The study also revealed that the number of premature deaths due to indoor air pollution from solid fuels is even more than outdoor air pollution in South Asia where it is ranked among the top 3 risk factors.

Table 1: Global Burden of Disease Due To Air Pollution

Air pollution type	Outcomes	Deaths attributable to air pollution in 2010	Disability adjusted life years attributable to air pollution in 2010
Ambient Particulate Matter Pollution	Lower respiratory infections; trachea, bronchus, and lung cancers; IHD; cerebrovascular disease; COPD	3.2 million (2.8 million to 3.6 million) deaths worldwide	3.1% (2.7 – 3.4) of global DALYs
Household Air Pollution From Solid Fuels	Lower respiratory infections; trachea, bronchus, and lung cancers; IHD; cerebrovascular disease; COPD	3.5 million (2.6 million to 4.4 million) deaths worldwide	4.3% (3.4 – 5.3) of global DALYs
Ambient Ozone Pollution	COPD	0.2 million (0.1 million to 0.3 million) deaths worldwide	0.1% (0.03 – 0.2) of global DALYs

Note: DALYs - disability adjusted life years: the sum of years lived with disability and years of life lost attributable to the risk
( ) 95% uncertainty intervals
IHD - Ischemic Heart Disease characterised by reduced blood supply to the heart causing chest pain
COPD - Chronic Obstructive Pulmonary Disease characterised by breathing difficulties due to limited inflow of air to and from lungs

Source: Lim et al., 2012

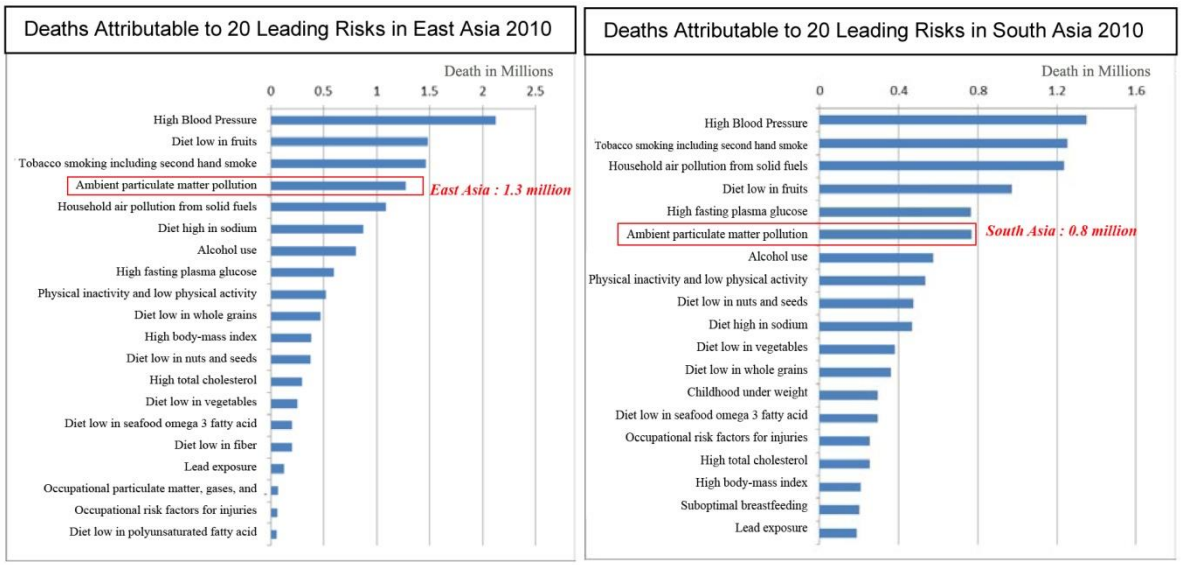


Fig. 11: Deaths Attributable to 20 Leading Risks in East Asia and South Asia in 2010
Note: East Asia in the graph refers to China and North Korea. South Asia includes India, Pakistan, Bangladesh and Sri Lanka.
Source: HEI, 2012

There have been a substantial increase in the number of studies on the effects of short-term exposure to pollution (particularly to PM_{10}) in Asia; however studies on the chronic effects of long-term exposure are still rather limited. In a study by the Health Effects Institute's (HEI) Public Health and Air Pollution in Asia Program 2010 (PAPA 2010) it was found that a 10 $\mu g/m^3$ increase in PM_{10} concentrations was associated with an increase of 0.6% in the daily rate of death from all natural causes. In Asia, this proportional increase in daily mortality was observed at levels of exposure which were several times higher than the record in most large Western cities. An increase of 10 $\mu g/m^3$ in ozone concentration is reported to increase the risk of death by 0.3-0.5%. Ozone can also have chronic health effects resulting in permanent lung damage. However more local epidemiological research should be conducted reflecting East Asian concentrations of particulate matter and ozone so that the uncertainty in risk estimation can be reduced.

Ozone is also the most important air pollutant causing damage to vegetation, diminishing crop yields and forest productivity and altering net primary productivity. Estimates suggest that ozone–induced yield losses range between 3 and 16% for four staple crops – maize, wheat, soybean and rice – which translates into annual global economic losses of US$14-26 billion (HTAP, 2010). Researchers in East Asia have found that the yield response functions may differ from North America and some crops (wheat and rice) showed a greater sensitivity in Asia (EANET, 2011c). The development of fundamental data sets such as crop distribution and calendar is crucial to obtain more reliable risk assessment of crop yield loss as well as exposure response function of crops in East Asia.

2.2 INTER-LINKAGES OF ACID DEPOSITION AND AIR POLLUTION WITH OTHER ATMOSPHERIC ENVIRONMENTAL ISSUES

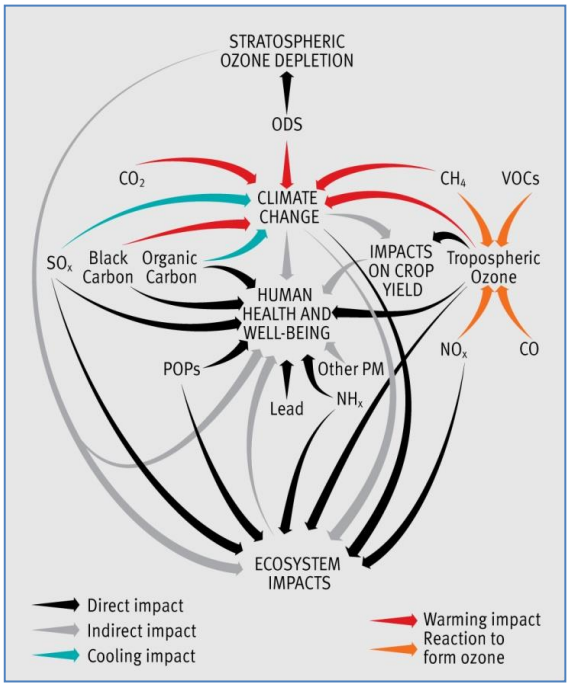


Fig. 12: Impacts of and links between selected substances emitted to the atmosphere
Source: UNEP, 2012

Climate change, air quality and stratospheric ozone depletion are closely related, as individual pollutants can have multiple impacts on health, crop yields, ecosystems, cooling or heating of the atmosphere and stratospheric ozone depletion, all with the potential to affect human well-being. Many sources also emit multiple pollutants that can both affect air quality and cause climate change (Figure 12).

Addressing sources of pollution can deliver both climate and air quality benefits. For instance, reducing ozone and aerosols/particulate matter emissions could reduce air pollution and acid deposition risk and since these pollutants contribute to climate change, it would also slow down the process of global warming, and mitigate possible disruption of rainfall patterns. Despite the strong inter-linkages, most governments address the issues separately, due to various reasons. Depending on which measures are implemented there could be co-beneficial or antagonistic outcomes and, unless a more integrated approach is adopted, there is a risk that different atmospheric policies could work against each other.

2.3 TRANSBOUNDARY NATURE OF AIR POLLUTION

Air pollution does not recognize national borders. Many countries have their own sources of air pollutants and are also receiving air pollutants transported from neighbouring and distant countries through pathways such as air and water, causing damage to the country's environment. Even the most remote places on earth are not spared from the effects of transboundary air pollution. The pollutants of concern can be grouped according to their effects:

Climate change: CO_2, CH_4, tropospheric O_3, N_2O, CFC11& 12, HCFC22 & 134a, aerosols such as black carbon
Acidification& eutrophication: SOx, NOx, VOCs, ammonia
Health and ecosystem: fine particulate matter, tropospheric ozone, heavy metals (cadmium, lead, mercury), POPs

Examples of transboundary air pollution in the Asian region are the long-range transport of mineral dust from the Gobi Desert and central east China, the high ozone concentrations affecting Northeast Asian countries during Spring/Summer, the regional haze episodes from forest fires and biomass burning in Southeast Asian countries and Atmospheric Brown Clouds (ABCs) over parts of Asia and other regions. Acid deposition, observed in some regions of East Asia, is also a transboundary pollution issue (EANET, 2011c).

As air pollution sources and overall emissions increase throughout Asia and become more dispersed, regional and transcontinental transport of air pollutants and related health issues become of greater concern. It is estimated that long-range transport of particulates may be responsible for 380,000 premature deaths worldwide, of which 75% are attributable to mineral dust $PM_{2.5}$ (HTAP, 2010).

A number of regional/international efforts are underway to deal with these issues:

- Acid Deposition Monitoring Network in East Asia (EANET)
- Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia
- Association of Southeast Asian Nations (ASEAN) Agreement on Transboundary Haze Pollution
- United Nations Economic Commission for Europe Convention on Long-range Transboundary Air Pollution (CLRTAP)
- The Global Atmospheric Pollution Forum (GAP Forum)
- Joint Forum on Atmospheric Environment in Asia and the Pacific
- Ministerial Regional Forum on Environment and Healthin South-East and East Asian Countries
- Long-range Transboundary Air Pollutants in Northeast Asia (LTP)
- North-East Asian Subregional Programme for Environmental Cooperation (NEASPEC)
- Atmospheric Brown Clouds (ABC) Project
- Framework Convention on Environmental Protection for Sustainable Development in Central Asia
- Climate and Clean Air Coalition to Reduce Short-Lived Climate Pollutants (CCAC) - an initiative of the US government
- Asian Co-benefits Partnership (ACP)
- Clean Air Asia (Former CAI-Asia)
- International Union of Air Pollution Prevention and Environmental Protection Associations (IUAPPA)

Cooperation at the regional and international level involving multi-stakeholders is essential to addressing transboundary air pollution issues. An initial understanding of the science involved is important for formulation of mitigation strategies and adoption of appropriate tools that would ultimately serve to improve regional air quality.

The Convention on Long-range Transboundary Air Pollution (CLRTAP) of Europe and North America has, through scientific collaboration and policy negotiation among its51 Parties, successfully achieved its targets for SO_2 reduction and has seen a decreasing trend in other pollutants. To be a Party indicates a legally-binding commitment requiring parliamentary ratification of the country. A similar type of legally binding instrument in East Asia may be useful and necessary to curb the increasing air pollution and deteriorating air quality in East Asia in the wider context of sustainable development.

