

The Twenty-sixth Session of the Scientific Advisory Committee (SAC26)
on the Acid Deposition Monitoring Network in East Asia
20-22 October 2026, Kuala Lumpur, Malaysia

Consideration of the activities of the Task Force on Monitoring and Assessment of Environmental Effects

Chairperson of the Task Force

Secretariat of the Task Force

I. Introduction

1. Task Forces under the Scientific Advisory Committee (SAC) of the Acid Deposition Monitoring Network in East Asia (EANET) have been reformed based on the decision at the 24th Session of the Intergovernmental Meeting at its (IG24) in November 2022. The Task Force on Monitoring and Assessment of Environmental Effects (TFEE) was established by reforming the previous task forces, namely Task Force on Soil and Vegetation Monitoring and Task Force on Research Coordination.
2. TFEE will assist the SAC, IG, and the Network Center (NC) in the process of EANET activities related to scientific and technical issues deemed important for future development of the EANET designated by the SAC and IG. In particular, TFEE will work on scientific and technical aspects for further development of monitoring, evaluation, and research on ecological impacts and human health risk.
3. The members of TFEE were nominated by the National Focal Points (NFPs) of the Participating Countries by the end of 2023. As the Chairperson of TFEE, Prof. Wilfredo Manila Carandang has formally appointed the members in April 2024.
4. Ecological monitoring and relevant research activities in the EANET have been promoted according to the *“Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances”*, which was developed by the previous task force and adopted by SAC at its Twentieth Session (SAC20) in 2020.
https://www.eanet.asia/wp-content/uploads/2021/01/Ecological_strategy_paper_2020.pdf
Specific activities and milestones described in the Annex of the strategy paper are expected to be updated for the next term (2026-2030). This is the first task of TFEE on ecological impacts.

5. Additionally, an exchange of information on the methodology for human health effects is expected to be carried out among TFEE members as well as SAC members.

II. Major outputs from the 3rd meeting of TFEE (TFEE3) in 2026

6. The 3rd meeting of TFEE (TFEE3) was held online on July 1, 2026. The update of the strategy paper and the implementation plan for information exchange on human health effects were discussed at the meeting. The meeting minutes were attached as Annex 1.
7. The strategy paper was updated to reflect the new MTP (2026–2030) while maintaining its overall long-term direction. The Annex on specific activities for 2026–2030 was mainly updated in accordance with the MTP (2026–2030). Descriptions related to inland aquatic environment monitoring, reactive nitrogen monitoring, VOC, LCS and collaboration with relevant networks were also revised where necessary.
8. The following three specific activities were proposed in the Annex for the period from 2026 to 2030:
 - 1) Strengthening efforts to obtain and assess data on atmospheric reactive nitrogen (Nr) deposition
 - 2) Accumulation of scientific knowledge on ozone and particulate matter (PM) in forest areas
 - 3) Confirmation of ecosystem recovery from acidification and eutrophication
9. Regarding the implementation plan for information exchange on human health effects, the following activities for the period from 2026 to 2030 were proposed:
 - 1) Promotion of methodological exchange on assessment of health effects of air pollution, including exposure assessment, health risk and health impact assessment, epidemiological approaches, and relevant case studies.
 - 2) Capacity-building activities through workshops, training sessions and expert lectures to strengthen technical knowledge and practical skills related to assessment of health effects of air pollution.
 - 3) Information exchange and knowledge sharing on emerging issues, including PM_{2.5}, surface ozone, biomass burning (haze), interactions between heat and air pollution, vulnerable populations and risk communication.
 - 4) Promotion of information exchange and technical cooperation with relevant international organizations, scientific networks and academic institutions, including WHO, CLRTAP, US EPA, AIT, IIASA and HEI.

10. The Chairperson suggested inviting a specialist in human health effects to participate in TFEE as a new member. The TFEE3 participants agreed with the proposal.
11. In accordance with the above proposal, the Chairperson has nominated Dr. Xerxes Seposo, Associate Professor at Hokkaido University, as a candidate for a new member specializing in human health effects. Dr. Seposo participated in the 2nd TFEE meeting, where he shared his knowledge on human health effects, and is already familiar with the activities of the Task Force.

III. Action required

12. The 26th Session of the SAC is invited to review the report of TFEE3, including the nomination of a new member specializing in human health effects.
13. The session is also invited to consider the updated “Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances” for adoption.