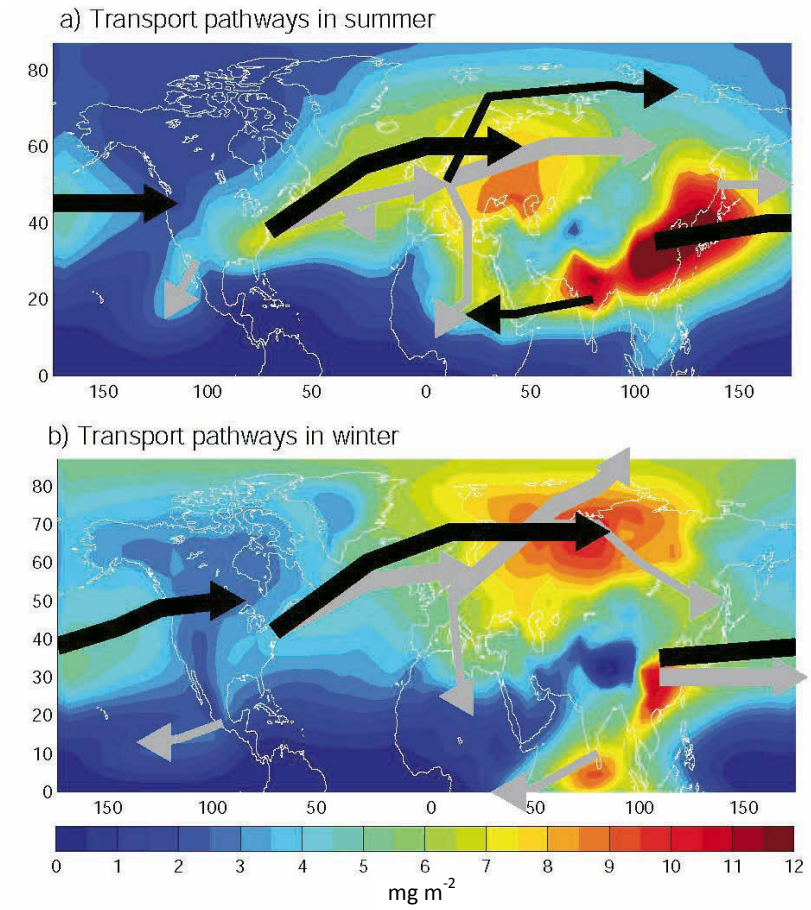


Fig. 13: Pathways of intercontinental transport of air pollutants in the Northern Hemisphere. Contours indicate the location of the total column of an anthropogenic CO tracer released over the Northern Hemisphere continents after 8-10 days of transport, and averaged over 15 years. Shown are transport pathways in summer (June, July, August; upper panel), and winter (December, January, February; lower panel). Gray arrows show transport in the lower troposphere (< 3 km) and black arrows show transport in the mid- and upper troposphere (> 3 km). [Image reproduced from Chapter 1, Figure 2, page 6, of Stohl and Eckhardt (2004), Intercontinental Transport of Air Pollution: An Introduction, in *Intercontinental Transport of Air Pollution*, edited by A. Stohl, with kind permission of Springer].

3. MAJOR ACHIEVEMENTS OF THE EANET

3.1 **KEY DEVELOPMENTS IN RECENT YEARS**

- Instrument for Strengthening the Acid Deposition Monitoring Network in East Asia (EANET)

The Instrument for Strengthening the EANET, adopted at the Twelfth Session of the Intergovernmental Meeting (IG12) on the EANET in November 2010 has been signed by 12 out of the 13 participating countries. The Instrument has been operational since 1 January 2012 in accordance with the decision of the IG12. In signing of the Instrument participating countries reaffirmed their strong commitment and support to the Network's objectives and activities.

- Improvement of Monitoring Activities

Development and/or revision of three technical manuals for the EANET - the Technical Manual on Dry Deposition Flux Estimation, Technical Manual for Wet Deposition Monitoring in East Asia -2010, and Technical Manual for Inland Aquatic Environment Monitoring in East Asia -2010, have been completed and uploaded on the EANET website. The development of a Technical Manual for Air Concentration Monitoring by a newly formed Expert Group commenced in 2011 and is expected to be completed by the end of 2013. A Strategy Paper on Future Direction of Monitoring for Dry Deposition and Strategy Paper for Future Direction of Soil, Vegetation and related Ecosystem Monitoring of the EANET have also been developed and are made available on the EANET website.

The EANET continues to conduct Inter-laboratory Comparison Projects annually to monitor and improve performance of the national chemical laboratories participating in sample analysis. Data Reports are also produced annually and distributed to the member countries. Revised QA/QC Manual for the EANET will be developed for improvement of QA/QC after development of the Technical Manual for Air Concentration Monitoring.

- Expansion of the Monitoring Network

Currently the network has 54 monitoring sites in 13 countries comprising 20 remote, 13 rural and 21 urban sites. Monitoring of wet deposition is carried out in all the 54sites, dry deposition monitoring is conducted in 46 sites in 13 countries, monitoring of soil at 19 areas in 28 forests, forest vegetation monitoring at 18 areas in 24 forests in 10 countries and inland aquatic environment monitoring is conducted at 18 lakes/rivers in 10 countries. The newly developed catchment scale monitoring is being conducted at 1 site in Japan, and Philippines will also start soon. The annual Data Reports from 2001 to 2011 have been published after adoption by the Session of the Scientific Advisory Committee (SAC) and are made available on the EANET website.

- Periodic Reports on the State of Acid Deposition in East Asia

Following the publication of the First Periodic Report on the State of Acid Deposition in East Asia (PRSAD1) in November 2006, the Second Periodic Report on the State of Acid Deposition in East Asia (PRSAD2) was completed in December 2011 and distributed to participating countries and other related organizations at the beginning of 2012. Both reports are available on the EANET website.

- Improvements to Administrative and Financial Management

For greater transparency and better management of the EANET activities, the Revised Guidelines on Administrative and Financial Management for the Secretariat and the Network Center has been developed and approved in 2012. The Revised Guidelines on administrative part consist of a set of rules of procedures of the meetings, working procedures, including principles of distribution of the EANET documents and criteria for uploading priority documents to the EANET website, personnel management and guidelines for fellowship awards. The Revised Guidelines on financial management part provide guidance on budgeting, voluntary financial contributions, preparation of financial statements, audit reports, management of savings and others. Voluntary financial contribution from the participating countries has been implemented based on the (Revised) Guidelines.

- Medium Term Plan for the EANET (2011–2015)

Implementation of the activities of the Medium Term Plan for the EANET (2011 -2015) started in January 2011. The plan focuses on strategies that will enhance the network capabilities in monitoring and assessment, developing scientific research on atmospheric environment and dissemination of knowledge and information to strengthen policy relevance of the EANET activities. A Mid Term Report on the Implementation of the Medium Term Plan reporting on the status of implementation will be/was developed in 2013.

- Fellowship Research Program

It has been the practice of the EANET to award fellowships each year to young researchers from participating countries to conduct research in specific areas at the Network Center under the guidance of a senior researcher of the Network Center for a period of 1 to 2 months. The beneficiaries in 2011 were researchers from China and Malaysia while a researcher from Thailand received the fellowship award in 2012.

- Technical Support to the Participating Countries

Technical support missions to the participating countries were made by experts from the Network Center every year to provide technical assistance, exchange information and assist countries in selecting new sites for monitoring activities and so on. In 2012, missions were made to Indonesia, Lao PDR, Myanmar and the Philippines.

- Research Activities

During the period 2009 -2010, the following three High Priority Research Projects were completed:

- Aerosol deposition studies in forests for improvement of estimation method for dry deposition
- Feasibility study on low cost methodologies for monitoring air concentration
- Analysis of existing data for improving the understanding of the status of acidification in East Asia, on wet deposition, dry deposition and on soil, vegetation and inland aquatic environment

In atmospheric modelling studies, the EANET in collaboration with the Model Inter-comparison Study in Asia (MICS-Asia) has developed the following research plans of the Phase III to carry out:

i) Model inter-comparison
ii) Development of reliable emission inventories
iii) Air quality / climate change

In order to estimate ecological effects of acidic deposition on the forest catchment in Thailand, Malaysia and Japan based on the measurement of elemental budget, a joint research project on catchment analysis has been implemented by the Network Center with Japan, Malaysia and Thailand, with support from the Ministry of the Environment, Japan and other funding agencies. A joint research project between the Network Center and Republic of Korea comparing the 3-stage and 4-stage filter pack method is also in progress. The samples is currently being analysed and data compiled for later exchange.

To share the research findings of the Fellowship Research Program, joint research projects among the EANET community, and other related researches conducted in the region, the EANET publishes a Science Bulletin biennially.

- Capacity Building and Public Awareness

One trainee each from China, Malaysia, and Russia participated in individual training on wet deposition, dry deposition, soil and vegetation and inland aquatic environment monitoring and data management at the Network Center in February/March 2011. Trainees from Lao PDR and the Philippines, and trainees from Malaysia, Mongolia, Russia and Vietnam participated in the training courses held in late January/February 2012 and December 2012 respectively.

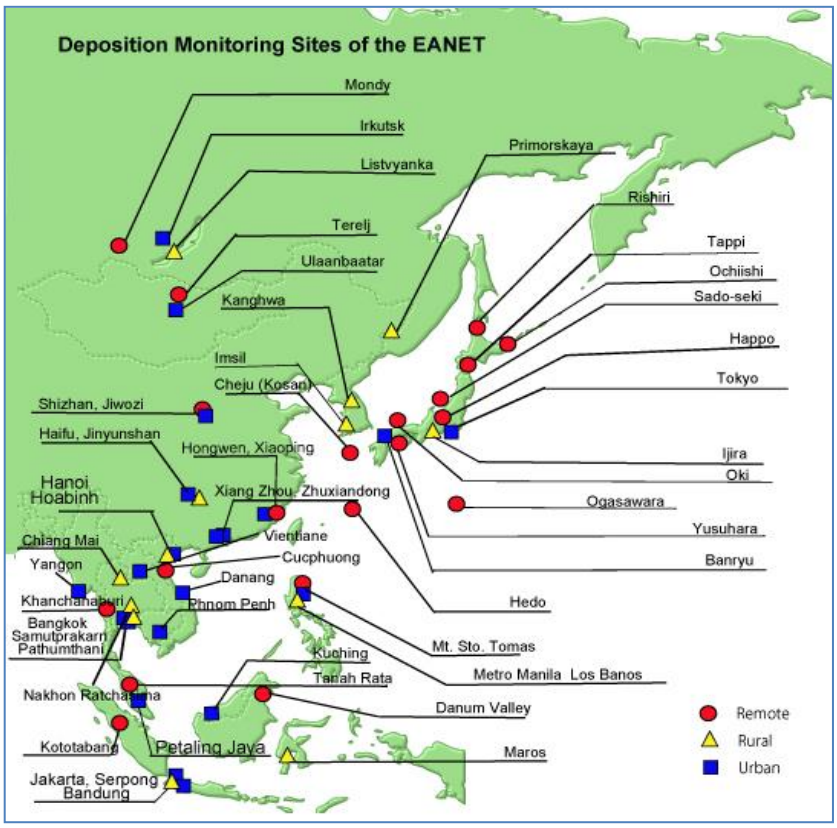
Participants from the EANET countries benefitted from several capacity building courses held in recent years:

i) First Capacity Building Workshop of the Joint Forum on Atmospheric Environment in Asia and the Pacific, Pathumthani, Thailand, 21-22 July 2011
ii) Tenth Workshop on Public Awareness for Acid Deposition Problems, Niigata, Japan, 29 February – 1 March 2012
iii) Modelling and Emission Inventory Training Workshop, Niigata, Japan, 30 January – 3 February 2012

Public awareness programs and activities in the participating countries are strongly encouraged and whenever possible the EANET experts attended these events to provide assistance and support.

To disseminate the latest information on governments' efforts to manage air pollution in the participating countries, the EANET has developed Fact Sheets for each country which were distributed and also issued on the EANET website. A Newsletter reporting on recent activities of the EANET is produced twice a year.

3.2 **RESULTS FROM THE EANET MONITORING**



A detailed assessment of the EANET monitoring data was conducted for the EANET Second Periodic Report on the State of Acid Deposition in East Asia (PRSAD2) in 2011. The assessment utilized data obtained from 54 monitoring sites in 13 participating countries, of which 20 are remote sites, 13 are rural and 21 are urban sites (Figure 14).

Fig.14: Location of the EANET 54 acid deposition monitoring sites in 2013

Using the criteria that rainwater with pH lower than 5.0 is considered acidic, it was found that 26 sites out of the 42 or 62% of the sites recorded annual average pH lower than this value indicating that precipitation in East Asia is significantly acidic. Values of less than 4.6 were recorded in several locations (Figure 15).

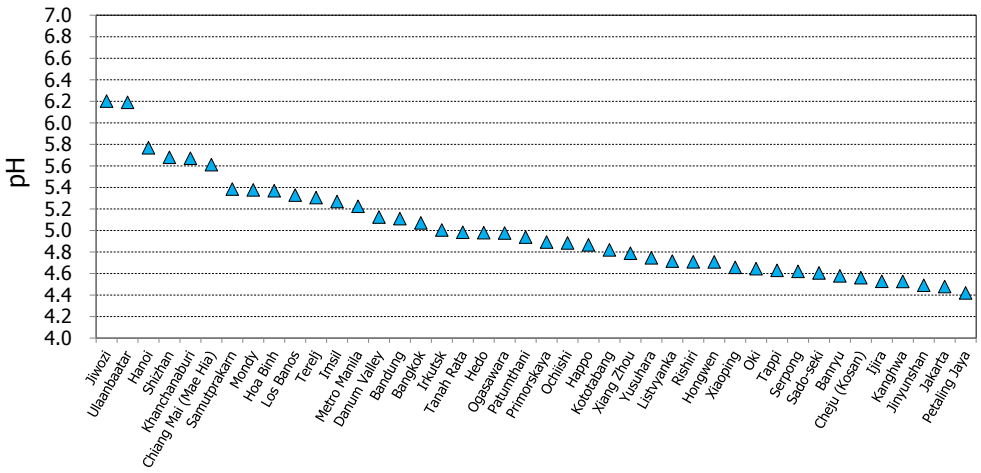


Fig. 15: Five-year average annual mean pH values for 42 sites
Source: EANET, 2011c

In many parts of the region, sulphuric acid is the primary contributor to the acidity although the contribution from nitric acid is almost reaching that of sulphuric acid. Wet deposition in East Asia

during the period 2005-2009 shows a wide range of concentrations and deposition, indicating the strong influence of both geography and climate (Figure 16 and Figure 17).

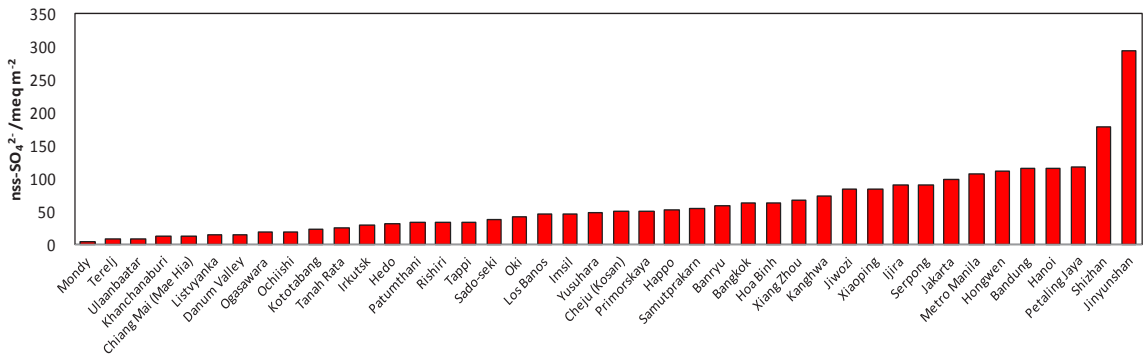


Fig. 16: Five year average annual deposition of nss-SO_4^{2-} (2005-2009)
Source: EANET, 2011c

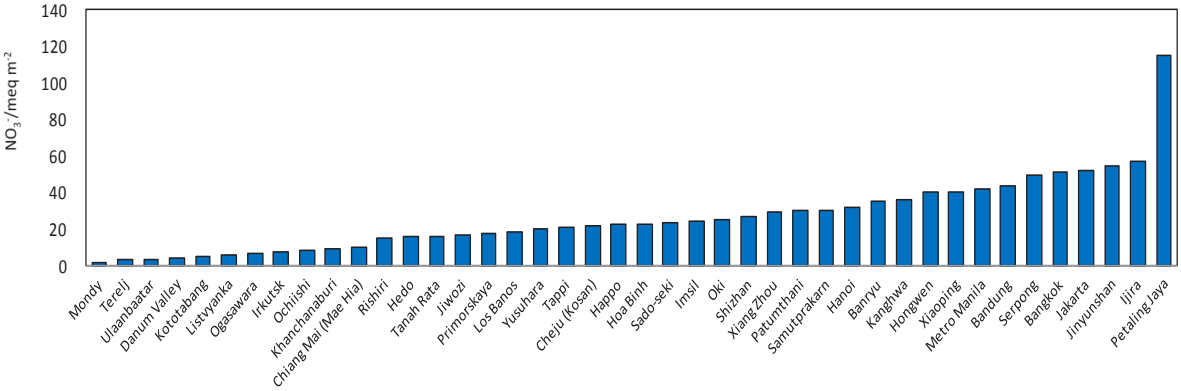


Fig: 17: Five year average annual deposition of NO_3^-(2005-2009)
Source: EANET, 2011c

Gaseous concentrations of SO_2, HNO_3 and NH_3 have stabilized in recent years. Some urban sites in Southeast Asia showed significant improvement in SO_2 concentrations (Figure 18). The sulphate concentrations in aerosols were comparatively higher than nitrate and ammonium at all sites in Northeast Asia. This could be the result of secondary reactions involving gaseous sulphur components during long range transport. Distinct seasonal characteristics were also observed in Northeast Asia.

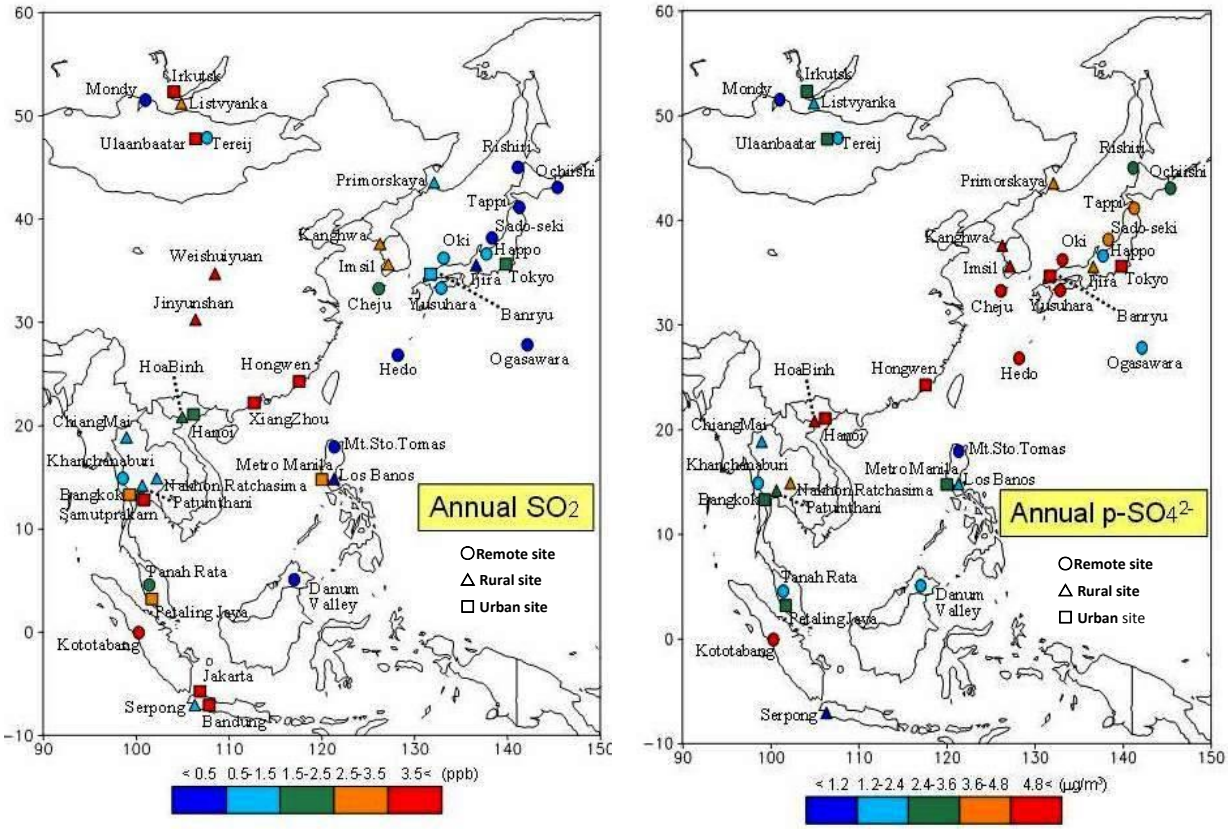


Fig.18: Spatial variation in concentrations of gaseous SO_2 and aerosol SO_4^{2-} at EANET sites
Note: Concentrations show the annual average of 2005-2009
Source: EANET, 2011c

Based on measurements mainly from sites in Northeast Asia, ozone concentrations exceeded a monthly average of 50 ppb and were even higher than 60 ppb at some sites. Monthly average ozone concentrations from 2005 to 2009 were higher than those for the previous five-year period (2000-2004) at many sites. Related research using chemical transport models indicate high ozone continental outflow originating from central east China towards the Korean Peninsula and Japan during January to June. Ensemble results of modelling also shows a maximum in the amount of sulphur deposition occurring in northern and southwest China in summer (Figure 19).

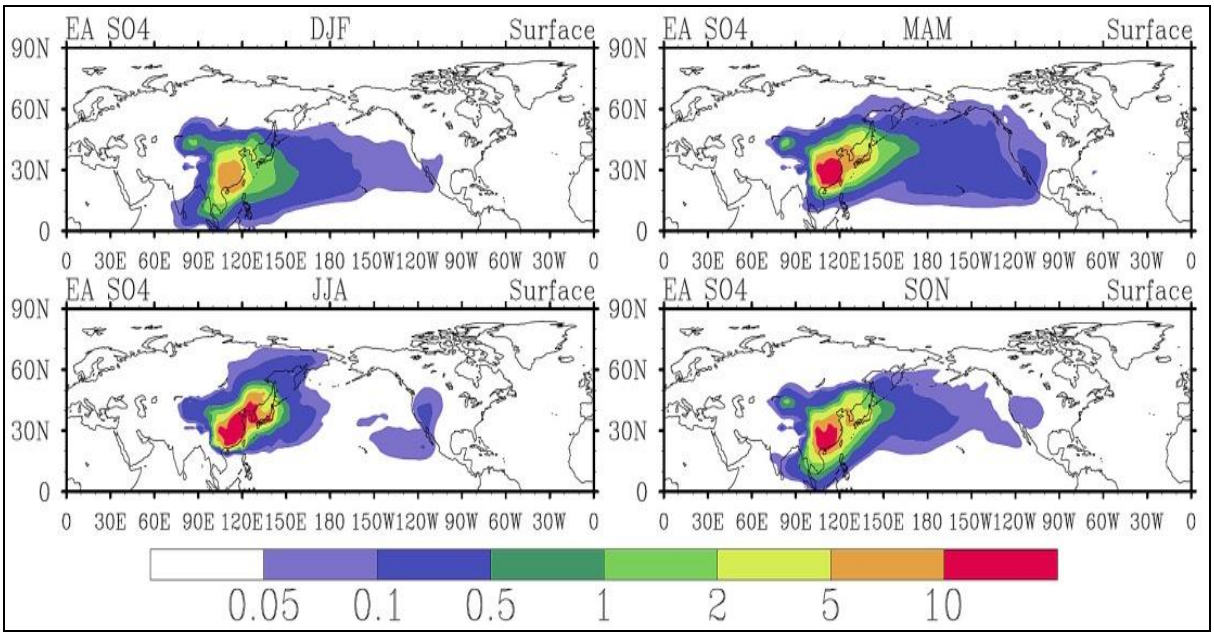


Fig. 19: Horizontal distribution of East Asian aerosol sulphate concentration at the surface in December, January, February (DJF), March, April , May (MAM), June, July, August (JJA), and September, October, November (SON)
Source: Liu et al, 2008

From studies on impacts on ecosystems, trends in changes in the soil, forest and inland water monitoring parameters have been detected. The data suggests possible acidification or nitrogen saturation at several sites. There is however a need to isolate other existing environmental conditions that may have contributed to such an observation. Studies show that the increase in emissions in Asia however will put sensitive ecosystems at risk from the effects of soil acidification (Figure 20). According to Figure 21, regional variations of buffering capacity mainly stemmed from soil type differences depending on geological and climatic conditions as well as topographical and biological factors over a long time scale were also clarified by the EANET.