Annex 1. Meeting Minutes of the Third Meeting of Task Force on Monitoring and Assessment of Environmental Effects (TFEE)

Annex 2. “Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances” (updated in 2026, with Track Changes)

Meeting Minutes

The Third Meeting of Task Force on Monitoring and Assessment of Environmental Effects (TFEE) Scientific Advisory Committee (SAC) (1 July 2026, online)

I. Opening of the Meeting

1. The meeting was opened by Professor Wilfredo Carandang, the Chairperson of the Task Force on Monitoring and Assessment of Environmental Effects (TFEE) of the EANET Scientific Advisory Committee (SAC).

II. Welcome Remarks

2. Dr. Toshimasa Ohara, Director General, the Asia Center for Air Pollution Research (ACAP), which is designated as the Network Center for the EANET (NC), delivered the welcome remarks. He emphasized the important role of TFEE in advancing scientific understanding of the impacts of air pollution on ecosystems and human health. He highlighted the importance of updating the Strategy Paper in line with the MTP (2026–2030) and strengthening activities on human health effects. The meeting is expected to contribute to the future development of EANET through productive discussions and scientific cooperation.

III. Introductory Remarks

3. The Chairperson introduced the Terms of Reference of TFEE (EANET/ TFEE 3/3/1) and the member list (EANET/ TFEE 3/3/2), including the Scope and Structure of TFEE.
4. The meeting noted that Professor Atsushi Kume, Kyushu University, Japan, would continue to serve as the Vice Chairperson of the Task Force.

IV. Adoption of Agenda

5. The meeting agenda (EANET/ TFEE 3/4) was adopted as proposed.

V. Draft update of the “Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances”

6. On behalf of the Chairperson, the Secretariat of the Task Force presented the draft update of the “Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances” (EANET/TFEE 3/5/1). The presentation explained the rationale for updating the Strategy Paper, summarized the proposed revisions, and invited comments from the members.
7. The presentation highlighted:
 - 1) The Strategy Paper was updated to reflect the new MTP (2026–2030) while maintaining its overall long-term direction. Descriptions related to inland aquatic environment monitoring, reactive nitrogen monitoring, VOC, LCS and collaboration with relevant networks were revised where necessary
 - 2) The following three specific activities were proposed for the period from 2026 to 2030:
 - 1) Strengthening efforts to obtain and assess data on atmospheric reactive nitrogen (Nr) deposition.
 - 2) Accumulation of scientific knowledge on ozone and particulate matter (PM) in forest areas.
 - 3) Confirmation of ecosystem recovery from acidification and eutrophication.
 - 3) The Annex on specific activities for 2026–2030 was updated in accordance with the MTP (2026–2030), and the draft update of the Strategy Paper will be circulated within the EANET community for consideration at SAC26 and endorsement at IG28.
8. Major discussion on this agenda included:
 - 4) A member suggested that impacts of air pollution and atmospheric deposition on agricultural crops and soils should be more explicitly reflected in the updated Strategy Paper, noting their importance in Southeast Asian countries.
 - 5) The Secretariat explained that agricultural crops were included in the title of the Strategy Paper following suggestions from participating countries. However, EANET has not conducted regular monitoring activities on crops, and therefore detailed activities have not yet been proposed.
 - 6) It was noted that assessment of crop impacts is complicated by agricultural practices such as fertilizer application. The importance of accumulating scientific knowledge on impacts of air pollutants on agricultural crops was emphasized.

- 7) A member pointed out that linkages among atmospheric deposition, vegetation monitoring and catchment-scale assessment were not sufficiently clear in the current framework and suggested further clarification of the monitoring strategy.
 - 8) The Secretariat explained that the current strategy was originally developed mainly for assessment of acid deposition impacts. Further consideration of interactions among nitrogen deposition, ozone and other environmental factors was suggested for future activities.
 - 9) The Secretariat agreed to further consider comments related to air pollution impacts on agricultural crops and to review possible revisions to the Strategy Paper. The Secretariat also proposed clarifying connections between basic surveys and catchment-scale monitoring in the overall framework.
9. The meeting confirmed the draft update of the Strategy Paper and agreed to circulate it within the EANET community for consideration at SAC26.