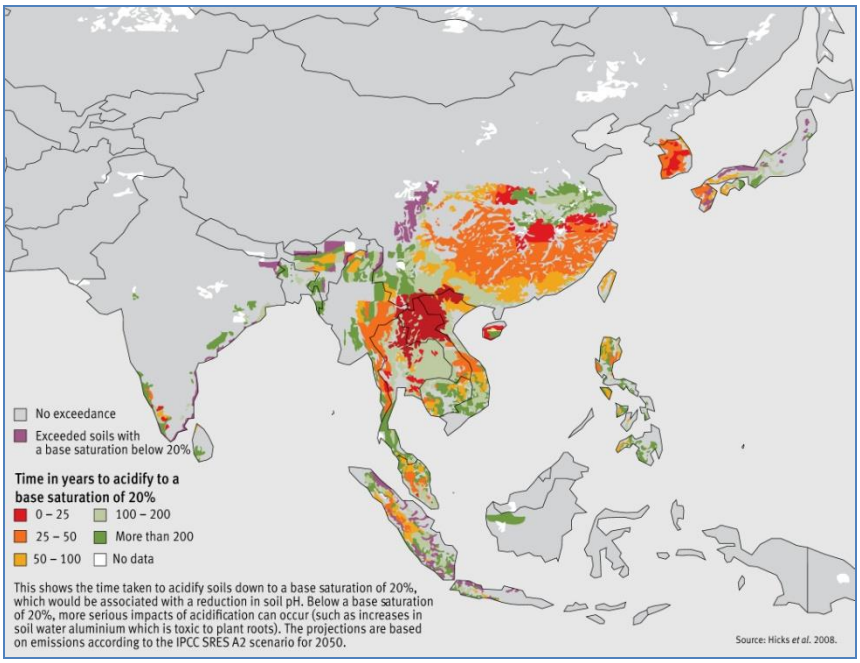


Fig. 20: Areas at risk and timeframe for acidification damage in Asia
Source: Hicks et. al, 2008

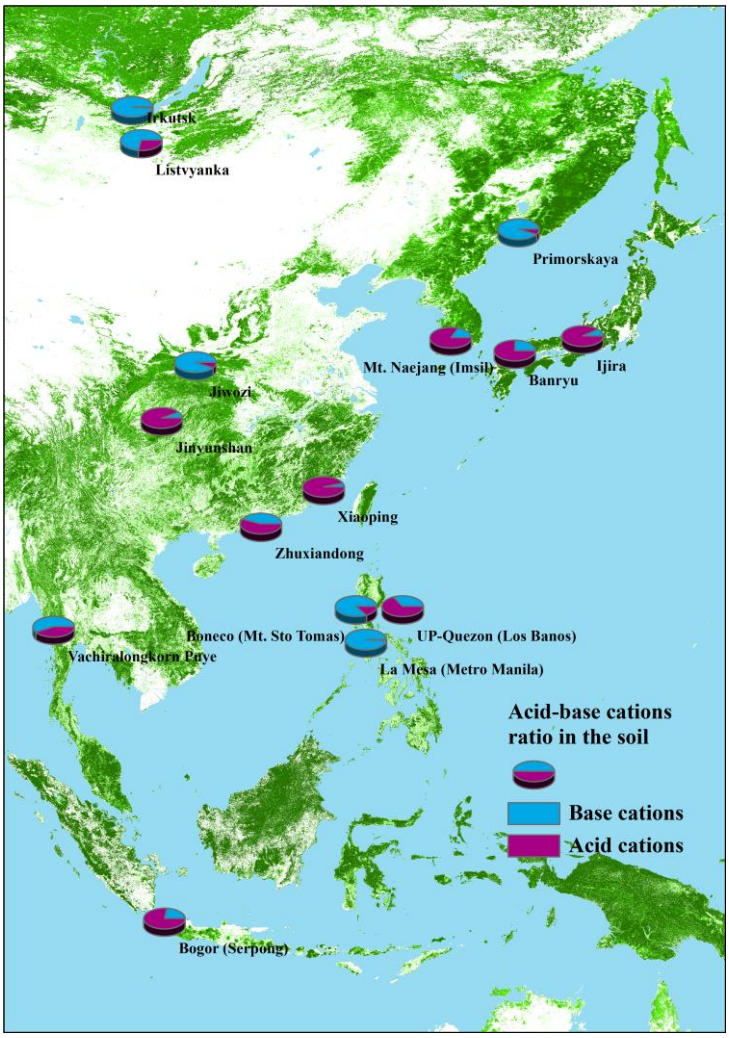


Fig.21: Ratio between base cations (Ca^{2+} + Mg^{2+} + Na^{+} + K^{+}) and acid cations (H^{+}+ Al^{3+}) on a negative charge of 0-10 cm soils. Only representative site in each area were displayed. Dense green color shows tree cover. The value is average in 2000-2009
Source: EANET, 2011c

There are also evidences of decline in certain forests in Japan, China and Mongolia. The possible direct effects of pollutants in tree decline in Mongolia are well documented.

The pH of water in five inland aquatic systems has significantly decreased from year 2000 to 2009. Simultaneously, the concentration of SO_4^{2-} has increased in the five inland waters. Moreover, NO_3^{-} concentration has increased in one of them. Acidification and/or eutrophication by leaching of these strong acid anions may be possible reasons. However further studies are necessary to determine whether other factors could have contributed to the acidification and nitrogen saturation of the inland waters. The promotion of catchment scale analysis by the EANET is an approach to clarify the relationship among components of the ecosystem, including soil, vegetation, inland water and atmosphere (Table 2).

Country	site	pH	EC	Alkalinity	SO_4^{2-}	NO_3^-
China	Jinyunsyan Lake	Declining	Increasing	Declining	Increasing	Increasing
	Xiaopin Dam	Declining			Increasing	
	Jiwozi River	Declining	Increasing	Increasing	Increasing	
	Zhuxiandong Stream				Declining	
Indonesia	Patengang Lake	Declining			Increasing	
Japan	Ijira Lake			Increasing		Declining
	Kamagatani River flowing river to Ijira Lake	Increasing		Increasing		
	Kobara River flowing river to Ijira Lake	Increasing		Increasing	Increasing	
	Banryu Lake		Increasing			Increasing
	Banryu Lake 3		Increasing			
Malaysia	Semenyih Dam	Declining			Increasing	
Mongolia	Terelj River			Increasing		
Phillipines	Pandin Lake				Increasing	Increasing
Russia	Pereemnaya River		Increasing		Increasing	Increasing
	Komarovka River			Declining	Increasing	
Thailand	Vachiralongkorn Dam 1 Ban Pong Chang		Declining		Declining	
	Vachiralongkorn Dam 2 Ban Pang Pueng		Declining			Increasing
Vietnam	Hoa Binh Reservoir					

Table 2: Trends of inland water chemistry
Source: EANET, 2011c (with modifications)

Note: Pink- and blue-colored cells indicate significant declining and increasing trends, respectively and yellow-colored cells indicate no trend (by a statistical analysis, seasonal Mann-Kendall test).

3.3 COUNTRY EFFORTS IN MANAGING ATMOSPHERIC ENVIRONMENT ISSUES

Cambodia

Cambodia started acid deposition monitoring at Phnom Penh City in 2004 and has expanded its activities recently to the monitoring of inland aquatic environment at Krirom National Park in 2011. Rapid industrialization coupled with a growing population and urbanization since 1993 has led to concerns on air pollution. In particular, emissions of harmful gases and particulates from factories and motor vehicles have caused the air quality in the industrialized and urban areas to deteriorate although the overall air quality in the country is still generally good. The Department of Environmental Pollution Control which is responsible for environmental protection in Cambodia is in the process of revising environmental quality standards at the national level including air quality standards. There is also a plan to upgrade their sub-decree to the law (Environmental Pollution Management).

China

China started EANET monitoring activities from 2001 and currently has monitoring projects on wet deposition, dry deposition, inland water, soil and vegetation in 4 cities, namely Chongqing, Xiamen, Xi'an and Zhuhai in addition to its national acid rain monitoring network. The results during the period from 2005 to 2009 indicate an increase in acidity in some cities while other sites showed an improvement. Higher acidity levels at the inland sites were attributed to coal-fired heating in winter. Due to strengthening of policies by the government during the Tenth and Eleventh Five Year Plan and increase in investments in environmental protection, the environment quality in China has improved. Industrial restructuring, a number of key projects, improvement of management and

release of a series of industrial, fiscal, taxation pricing policies mainly contributed to the reduction in SO_2 emissions at all the urban sites. Under the Twelfth Five Year Plan (2011-2015) China will intensify environmental protection by accelerating transformation of the mode of economic development through resource conservation and environmental protection, energy saving, policies to reduce greenhouse gas emissions, promote social and economic growth with the population, resources and environment along the path of sustainable development. Pollutant emission reductions will continue with reduction targets set for SO_2 and NO_2 emissions. Strategies include policies limiting emissions from power plants, steel, nonferrous metals, chemical industry and building materials industries, enhancing desulfuration and denitration facilities, and strengthening policies controlling emissions from motor vehicles with the aim is to achieve 80% of Level II of the National Ambient Air Quality Standard by 2015.

Indonesia

Acid deposition monitoring is carried out at Serpong, Bandun, Jakarta and Kototabang, inland aquatic monitoring at Situ Patengang and Situ Gunungand soil and vegetation observations are made at the Dramaga Research Forest, Bogor. Indonesia has emission standards and policies for mobile sources and ambient air pollution. Various programs and activities are being implemented by the Ministry of the Environment for mobile sources conformity of production (COP), car free days, urban air quality evaluation (EKUP), emissions testing, cities blue sky index and for stationary sources (PROPER program).

Japan

Continuous monitoring of acid deposition has been implemented based on the long term monitoring plan for acid deposition by the Ministry of the Environment Japan since 2003. Japan has12 EANET wet and dry deposition monitoring sites, 2 soil and vegetation monitoring sites, 2 inland aquatic environment monitoring sites and a catchment study site near Ijira Lake. The current status of air quality in Japan is largely good in terms of SOx, NOx and PM_{10}. The challenge remaining is the very low attainment rate of air quality standards for photochemical oxidant (Ox) and $PM_{2.5}$ and so on. The Ministry of the Environment is focussing on i) photochemical oxidant and $PM_{2.5}$, ii) transboundary air pollution, and iii) short-lived climate pollutants. Close collaboration with other ministries and relevant departments in the ministry is essential such as with the Meteorological Agency for dust and sandstorm (DSS) monitoring, coordination with the Ministry of Foreign Affairs for international cooperation on transboundary air pollution, and with the departments in charge of climate change within the ministry concerning short-lived climate pollutants.

Lao P.D.R.

Realizing the need to take preventive action against acid deposition, Lao PDR started monitoring activities with the establishment of a wet deposition monitoring site in Vientiane in 2005 and has surveyed a candidate site for inland aquatic environment monitoring at Namhum Lake in 2009. By 2011, both wet and dry deposition monitoring was conducted at the Vientiane site. Environment monitoring activities are carried out by the Environment Quality Monitoring and Hazardous Chemical Center (EQMHCC) under the Water Resources and Environment Research Institute of Water Resources and Environment Administration (WREA) now changed to Environmental Quality Monitoring Center, under the Natural Resources and Environment Institute of the Ministry of Natural Resources and Environment (MONRE). MONRE is responsible for environment quality protection at the national level. The air quality status is considered acceptable in Lao PDR although the effects of climate change have been visible in changes in average temperatures, shifts in seasons

and increasing intensity of extreme weather events. After being a signatory to the Kyoto Protocol the government has initiated a number of actions for protection of the environment.

Malaysia

Malaysia has been involved in the EANET activities since 2001 and has four monitoring sites for monitoring wet and dry deposition at Tanah Rata, Petaling Jaya, Danum Valley and Kuching, three sites for monitoring soil and vegetation at Sg. Lallang, Pasoh Forest Reserve and UPM Bintulu, and two sites for inland aquatic environment monitoring sites at Danum Valley and Semenyih Dam. Results show high variability of wet deposition at all sites which is likely due to inherent high rainfall in the tropics.

Local air quality is monitored by the Department of Environment (DOE) from a network of automatic and manual sites. The data collected is used to compute the Air Pollutant Index (API) to inform the public on air quality status. Rules and regulations have been implemented to control pollution emissions in the country in particular the Environmental Quality Act (EQA) 1974 which was amended in 2001 to strengthen the existing regulations to protect and conserve the environment. From time to time a number of legal instruments such as the Environmental Quality (Clean Air) Regulations 1978 were gazetted and enforced to maintain environmental quality. The Malaysian Recommended Ambient Air Quality Guidelines for the major air pollutants has also been developed. Environmental Impact Assessment (EIA) reports are used as a means to include environmental considerations in development project planning. The government enforces related laws by implementing enforcement acts against activities that contravene the laws and regulations. Regular checks for compliance with the Environment Quality (Clean Air) Regulations are conducted throughout the year on activities that are known to emit air pollutants. Emissions of smoke and gaseous pollutants from motor vehicle exhausts are controlled under the Environmental Quality (Control of Emission from Diesel Engines) Regulations 1996 and Environmental Quality (Control of Emission from Petrol Engines) Regulations 1996. Public awareness programmes on pollution prevention are conducted for targeted groups such as industries, development project proponents, local communities, school children and teachers.

Malaysia has taken measures to address transboundary air pollution problems through a number of initiatives, namely, ASEAN Working Groups on Sub-Regional Fire Fighting Arrangement for Sumatra and Borneo, ASEAN Agreement on Transboundary Haze Pollution, Sustainable Development Strategy for Seas of East Asia, EANET and other multilateral and bilateral agreements.

Mongolia

Acid deposition monitoring was initiated in 1998 with wet and dry deposition monitoring at two sites Terelj and Ulaabaatar, and inland aquatic environment monitoring at one site in the Terelj River. On the initiative of Mongolian President Ts. Elbegdorj, a law on reducing the capital city's air pollution was drafted and approved by the Great State Khural on February 10, 2011. Pursuant to this law, the National Committee for reducing air pollution was founded to control the air quality, regulate and correlate projects and efforts made by people, economic entities, governmental and non-governmental organizations, which are directed towards reducing the pollution rates and controlling air quality as well as to carry out the governmental policy in this sphere.

Over the recent years, a number of actions have been taken including the development of projects for housing construction in the ger areas being the major source of air pollution, building up relevant structures, reducing the rural areas' air pollution rates, providing with low power-consumption products the households living within the "Capital city's air quality improvement zones", giving

various incentives as reducing electricity costs in order to heighten citizens' involvements, working out and approving relevant regulations and standards, raising people's awareness of the air quality issues.

Concerning Bayankhongor, Darkhan-Uul, Dornod, Orkhon, Uvurkhangai, Khuvsgul, Sukhbaatar, Khovd provinces which air pollution rates are indicated to far exceed the permissible concentrations, currently programs and plans are being worked out to set up there sub-committees of the National committee to reduce the air pollution. With the implementation of a project for setting up 2 centers for conducting technical inspection of vehicles and purchasing 11 vehicles fully equipped with mobile repair service equipment it is expected that more appropriate conditions would be provided for controlling, registering noxious fumes emitted from the motor vehicles, improving thus the system of responsibility while the vehicles' technical inspections and diagnostics would be carried out at the modern international level.

Actions are taken to encourage the public transport vehicles to shift to gas and diesel combined fuel consumptions, and in order to reduce the rates of emissions from the motor transport 124 public service big buses were equipped with gas and diesel fuel facilities, toxic fume filters were provided for 1,523 cars, 18 trolleybuses, duobus were assembled to be used for public service. Accordingly, the rates of fume releases from big buses have reduced by 25%.

According to the monitoring data conducted by Ulaanbaatar city's air quality control stationary posts during the period from October 2012 till March 2013, the average concentrations for major pollutants discharged into the atmosphere from raw coal application, namely sulphuric acid has diminished by 20.1% as against the results recorded for the same period of the previous year, that of PM by 29.5%. So, as a result of all the actions undertaken to improve the air quality, the air pollution rate has dropped by 20 to 30% as compared with the same period of the previous year.

Myanmar

Wet deposition monitoring is carried out at one site in Yangon (Kaba-Aye) since 2007 to monitor the state of acid deposition in Myanmar. The monitoring is conducted by the Department of Meteorology and Hydrology (DMH). On air quality management in the country there are existing environmental laws and institutional framework for environmental management in the country. The seven key priority areas of environmental issues have been identified through Environmental Protection Assessment (EPA-2009), namely, forest resources degradation, threat to biodiversity, land degradation, water resources and quality status, solid waste management, impact of mining industry and air pollution, and climate change. Some of the challenges in air pollution control in Myanmar include i) no air quality monitoring system and national ambient air quality standard, and ii) no advanced technology and instruments for monitoring. Future plans for environmental management are: a) policy, guidelines and planning; b) environmental pollution control; c) natural resources and environmental sustainability; d) capacity development; e) international cooperation; f) public awareness and participation; g) research and development on environmental conservation.

Philippines

The Philippines participated in EANET monitoring activities since 2001 and currently has 3 wet and dry deposition monitoring sites at Metro Manila, Los Baños and Mt. Sto. Tomas. Soil and vegetation monitoring activities are conducted at 4 sites, namely, at the Mt. Makiling Forest Reserve at the University of the Philippines, Los Baños College, Laguna; at U.P. Quezon Laguna Land Grant located in Siniloan, Laguna; at Boneco Long Term Ecological Research Site in Itogon, Benguet; and at La Mesa Watershed Area at Quezon City. Inland aquatic environment monitoring is carried out in Pandin Lake

in Laguna and Ambulalakao Lake in Kabayan, Benguet. The Clean Air Act or Republic Act 8749 is the guiding framework in the effective implementation of air quality management, interventions and programs. Under the Clean Air Act, publication of Air Quality Status Report is required to report the extent of air pollution, per type of pollutant and per type of source, including an analysis of the current situation and identifies trends in air pollution, critical areas activities and projects that require closer monitoring or regulation. Measures for mitigating air pollution include strategies for i) enforcement on motor vehicles, ii) enforcement on stationary/industrial sources, iii) enforcement on area sources, iv) shift to cleaner fuels, and v) public awareness. To further enhance air quality management, the DENR has recently issued the national ambient air quality guideline value for $PM_{2.5}$ and procured state-of-the-art ambient air quality monitoring stations (real-time) to be installed in key cities nationwide.

Republic of Korea

The acid deposition monitoring sites for EANET are located in Ganghwa, Jeju and Imsil. Recognizing the seriousness of air pollution caused by industrialization, the Korean government has taken comprehensive measures to reduce air pollutant emissions for the last three decades and implemented a national air monitoring program from mid 1970s. Adverse effects of long range transport of air pollutants have become a great public concern along with natural air pollutants and Asian dust. Monitoring at rural and remote sites is for evaluating the effect of long range transport on the air quality. Recognizing that international collaboration is required, Republic of Korea has actively promoted and participated in regional endeavours such as LTP, NEASPEC, EANET, NOWAP and ACE-ASIA which addresses long range transport of air pollutants and other regional air quality problems. Republic of Korea has a ten-year plan to improve urban air quality. The main tasks for air quality management were) $PM_{2.5}$ management, and ii) basic plan to improve air quality in metropolitan areas

Russia

Russia national precipitation chemistry monitoring network in the Asian Russia consists of different categories of sites where pollutants concentrations in both air and precipitation are measured. Included in the network are the EANET monitoring stations located at Irkutsk, Listvyanka, and Mondy in East Siberia and Primorskaya in the Far East Region which conducts wet and dry deposition, and also soil and vegetation monitoring. Inland aquatic environment monitoring is conducted at Listvyanka and Primorskaya.

Thailand

There are six EANET monitoring sites in Thailand located in Bangkok, Samutprakan, Pathumthani, Chiang Mai, Nakhon Ratchasima and Kanchanaburi. In Thailand a Sub-Committee on Acid Deposition Monitoring Network was established by the Pollution Control Board to oversee the implementation of acid deposition monitoring activities in Thailand. In Thailand, air pollution problems are significantly related to meteorological conditions. Air pollution concentrations are elevated during the dry season and decrease during the wet season. Thailand has implemented programs for i) SO_2mitigation, ii) NO_x mitigation, and iii) PM_{10} mitigation, and iv) O_3 mitigation.

Vietnam

There are two networks of environmental monitoring stations in Vietnam, the environmental background and impacts stations network and the EANET acid deposition monitoring stations network, both under the Ministry of Natural Resources and the Environment. The EANET stations are

located at Hanoi, Hoa Binh, Cuc Phuong and Da Nang. In Vietnam air pollution are emitted primarily from industrial sources such as power plants, factories producing cement, construction materials metallurgy and chemicals. To address the problems of air pollution the Government of Vietnam has promulgated policies and action plans for environmental protection such as Clean Air Ordinance, environmental impact assessments for all projects, effective control of pollution at factories with serious pollution emission, use clean production technologies, unleaded gasoline, reducing substances that cause greenhouse effect, enhanced automatic air monitoring station. Vietnam will gradually apply the system of national standards on a uniform environment, access to international standards, to ensure management objectives for environmental management and sustainable development.

4. CLIMATE CHANGE AND ACHIEVING SUSTAINABLE DEVELOPMENT

4.1 OUTCOMES OF RIO+20 IN RELATION TO ATMOSPHERIC ENVIRONMENT ISSUES AND THE EANET

The Rio+20 Conference held in Rio de Janeiro in 2012 focussed on 2 main themes: how to build a green economy to achieve sustainable development and lift people out of poverty; and how to improve international coordination for sustainable development.

The momentum created by Rio+20 offers an opportunity for the development of an integrated approach to addressing air pollution, which is inextricably linked to human health, climate mitigation, energy security, water security, food security and poverty alleviation. Partnerships involving multi-stakeholders are considered among the most participatory and effective mechanisms to implement sustainable development and enhance international cooperation. Partnerships can facilitate, strengthen and expedite implementation by involving relevant stakeholders that can make a contribution to sustainable development.

The *Future We Want - Outcome Document* states, among others, that: "We acknowledge that climate change is a cross-cutting and persistent crisis and express our concern that the scale and gravity of the negative impacts of climate change affect all countries and undermine the ability of all countries, in particular, developing countries, to achieve sustainable development and the Millennium Development Goals and threaten the viability and survival of nations. Therefore we underscore that combating climate change requires urgent and ambitious action, in accordance with the principles and provisions of the United Nations Framework Convention on Climate Change".

The activities of the EANET support the goals of Rio+20 and the EANET will continue to promote capacity building, sharing of knowledge, technology and experiences in an open and transparent manner. At the same time policy makers are urged to use the momentum from Rio+20 to implement green economy strategies and policies to achieve sustainable development in their countries.

4.2 GLOBAL WARMING AND ITS IMPACTS

Climate change is the most important atmospheric environment issue today. Atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases continue to increase to levels likely to push global temperatures beyond the internationally agreed limit of 2˚C above the pre-industrial average temperature (Figure 22). In May 2013 it was reported at monitoring stations in Hawaii and California that the level of 400 ppm had been exceeded, an approximate level that has been suggested to be crucial for staying below the 2° C increase.

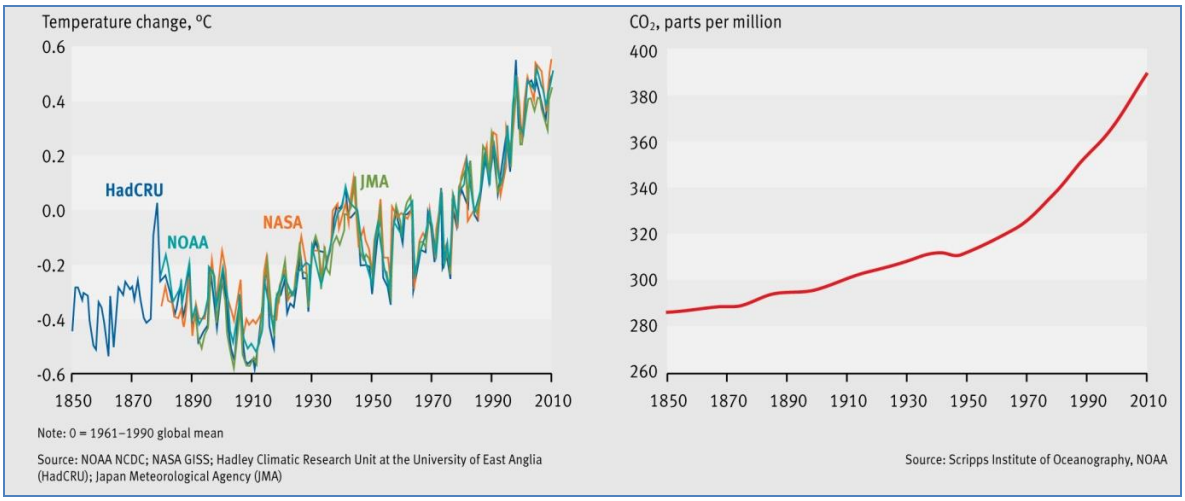


Fig. 22: Trends in temperature change and atmospheric CO_2 concentrations, 1850-2010
Source: UNEP, 2012b.

Currently, warming caused by greenhouse gases and aerosols that have positive radiative forcing is offset by cooling aerosols, primarily organic carbon and sulphates, which have negative radiative forcing. It should be noted that since these cooling aerosols are being reduced under current pollution policies, climate warming may occur even more rapidly in the future.

Climate change can induce a host of responses most notably through temperature and hydrological cycle, atmospheric transport and stability, and natural emissions, thereby threatening food and energy security, air quality, human health and biodiversity. The East Asian region, consisting of many island nations, countries with low-lying coastal regions, and agriculture-dependent economies is particularly vulnerable to climate change. Droughts, floods and shifting rainfall will occur more frequently and with greater intensity. Slowing the rate of climate change and reducing near-term impacts is a critical complement to adaptation strategies and to sustainable development.