VI. Implementation Plan for Information Exchange on Human Health Effects

10. On behalf of the Chairperson, the Secretariat of the Task Force presented the proposed implementation plan, “Implementation plan for information exchange on human health effects (EANET/ TFEE 3/6)”. The presentation highlighted:
- 10) Air pollution remains a major environmental risk factor affecting human health in East Asia. The presentation emphasized that the implementation plan was developed in accordance with the EANET Instrument, its Annex, the TOR of TFEE and the MTP (2026–2030), which identified methodological research and capacity building on human health impacts as important activities of EANET.
 - 11) The following activities for the period from 2026 to 2030 were proposed:
 - 1) Promotion of methodological exchange on assessment of health effects of air pollution, including exposure assessment, health risk and health impact assessment, epidemiological approaches, and relevant case studies.
 - 2) Capacity-building activities through workshops, training sessions and expert lectures to strengthen technical knowledge and practical skills related to assessment of health effects of air pollution.
 - 3) Information exchange and knowledge sharing on emerging issues, including PM_{2.5}, surface ozone, biomass burning (haze), interactions between heat and air pollution, vulnerable populations and risk communication.

- 4) Promotion of information exchange and technical cooperation with relevant international organizations, scientific networks and academic institutions, including WHO, CLRTAP, US EPA, AIT, IIASA and HEI.

- Tentative activities for 2026–2030 were introduced, including training lectures, seminars and workshops on methodologies for exposure assessment, health impact assessment, health risk assessment and risk communication.

11. Major discussion on this agenda included:

- 12) The Chairperson asked whether participating countries could recommend experts on human health effects of air pollution to support the proposed activities.
- 13) The Secretariat explained that ACAP has link with experts from WHO, universities and other organizations, who have contributed to EANET seminars and training activities.
- 14) The Chairperson suggested considering the participation of human health specialists in TFEE activities. The Secretariat responded that such participation would be possible.
- 15) A member welcomed the inclusion of human health assessment topics in the TNT training program and asked about monitoring data requirements for health assessment.
- 16) The Secretariat explained that the required monitoring network depends on the spatial scale of the assessment and emphasized the importance of methodological capacity building for conducting health impact assessments. Relevant references and scientific information on health assessment methodologies could be shared with participating countries.
- 17) The meeting took note of the proposed implementation plan for information exchange and capacity building on human health effects and agreed to report it to SAC26.

VII. Next Steps

12. The Secretariat of the Task Force explained the Next steps (EANET/ TFEE 3/7) including the schedule. The presentation highlighted:
 - ☞ The draft meeting minutes will be circulated among the TFEE members after the meeting. Progress of the Task Force activities, including the meeting minutes, will be reported to the 26th Session of the Scientific Advisory Committee (SAC26).
 - ☞ The updated Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances, including specific activities for the period from 2026 to 2030, will be circulated among the EANET community.
 - ☞ The implementation plan for information exchange and capacity building on human health effects will be reported to SAC26.

- œ The updated Strategy Paper is expected to be adopted at SAC26 in October 2026 and endorsed at the 28th Session of the Intergovernmental Meeting (IG28) in November 2026.
- œ The next TFEE meeting is planned to be held online in spring/summer 2027.

VIII. Closing of the Meeting

13. The meeting was officially closed by the Chairperson of TFEE.

PROVISIONAL AGENDA (including timetable)

<u>Time table</u>	<u>Speakers/ contributors</u>
15:00-15:10 (Japanese Standard Time, UTC+9) Open by the Chair	Prof. Wilfredo Carandang, Chair of TFEE
Welcome remarks	Dr. Toshimasa Ohara, DG of ACAP
15:10-15:15 Introductory remarks by the Chair (Group-photo session on screen)	Chair
15:15-15:20 Adoption of the agenda	Chair
15:20-16:30 Draft update of the “Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances”	NC and Chair
16:30-17:20 Implementation plan for information exchange on human health effects	NC
17:20-17:40 Next steps	NC
17:40-17:50 Other issues	NC
17:50 Closing of the meeting	Chair

Attachment 2

List of Participants

Participants from the countries

Cambodia

Mr. Yim Raksmei

Deputy Director of the Department of Air
Quality, Noise and Vibration Management

Japan

Prof. Atsushi Kume (Vice-Chairperson)

Kyushu University

Malaysia

Dr. Siti Aisah binti Shamsuddin

Senior Research Officer, Environment and
Climate Change Programme, Forestry and
Environment Division, Forest Research
Institute Malaysia (FRIM)