4.3 **WHY FOCUS ON SLCPS REDUCTION?**

CO_2 emissions are responsible for 50-60% of anthropogenic radiative forcing. Fast and aggressive CO_2 mitigation is therefore essential to combat the resulting climate change. However, CO_2 mitigation must be combined with fast and aggressive reductions of the pollutants causing the other 40-45% of warming. These pollutants include black carbon, tropospheric ozone, methane, and hydrofluorocarbons (HFCs). As these pollutants have atmospheric lifetimes of only days to a decade and a half, they are referred to as short-lived climate pollutants (SLCPs). Reducing SLCPs is critical for slowing the rate of climate change over the next several decades and for reducing, with immediate effect, human mortality and morbidity as well as safeguarding agricultural production while simultaneously mitigating global warming, particularly in those regions most vulnerable to near-term climate change.

It was estimated that reducing black carbon, tropospheric ozone and methane has the potential of cutting the current rate of global warming by half and preventing growth of HFCs can avoid additional warming by another 20%, overall slowing down the warming expected by 2050 by as much as 0.5˚C (Figure 23). Recent research shows that black carbon is 680 times more heat trapping than CO_2. Thus mitigating these three SLCPs using technologies and institutions offers the most effective strategy for constraining warming in the near term. An Atmospheric Brown Clouds (ABC) study published in 2010 (Ramanathan and Xu, 2010) showed that mitigation of all four SLCPs (black

carbon, methane, ozone precursors, and HFCs) using maximum available technologies will reduce global warming by 0.60°C by 2050. These actions should complement on-going actions to reduce carbon dioxide emissions as part of a comprehensive climate strategy to prevent near-term, abrupt climate change and long term climate destabilization.

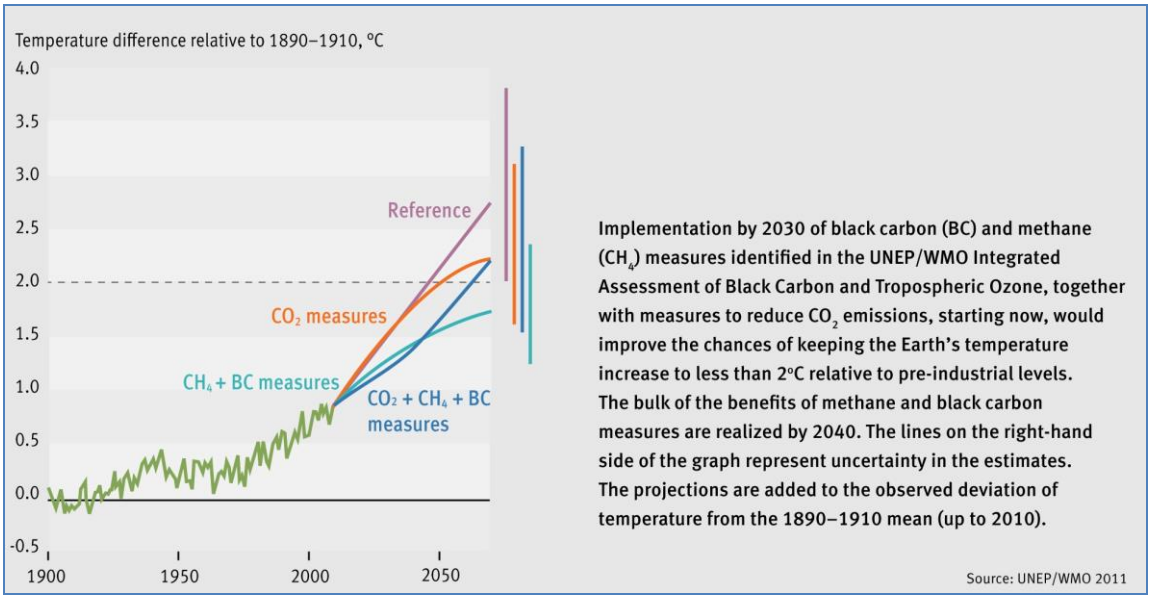


Fig. 23: Projected effects of measures to reduce CO_2, methane and black carbon emissions in relation to a reference scenario.
Source: UNEP/WMO, 2011

4.4 **NEAR-TERM CLIMATE PROTECTION AND CLEAN AIR BENEFITS**

Three of the four major SLCPs are harmful air pollutants. Black carbon, a component of fine particulate matter ($PM_{2.5}$), is a product of incomplete combustion of fossil fuels, biofuels and biomass. Its main sources are open burning of biomass, diesel engines and residential burning of wood and coal for heating or cooking. Black carbon, besides causing adverse air quality, lead to scattering and absorption of radiation, and affect climate indirectly through increased cloud formation and extended life-time of clouds. Tropospheric ozone is not emitted directly but is formed from reactions of precursor gases, nitrogen dioxides (NO_2) and volatile organic compounds (VOCs), in the presence of sunlight. Ozone damages human health, ecosystem and crop production. The main sources of anthropogenic methane emissions are oil and gas systems, enteric fermentation, landfills, manure management, wastewater treatment, rice cultivation and emissions from coal mines.

Reduction of the SLCPs combined will avoid an estimated 2.4 million premature deaths due to cardiopulmonary disease including lung cancer annually. Improvements in crop production are estimated to be up to 4% of total annual global production of the four major staple grains: maize, rice, soybeans and wheat (UNEP/WMO, 2011) if the SLCPs are reduced.

Due to the relatively short lifetimes of SLCPs, the benefits for health, crops and sustainable development will be most felt in the regions that take action to reduce these pollutants.

The Climate Benefits:

- Help stabilize regional climate systems and reduce heat waves, fires, droughts, floods and typhoons in mid-latitudes, and slow shifts in monsoons, expansion of desertification and increase in cyclones in the tropics
- Slow the melting of glaciers, not least in the Greater Himalaya and Arctic sea ice and rate of sea-level rise
- Slow the thawing of permafrost in the North, thereby curbing the expected release of methane which could otherwise considerably accelerate global warming
- Slow the pace of climate impacts and provide critical time to adapt to large climate changes

The Environmental Benefits:

- Save millions of lives a year and significantly reduce other illness
- Improve food security
- Expand energy access for the billions forced to depend on solid biomass
- Improve air quality

There are strong links between acid deposition and climate change. Air pollutants causing acid deposition (such as ozone and aerosols) contribute to climate change while climate change affects acid deposition through influences such as precipitation variations. Ozone and PM_{10} are included in the components of the EANET monitoring.

5. AN INTEGRATED APPROACH TO AIR QUALITY MANAGEMENT AND ENVIRONMENTAL PROTECTION

5.1 A CO-BENEFIT/CO-CONTROL APPROACH

It is highly recommended that countries adopt a co-benefit approach to maximize co-benefits arising from climate action. Co-benefits are defined as the benefits for the local environment as a result of mitigation and adaptation actions that are targeted at addressing global climate change. Climate change has attracted the attention of the highest levels of national government and with substantial flows of climate finance there is potential for environmental co-benefits. As shown in Figure 24below, the potential of environmental co-benefits lies at the intersection of efforts to address environmental issues and climate change actions. The highest priority should be win-win solutions.

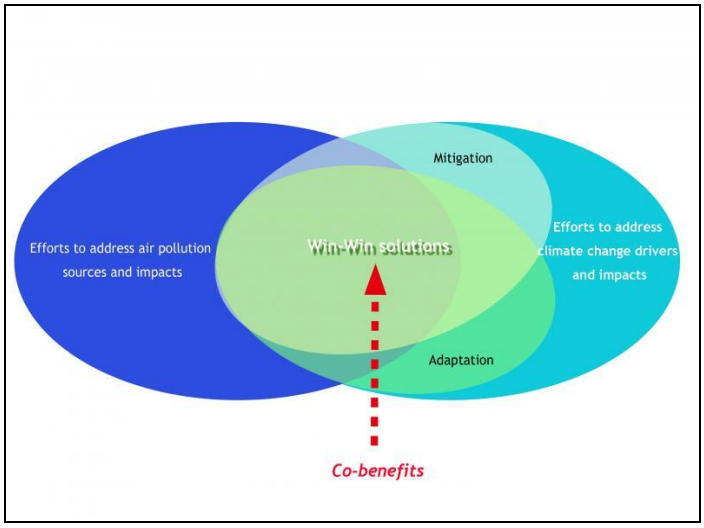


Fig. 24: Co-benefits from complementary mitigation of air pollution and climate change

A win-win mitigation project for example could be reduction of black carbon emissions from biomass cooking stoves and dirty diesel vehicles which can result in important benefits ranging from reduction in health impacts to reduction in glacier melt since black carbon particles are associated with local and regional warming.

The Asian Co-benefits Partnership (ACP) launched in November 2010 offers a platform for improving information sharing and stakeholder dialogue on co-benefits in Asia. It supports the mainstreaming of co-benefits into decision-making processes in Asia and thus could assist policy makers in development of co-benefits policies and projects, particularly those policies integrating SLCPs reduction.

Co-control planning or “an integrated multi-pollutant approach for controls” is also recommended for planning control measures that can simultaneously reduce several pollutants, and therefore can be highly cost-effective. Co-control air quality planning is a transparent process which offers flexibility of choices for control measures and optimizes trade-offs between pollutants, impacts and benefits. Co-controls relating public health and climate to measures for tropospheric ozone and black carbon reduction should be also considered.

5.2 COLLABORATION BETWEEN INTERNATIONAL, REGIONAL, AND SUB-REGIONAL AIR QUALITY NETWORKS, INITIATIVES, AND EXPERTS IN KEY AREAS

Since 2000, the EANET has worked in close cooperation with a number of international organizations which serve to provide the standards for environmental monitoring and assessment. They include:

i) The Global Atmosphere Watch programme of the World Meteorological Organization (WMO/GAW)
ii) The World Health Organization (WHO)
iii) United Nations Environment Programme (UNEP)
iv) The European Monitoring and Evaluation Programme (EMEP), International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP-Forests), and Task Force on Hemispheric Transport of Air Pollution (TF HTAP) of the UNECE Convention on Long-range Transboundary Air Pollution (UNECE CLRTAP)

Additionally, the EANET has established linkages with many regional and sub-regional initiatives, networks and programmes involved in the protection of the atmospheric environment as described in Section 2.3.

An Asian Scientific Panel on Air and Climate (ASPAC) has been recently proposed to establish common understanding among scientists and policy makers and developing an international initiative for an integrated approach to air pollution and climate change among Asian scientists.

There is a need for closer cooperation and coordination among all organizations, initiatives and networks to reduce regional atmospheric pollution and climate change in East Asia. They can pool resources to help governments in identifying and implementing key mitigation measures to bring about rapid climate, health and environmental benefits to the population. They can also work together to ultimately develop a regional framework convention on air pollution in Asia for longer term benefits.

5.3 INTEGRATING PREVENTION AND MITIGATION OF ACID DEPOSITION, AIR POLLUTION AND RELATED ATMOSPHERIC ENVIRONMENTAL ISSUES FOR WIN-WIN BENEFITS

Although climate change is a global issue, it can be better addressed if regional concerns of air pollution are included in its program and vice versa. There are obvious co-benefits to be gained from taking complementary measures on air pollution and greenhouse gases, and there are economic benefits from coordinated emission inventories and reporting. There are also opportunities to address impacts on human health, agricultural crops, and ecosystems in an integrated way and also scope for synergetic gains when addressing socio-economic aspects of climate change and air pollution. For example, UNEP supported Project Surya (http://www.projectsurya.org/) has demonstrated multiple benefits of improved cook stoves as an alternative to traditional mud stoves.

The 2007 Fourth Assessment Report of the Intergovernmental Panel on Climate Change states: "Integrating air pollution abatement and climate change mitigation policies offers potentially large cost reductions compared to treating those policies in isolation. Decision making on control measures should take account of the impact of these measures on greenhouse emissions and wherever possible look for win-win solutions."

Policy makers should therefore consider adopting a comprehensive approach that integrates current measures and plans for prevention and mitigation of atmospheric pollution issues, including acid deposition, with measures for mitigating climate change such as reducing SLCPs for near-term climate protection. By integrating SLCP reductions into national air pollution mitigation programs, governments can simultaneously improve air quality and human health of the population, cut crop losses and help to slow the rate of climate change.

The Global Atmospheric Pollution Forum (GAPF), a Sida-funded non-governmental endeavour, supports the development of solutions to air pollution-related problems by promoting effective cooperation among nations at the regional, hemispheric and global scales. It is currently pursuing flexible approaches that can also address climate change for the region.

5.4 **EXPANDING THE SCOPE OF THE EANET**

After more than ten years of successful operation, it is timely for the EANET to consider expansion of its scope to meet today's challenges. The recently adopted Instrument for Strengthening the Acid Deposition Monitoring Network in East Asia (EANET) includes a provision for "expansion of the scope of the EANET" and many of the activities under the Medium Term Plan for the EANET have paved the way for consideration of new activities that would benefit the community.

Discussion on this topic has been on-going within the EANET for several years with various views expressed by the participating countries, some strongly supported the expansion of the scope of the EANET both on activities and chemical species with emphasis on high priority air pollution species (ozone, $PM_{2.5}$ and black carbon) taking into account of their impacts to human health and linkages to climate change, while some other countries prefer the EANET to confine its activities to acid deposition focussing on capacity building and improving public awareness, and stressed that a step-wise approach to monitoring of ozone and $PM_{2.5}$ should be adopted. The Scientific Advisory Committee (SAC) of the EANET has requested its Task Force on Research Coordination to conduct a review of the state of air pollution in East Asia, including associated health effects. The review will be useful input for discussions on this topic by the various bodies of the EANET and for the IG in its consideration on the expansion of the scope.

From the scientific viewpoint, there is strong basis for supporting the expansion of the scope of the EANET:

- The monitoring of acid deposition and scientific assessment in past years has enabled a better understanding of the sources of acid deposition and its consequences on the environment. It is necessary to further consider ways to address the origins of harmful emissions by reaching out to policy developers and decision makers.
- The global spread of atmospheric pollution calls for more attention on urban air pollution, regional/hemispheric air pollution focussing on ozone and fine particulates.
- The close links between air pollution (including acid deposition) and climate change provides opportunities for the EANET's involvement with other regional initiatives in monitoring and developing measures to mitigate tropospheric ozone and fine aerosols emissions.

The extended assessment of acid deposition including other relevant atmospheric pollutants involved in transboundary and intercontinental transport and climate change, and impact studies could be coordinated with regional/international partners. The EANET's response to the emerging issues would strengthen the policy relevance of the EANET's mandate, and secure achievements (including financial support) that could sustain its continued operations and development.

6. PRIORITY MEASURES TO ENSURE CLEAN AIR FOR SUSTAINABLE DEVELOPMENT

6.1 **CALL FOR TIMELY ACTIONS BY POLICY MAKERS**

Reducing emissions of air pollutants, including the short-lived climate pollutants (SLCPs), require actions from local up to regional levels. Knowledge-to-action projects and knowledge action networks are needed to transfer knowledge generated by scientists and countries to local institutions where such knowledge is much needed. Many emission sources release both greenhouse gases and air pollutants. Cost effective technologies are available to reduce emissions from a wide range of sources, particularly in the industrial and transport sectors. Complementary actions to improve air quality and limit near-term climate change would therefore be a win-win approach.

Recognizing the achievements attained through the EANET, and aware of the serious impacts of air pollution on human health, ecosystem and climate change, and with a common desire for clean air and achieving sustainable development, policy makers are urged to:

- ***Support the activities of the EANET on acid deposition and other high priority air pollutants***
- ***Raise awareness on scientific aspects of air pollution and climate change, including health risks and impacts on environment***
- ***Strengthen national monitoring of air pollutants, including SLCPs***
- ***Use an effects oriented approach in formulation of abatement strategies***
- ***Explore the potential for applying differential abatement strategies and responsibilities according to national susceptibility, priorities, institutional and administrative capacity and available resources in a cooperative transboundary context***
- ***Identify key sources of SLCPs and consider integration of SLCPs into national action planning as a part of abatement strategies for acid deposition and other related atmospheric pollutions.***
- ***Adopt a Co-benefits approach which links management of air quality and climate protection for mutual benefits***
- ***Promote and strengthen collaborative partnerships with international organizations, regional initiatives, and other networks for reduction of air pollutants***
- ***Share best practices and technological knowledge and experiences***

6.2 **SUPPORTING THE LONG TERM VISION ON URBAN AIR QUALITY BY INITIATIVES IN ASIA AND OTHER REGIONS**

At the Fourth Governmental Meeting on Urban Air Quality in Asia organized by United Nations Environment Programme (UNEP) and the Clean Air Asia (former Clean Air Initiative for Asian Cities - CAI-Asia) in Bangkok on 6 February 2013, representatives of the governments of countries in Asia reviewed and discussed the strategies to achieve the Long Term Vision on Urban Air Quality in Asia (LTV): "*Healthy people in healthy cities, which put emphasis on prevention of air pollution and which implement effective and appropriate strategies for the abatement of air pollution*".

Clean Air Asia and UNEP are currently collaborating with Asian governments to develop a Guidance Framework on Urban Air Quality in Asia to strengthen the capacity of governments in the management of air quality and control of greenhouse gas emissions. The Guidance Framework is expected to be presented at the Fifth Governmental Meeting in 2014.

Recognizing the deteriorating air quality in most cities and recent findings on health impacts, urban air quality management must be made a priority. Collaboration between countries, organizations, networks and experts across Asia and with other regional/global initiatives is crucial.

6.3 **FUTURE DIRECTION OF THE EANET**

The EANET has an important role to provide policy advice and information to the participating countries, regional and global initiatives based upon sound science and assessment. To further strengthen the network the following action plans were suggested at the Fourteenth Session of the Intergovernmental Meeting (IG14)on the EANET under the present scope of the EANET:

- Ozone and $PM_{2.5}$ monitoring to be added to the monitoring items at the EANET sites with high priority. Practical implementation of the monitoring should follow in a stepwise manner. Pre-existing sites which have already started monitoring ozone and $PM_{2.5}$ monitoring could be added to the EANET monitoring network.

- Technical support and capacity building for air concentration monitoring including ozone and $PM_{2.5}$tobe enhanced.

- Research activities on inter-linkages between acid deposition, air pollution, climate change, and co-benefits/co-control approach to be undertaken by utilizing external funding. Monitoring of black carbon to be considered as a research activity of interlinking acid deposition, air pollution and climate change.

- Extended assessment of the state of acid deposition and air pollution to be made with the aid of modelling and emission inventories. Assessment of the impacts on human health from exposure to ozone and $PM_{2.5}$ in combination with monitoring, modelling and emission inventory to be considered for future research activities of the EANET.

- Public awareness activities and the establishment of an epistemic community to be promoted in order to achieve a common understanding among different stakeholders on acid deposition and its inter-linkages with other atmospheric pollution and climate change.

- Information on new direction of atmospheric management to be disseminated among the EANET participating countries through enhanced collaboration with international organizations outside the region.

As a follow up to the above, the IG may wish to explore science-based options and technical modalities for taking further steps towards a draft agreement on emission reduction and other strategic measures with differentiated obligations under a common vision statement.

REFERENCES

Ajero, M. and Patdu, K. 2013. Status and Trends of Urban Air Quality in Asia. Clean Air Asia. The Fourth Governmental Meeting on Urban Air Quality held in Asia. Bangkok, Thailand.

BAQ. 2012. Risk assessment for possible impacts of ozone and $PM_{2.5}$ on human health and crop yield. Better Air Quality (BAQ) Conference. Clean Air Asia Center. Manila, Philippines.

Clean Air Asia. 2013. Status and Trends of Urban Air Quality in Asia. The Fourth Governmental Meeting on Urban Air Quality held in Asia. Bangkok, Thailand.

Clean Air Asia. 2010. Air Quality in Asia: Status and Trends. Clean Air Asia (formerly Clean Air Initiative for Asian Cities (CAI Asia)) Center. The 2010 Edition. Manila, Philippines.

EANET. 2012a. Proceedings of the Fourteenth Session of the Intergovernmental Meeting (IG14) on Acid Deposition Monitoring Network in East Asia (EANET). Pathumthani, Thailand.

EANET. 2012b. Proceedings of the Thirteenth Senior Technical Managers' Meeting (STM13) on the Acid Deposition Monitoring Network in East Asia (EANET). Pathumthani, Thailand.

EANET. 2012c. Proceedings of the Twelfth Session of the Scientific Advisory Committee (SAC12), on the Acid Deposition Monitoring Network in East Asia (EANET). Pathumthani, Thailand.

EANET. 2011a. EANET Science Bulletin (Vol. 2).Acid Deposition Monitoring Network in East Asia (EANET). Niigata, Japan.

EANET. 2011b. The Second Periodic Report on the State of Acid Deposition in East Asia (PRSAD2), Part II: National Assessments. Acid Deposition Monitoring Network in East Asia (EANET). Niigata, Japan.

EANET. 2011c. The Second Periodic Report on the State of Acid Deposition in East Asia (PRSAD2), Part I: Regional Assessment. Acid Deposition Monitoring Network in East Asia (EANET). Niigata, Japan.

EANET. 2009a. Clean Air for a Sustainable Future. The Second Report for Policy Makers (RPM2). Acid Deposition Monitoring Network in East Asia (EANET). Pathumthani, Thailand.

EANET. 2009b. The EANET Science Bulletin (Vol. 1), Acid Deposition Monitoring Network in East Asia (EANET). Niigata, Japan.

EANET. 2005. Goals, Achievements and Way Forward. Report for Policy Makers (RPM) on Acid Deposition Monitoring Network in East Asia (EANET). Pathumthani, Thailand.

HEI. 2012. Outdoor Air Pollution Among Top Global Health Risks in 2010 – Press Release on December 13, 2012. Health Effects Institute (HEI). Geneva, Switzerland.

HEI. 2010. Outdoor Air Pollution and Health in the Developing Countries of Asia: A Comprehensive Review. Health Effects Institute (HEI). The Special Report 18. Geneva, Switzerland.

Hicks, W.K., Kuylenstierna, J.C.I., Owen, A., Dentener, F., Seip, H.M. and Rodhe, H. 2008. Soil Sensitivity to Acidification in Asia: Status and Prospects. Ambio. 37: 295–303.

HTAP. 2010. Hemispheric Transport of Air Pollution 2010. Part A: Ozone and Particulate Matter. Air Pollution Studies No. 17. The Task Force on Hemispheric Transport of Air Pollution (HTAP). United Nations Economic Commission for Europe. Geneva, Switzerland.

Lim S.S., Vos T., Flaxman A.D., Danaei G., Shibuya K., Adair-Rohani H., Amann M., Anderson H.R., Andrews K.G., Aryee M., Atkinson C., Bacchus L.J., Bahalim A.N., Balakrishnan K., Balmes J., Barker-Collo S., Baxter A., Bell M.L., Blore J.D., Blyth F., Bonner C., Borges G., Bourne R., Boussinesq M., Brauer M., Brooks P., Bruce N.G., Brunekreef B., Bryan-Hancock C., Bucello C., Buchbinder R., Bull F., Burnett R.T., Byers T.E., Calabria B., Carapetis J., Carnahan E., Chafe Z., Charlson F., Chen H., Chen J.S., Cheng A.T., Child J.C., Cohen A., Colson K.E., Cowie B.C., Darby S., Darling S., Davis A., Degenhardt L., Dentener F., Des Jarlais D.C., Devries K., Dherani M., Ding E.L., Dorsey ER, Driscoll T, Edmond K, Ali SE, Engell RE, Erwin PJ, Fahimi S, Falder G, Farzadfar F., Ferrari A., Finucane M.M., Flaxman S., Fowkes F.G., Freedman G., Freeman M.K., Gakidou E., Ghosh S., Giovannucci E., Gmel G., Graham K., Grainger R., Grant B., Gunnell D., Gutierrez H.R., Hall W., Hoek H.W., Hogan A., Hosgood H.D. 3rd, Hoy D., Hu H., Hubbell B.J., Hutchings S.J., Ibeanusi S.E., Jacklyn G.L., Jasrasaria R., Jonas J.B., Kan H., Kanis J.A., Kassebaum N., Kawakami N., Khang Y.H., Khatibzadeh S., Khoo J.P., Kok C., Laden F., Lalloo R.,

Lan Q., Lathlean T., Leasher J.L., Leigh J., Li Y., Lin J.K., Lipshultz S.E., London S., Lozano R., Lu Y., Mak J., Malekzadeh R., Mallinger L., Marcenes W., March L., Marks R., Martin R., McGale P., McGrath J., Mehta S., Mensah G.A., Merriman T.R., Micha R., Michaud C., Mishra V., MohdHanafiah K., Mokdad A.A., Morawska L., Mozaffarian D., Murphy T., Naghavi M., Neal B., Nelson P.K., Nolla J.M., Norman R., Olives C., Omer S.B., Orchard J., Osborne R., Ostro B., Page A., Pandey K.D., Parry C.D., Passmore E., Patra J., Pearce N., Pelizzari P.M., Petzold M., Phillips M.R., Pope D., Pope C.A. 3rd, Powles J., Rao M., Razavi H., Rehfuess E.A., Rehm J.T., Ritz B., Rivara F.P., Roberts T., Robinson C., Rodriguez-Portales J.A., Romieu I., Room R., Rosenfeld L.C., Roy A., Rushton L., Salomon J.A., Sampson U., Sanchez-Riera L., Sanman E., Sapkota A., Seedat S., Shi P., Shield K., Shivakoti R., Singh G.M., Sleet D.A., Smith E., Smith K.R., Stapelberg N.J., Steenland K., Stöckl H., Stovner L.J., Straif K., Straney L., Thurston G.D., Tran J.H., Van Dingenen R., van Donkelaar A., Veerman J.L., Vijayakumar L., Weintraub R., Weissman M.M., White R.A., Whiteford H., Wiersma S.T., Wilkinson J.D., Williams H.C., Williams W., Wilson N., Woolf A.D., Yip P., Zielinski J.M., Lopez A.D., Murray C.J., Ezzati M., AlMazroa M.A. and Memish Z.A.. 2012. A Comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet. 380: 2224-60.