Mongolia

Mr. Barkhasragchaa Baldorj

Head of Environmental Monitoring

Division,

Central Laboratory of Environment and
Metrology

Myanmar

Ms. Wittyi Soe

Assistant Director, Department of
Meteorology and Hydrology

Philippines

Dr. Wilfredo M. Carandang (Chairperson)

University of the Philippines Los Baños

Russia

Dr. Ekaterina Zhigacheva

Institute of Global Climate and Ecology

(IGCE)

Viet Nam

Ms. Ngo Thi Van Anh

Vietnam Institute of Meteorology,
Hydrology, and Climate change (IMHEN)Network Center for the EANET (NC), Asia Center
for Air Pollution Research (ACAP)

Dr. Toshimasa Ohara

Director General

Dr. Keiichi Sato

Head, Atmospheric Research Department

Dr. Kim-Oanh PHAM

Researcher, Data Management Department

TFEE Secretariat, NC/ACAP

Dr. Hiroyuki Sase

Head, Ecological Impact Research

Department

Dr. Ken Yamashita

Senior Research Fellow

Dr. Masayuki Morohashi

Senior Researcher, Ecological Impact

Research Department

Ms. Azusa Sakaue

Senior Researcher, Ecological Impact

Research Department

EANET/ TFEE 3/5/1

Strategy Paper for
Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest
and Inland Water by Acidifying Species and Related Chemical Substances

Updated at the 3rd Meeting of the Task Force on Monitoring and Assessment of
Environmental Effects and adopted by the Scientific Advisory Committee of the
EANET at its 26th Session

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- 刪除: 20th

Strategy Paper for
Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest
and Inland Water by Acidifying Species and Related Chemical Substances
(Updated in 2026)

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Annex: Specific activities for the period from 2026 to 2030

Appendix: Members of the Task Force on Monitoring and Assessment of Environmental Effects of the EANET

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I. Introduction

1. *The Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances* was adopted as the long-term directions of the EANET monitoring by the Scientific Advisory Committee at its 14th Session in 2014. Simultaneously, the specific activities for the period from 2015 to 2020 were set as the annex.
2. In the discussion about adopting the *Strategy Paper* above, importance of collaboration with relevant research projects and other international initiatives was suggested to accomplish the objectives, although the issues described in the *Strategy Paper* seemed to be too ambitious for the EANET. Moreover, importance of considering multiple air pollutant factors, such as ozone and particulate matter, was suggested to evaluate ecological changes.
3. The *Strategy Paper* had already described importance of air pollutants, such as ozone and particulate matter, as the long-term directions of the EANET monitoring, which are consistent to the *Medium-Term Plan (MTP) for the EANET (2026-2030)*. Therefore, the main text should not significantly be changed, while slight modifications may be necessary to adjust to the latest discussion in the EANET community and scientific knowledge.
4. As shown in the title, the Strategy Paper is expected to cover the direction of inland aquatic environment monitoring in addition to soil and vegetation monitoring. However, some descriptions in the previous version had not been adjusted to reflect inland aquatic environments. In this update, those descriptions have been revised with reference to the *Technical Manual for Inland Aquatic Environment Monitoring in East Asia-2010 (EANET 2010)*.
5. Additionally, importance of monitoring reactive nitrogen (Nr) species, such as NO_x, NH₃, and their ionic species, in rural and forest areas are clearly stated in this update, since the *MTP for the EANET (2026-2030)* recommended to strengthen monitoring these Nr species to contribute to the global discussion on “sustainable nitrogen management”.
6. Specific activities for the term from 2026 to 2030 are mainly updated as the annex. Selected activities taking account of their feasibilities are described there.

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<#>The updated Strategy Paper directly contributes to the “activity No. (4) Development/update of strategy paper for guidance on future direction of EANET monitoring, as necessary” in the *Medium Term Plan (MTP) for the EANET (2016-2020)*.

II. Objectives of soil, vegetation, and inland aquatic environment monitoring of EANET

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II-1. Initial objectives

7. The initial objectives of soil and vegetation monitoring, “establishment of baseline data” and “early detection of possible impacts” described in the *Guidelines for Acid Deposition Monitoring in East Asia (2000)* and *Technical Manual for Soil and Vegetation Monitoring in East Asia (2nd ISAG, 2000)* can be interpreted as follows.