Liu J., Mauzerall, K.L. and Horowitz, L.W. 2008. Source receptor relationships between East Asian sulphur dioxide emissions and Northern Hemisphere sulphate concentrations. Atmos. Chem. Phys. 8: 3721-3733.

Ramanathan, V. and Xu, Y. 2010. The Copenhagen Accord for limiting global warming: Criteria, constraints, and available avenues.

Stohl, A. and S. Eckhardt. 2004. Intercontinental Transport of Air Pollution: An Introduction, in Intercontinental Transport of Air Pollution. Springer Science and Business Media B.V.

UN. 2012. World Urbanization Prospects. United Nations (UN), Department of Economic and Social Affairs, Population Division. The 2011 Revision Highlights. New York.

UNEP. 2012a. Black Carbon e-Bulletin, Volume 4, Number 1. April 2012. United Nations Environment Programme (UNEP). Nairobi, Kenya.

UNEP. 2012b. Global Environmental Outlook (GEO)-5: Chapter 2 Atmosphere. United Nations Environment Programme (UNEP). Nairobi, Kenya.

UNEP. 2011a. Actions for Controlling Short-Lived Climate Forcers. The Synthesis Report, Near-term Climate Protection and Clean Air Benefits. United Nations Environment Programme (UNEP). Nairobi, Kenya.

UNEP. 2011b. Black Carbon e-Bulletin, Volume 3, Number 2. December 2011. United Nations Environment Programme (UNEP). Nairobi, Kenya.

UNEP/Clean Air Asia. 2008. Blue Skies 2030: Background Document on the Long Term Vision for Urban Air Quality in Asia.

UNEP/WMO. 2011. Integrated Assessment of Black Carbon and Tropospheric Ozone – Summary for Decision Makers, United Nations Environment Programme (UNEP). Nairobi, Kenya.

WHO. 2012. Health Effects of Black Carbon. World Health Organization (WHO). Geneva, Switzerland.

WHO. 2009. Global Health Risk: Mortality and Burden of Disease Attributable to Selected Major Risks. World Health Organization (WHO). Geneva, Switzerland.

Acid Deposition Monitoring Network in East Asia (EANET)

URL: http://www.eanet.asia

Secretariat
Regional Resource Centre for Asia and the Pacific (RRC.AP)
Asian Institute of Technology (AIT)
P.O. Box 4, Klongluang
Pathumthani 12120
Thailand
Phone: +66-2-524-5366 / 524-6233
Fax: +66-2-516-2125 / 524-6233
URL: http://www.rrcap.ait.asia

Network Center
Asia Center for Air Pollution Research (ACAP)
1182 Sowa, Nishi-ku
Niigata-shi, 950-2144
Japan
Phone: +81-25-263-0550
Fax:+81-25-263-0566
Email: eanet@acap.asia
URL: http://www.acap.asia

The Thirteenth Session of the Scientific Advisory Committee
on the Acid Deposition Monitoring Network in East Asia
25-27 September 2013, Xiamen, China

Annex 2

Views and Comments
on
the First Draft of the RPM3

Mr. Lars Nordberg

I have perused the draft report with great interest and I find it very timely and highly relevant. It provides an important platform for further action. It is, in my view, comprehensive and well underpinned and captures all major points in an attractive way. It is well documented, illustrated and referenced. It was a pleasure to note the very significant progress that has taken place over the years and the suggestions for the future are motivated in an excellent way.

While the report is outstanding as it is, I do have a few minor observations:

1. In the Executive Summary the degradation of the environment could be exemplified by mentioning acidification, eutrophication and loss of biodiversity, as well as vegetation damage from tropospheric ozone.

2. On page 11 I would suggest a clarification. CLRTAP has 51 Parties (EU is one of the Parties). To be Party indicates a legally-binding commitment requiring parliamentary ratification of the country in question.

3. Segment 4.2 on Global Warming and its Impacts. One could consider adding a sentence in the fourth line: "In May 2013 it was reported at monitoring stations in Hawaii and California that the level of 400 ppm had been exceeded, an approximate level that has been suggested to be crucial for staying below the 2C increase".

4. Chapter 6 is key to progress on policy development. Segment 6.1. In order to facilitate adherence to an envisaged agreement as much as possible, one might add a new fifth bullet: "Explore the potential for applying differentiated abatement strategies and responsibilities according to national susceptibility, priorities, institutional and administrative capacity and available resources in a cooperative transboundary context".

5. Segment 6.3. As a consequence of the suggested new bullet in segment 6.1, one might consider adding a new action-oriented point: "IG14 may wish to establish a small ad hoc expert group to explore and propose science-based options and technical modalities for taking further steps towards a draft agreement on emission reduction and other strategic measures with differentiated obligations under a common vision statement. Such a group would report back to IG15".

Malaysia

From: MegatMohdHisham bin MegatTajudin

To: "'Supat.Wangwongwatana"

Date: 06/19/2013 04:29 PM

Subject: RE: Reminder : Request for comment on the First Draft of the Third Report for Policy Makers (RPM3)

Dear Dr. SupatWangwongwatana,

I respectfully refer to your e-mail on the above as appended below.

Appended herewith is the First Draft of the RPM3, with our proposed amendments which are mostly editorial in nature (highlighted in blue font). We have no objections to the Draft Report in general and consider the Draft as very well prepared and written.

However, we would like to request for a small typographical correction on page 20 of the Draft Report. The name of the Malaysian dam in "Table 2: Trends of Inland Water Chemistry" should be spelled as "Semenyih" and not "Semenih" as it is currently referred to in the Draft Report.

We have no other observations to be made on the Draft Report as it currently is.

Thank you and best regards.

MEGAT MOHD. HISHAM MEGAT TAJUDIN

NFP, EANET (MALAYSIA)

Views and Comments
on
the Second Draft of the RPM3

Mr. Lars Nordberg

I enjoyed reading the slightly revised version the EANET Third Report for Policy-makers and, apart from possible further national additions, I think that the report could be regarded as final. However, I would like to suggest three clarifications related to the interface air quality/climate change since full clarity of these matters will facilitate further progress on EANET cooperation.

1. Page 29 (text clarified, section 4.3 first paragraph, last sentence) "… and for reducing, with immediate effect, human mortality and morbidity as well as safeguarding agricultural production while simultaneously mitigating global warming, particularly in those regions most vulnerable to near-term climate change …"

2. Page 30 or 31 (new bullet suggested) "Slow the thawing of permafrost in the North, thereby curbing the expected release of methane which could otherwise considerably accelerate global warming".

3. Page 31 (somewhat amended text in existing bullet) "Slow the melting of glaciers, not least in the Greater Himalayas and Arctic Sea ice, and rate of sea-level rise".

Malaysia

With regard to the draft RPM3, Malaysia commends the effort by the EANET Secretariat in preparing the report. Malaysia finds the report to be well written and fairly comprehensive.

Under paragraph 6.3 Future Direction of EANET, Malaysia's views are as follows:

1. With regard to the proposed expansion of the scope of EANET, Malaysia would like EANET to remain focused on its core activities related to acid deposition monitoring i.e. continue to focus on research, capacity building and improving public awareness on acid deposition;

2. With regard to the proposed inclusion of high priority air pollution species (ozone, PM2.5 and black carbon), Malaysia would like EANET to remain focused on the extended assessment of acid deposition (wet deposition, dry deposition, inland aquatic environment, soil and vegetation) and other related matters; and

3. Malaysia would also like to propose that further research/studies be conducted on how acid deposition negatively influences the agriculture and fisheries industries as well as its negative effects on human health.

   In this regard, Malaysia had conducted an analysis on the impacts on the ecosystem due to acid deposition based on EANET datasets in 2011 and had found that there is no clear evidence of tree decline. However, since the draft RPM3 reported that Mongolia has evidence of such an effect, EANET should assist Mongolia in determining the effects of acid deposition on the ecosystem as a future priority project.

答复: 答复: Request for view and comment on the Second Draft of the Third Report for Policy Makers (RPM3)
DONG Yao
to:Supat.Wangwongwatana
08/16/2013 03:02 PM

Dear Dr. Supat,

Thank you very much for your reply! After discussion and careful consideration on the report of PRSAD3 with several related departments, considering it covers broad range of specific scientific areas and quoting various sources both of organization and of individuals, our special expert group working on the report concludes that it's difficult to provide reply very soon since the quoting and conclusion should be considered as authorized and representing our intergovernmental network.

One suggestion is that such an important report, to be submitted to high-level policy makers, could be developed by experts from the network, while after the draft has been developed, a special expert team including experts nominated from each participating country could work on reviewing it. Afterward, the report could be submitted to the formal EANET meeting for review by the governmental representatives.

Anyway, we'll intensively work on the report with our expert team and try to provide a revised version to you at the earliest possible time, however, it will take a period of time. We'll keep you informed and updated. It'll be appreciated that the Secretariat could work on the suggestion above and it will also facilitate the future important report of the network. We'll be ready to nominate the expert for special expert team for PRSAD3.

For the inconvenience brought to you, I feel sorry. Our target is to work toward a more confidential and valuable report for policy makers, representing the network. Once again, the efforts made by the Sec, NC and drafting experts on the report are much appreciated. Thank you very much for your understanding!

With best regards,

DONG Yao

Response of the Secretariat to China's Views and Comments

From: SupatWangwongwatana/RRCAP/BKK/UNO
To: "DONG Yao"
Date: 08/16/2013 10:47 PM
Subject: Re: 答复: 答复: Request for view and comment on the Second Draft of the Third Report for Policy Makers (RPM3)

Dear Ms. Dong Yao,

Thank you very much for the view and comment from China.

In the development of the Second Report for Policy Makers (RPM2) the Secretariat also engaged a consultant to develop draft RPM2. Then, the representatives from participating countries were invited to a Workshop to review the draft RPM2 before it was finalized and published taking account of views and comments from the Workshop. At that time there were budget of the Secretariat allocated under the Work Program and Budget (WPB) of the EANET in that year for the Workshop. However, following the MTP for the EANET (2011-2015) there is budget allocated in the WPB of the EANET in 2013 only US$18,000 which is only sufficient for engaging a consultant but not enough for holding a Workshop.

Therefore, in the development of the RPM3 it is planned that the draft RPM3 developed by the consultant in consultation with the Secretariat and the NC will be reviewed by the SAC13 and the WGFD12. This will give the opportunity for the experts of the participating countries to review and provide input to the draft RPM3 which is supposed to be equivalent to having a Workshop. The draft RPM3 will then be revised taking account of views and comments from the NFPs, the SAC13 and the WGFD12 before it will be submitted to the IG15 for its consideration.

As far as I understand from your e-mail, China suggests that a special expert team including experts nominated from each participating country would work on the review of the draft RPM3. Subsequently, the report would be submitted to the formal EANET meeting for review by the governmental representatives.

The Secretariat believes that the review of the draft RPM3 by the NFPs including experts in the country, the SAC13 and the WGFD12 should be equivalent to the review by a special expert team consisting of experts nominated by the participating countries as proposed by China. As mentioned above, the Secretariat does not have the budget in 2013 allocated for holding a meeting of such a special expert team to review the draft RPM3 this year.

To follow the suggestion made by China and if a meeting of such a special expert team to review the draft RPM3 is needed then it will not be possible to finalize the RPM3 within this year as specified in the MTP (2011-2015) due to budget and time constraints. Such a meeting of a special expert

team will have to be held next year with a special budget allocation, may be from the Saving at the Secretariat, in the Work Program and Budget for the EANET in 2014 since it is not included in the MTP (2011-2015). Then the RPM3 will then have to be finalized at the IG16 around the end of next year which will then not follow the schedule specified in the MTP (2011-2015).

Please consider the explanation by the Secretariat above. The Secretariat would appreciate guidance from China.

With best regards.

Dr.SupatWangwongwatana
Coordinator, the EANET Secretariat