8. Establishment of baseline data is to describe the present status on plants and terrestrial ecosystems by the basic survey, which was described in chapter 2 of the *Technical Manual*. As the baseline data, the following data should be accumulated:

- Chemical properties of soil
- Growth of trees (by description of trees)
- Species composition of understory vegetation

The basic survey should consider climatic zones in the participating countries.

9. Early detection of possible impacts requires establishing the methodologies for detecting decline symptoms on plants in the early stage. To avoid serious damage on plants and terrestrial ecosystem and enable recovery from the problem, the symptoms should be detected in the early stage. In the EANET region, information on forest decline, plant sensitivities, and their implication with air pollution have not been sufficiently accumulated.

10. With a philosophy similar that of soil and vegetation monitoring, the objectives of inland aquatic environment monitoring, as defined in the *Technical Manual for Inland Aquatic Environment Monitoring in East Asia-2010*, are described as follows:

- To accumulate baseline data on inland aquatic environment and to evaluate the current situation
- To detect possible impacts of acid deposition on inland aquatic environment in early stages

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II-2. The long-term objective

11. The long-term objective of soil and vegetation monitoring is “To assess impact of acid deposition on terrestrial ecosystem in a comprehensive and systematic manner through development and maintenance of a good quality database”, which is described in the *Guideline for Acid Deposition Monitoring in East Asia (2000)*.

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12. The long-term objective of soil and vegetation monitoring can be achieved by evaluating spatially and temporally the impacts of air pollution/acid deposition on terrestrial ecosystems in the EANET region by understanding the processes (mechanisms) in the ecosystems that are related to air pollution/acid deposition.

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13. For quantitative evaluation of air pollution/acid deposition impacts, as the first step, the present status of ecosystem should be described by input-output budget analysis and ecosystem modeling in the respective monitoring sites (e.g. catchment areas). Taking account of the above budget analysis and the present status of soil and vegetation by the basic survey, spatial and temporal evaluation should be promoted by appropriate methods for upscaling monitoring data.

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14. The Technical Manual for Inland Aquatic Environment Monitoring in East Asia-2010 did not clearly describe long-term objectives; however, it recommended the promotion of catchment-scale analysis as one of the future directions. Since inland waters can be regarded as outputs of biogeochemical processes within watersheds/catchments, the importance of evaluating data at the watershed/catchment scale has been emphasized.

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III. Issues to be implemented to achieve the objectives

III-1. Issues for the initial objectives

III-1-1. Issues for establishment of baseline data

Promotion of continuous monitoring:

15. Accumulation of the data on soil, forest vegetation, and inland water is the first step for establishment of the baseline data, and monitoring in the current sites should be carried out continuously. Protection/conservation of the monitoring site is important so that long-term data can be accumulated over several decades.

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16. Financial and human resources in the respective countries are essential for continuous monitoring. Countries should make efforts to source funds from both national and international organizations. Networking and capacity building of relevant experts should also be promoted to accumulate human resources at both national and regional levels.

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Improvement of monitoring system:

17. The number and location of monitoring sites should be reviewed considering climatic zones and the concept of the multi-stage sampling. Monitoring sites should be established systematically even though the numerous monitoring sites could not be established on small grids.

18. The EANET region is a latitudinally wide area and consists of varied climatic zones. It can be recommended that one area should at least be selected for representative climatic zones in the respective countries. For each area, two types of soil are selected if possible, and plots and subplots are established according to the multi-stage sampling system on soil monitoring.

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19. Support by experts on soil, forest vegetation, and inland aquatic environment is essential for the monitoring, and such experts should be involved continuously. In most participating countries of EANET, one expert may not be able to complete all work involved in soil, forest vegetation, inland water, and ecosystems monitoring, and therefore needs cooperation with other experts. The continuous involvement of these experts in monitoring activities, and establishment of an appropriate system for regular reporting to a national committee involving relevant agencies involved in EANET activities should be considered.

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III-1-2. Issues for early detection of possible impacts, especially for vegetation

20. The *Sub-Manual on Forest Vegetation Monitoring in EANET* was endorsed by SAC at its 6th Session in 2006. The *Sub-Manual* proposed modified methods on observation of tree decline and some additional methodologies for early detection of possible impacts. Observation of tree decline should be conducted at least once a year according to the *Sub-Manual*. The methodologies described in the *Sub-Manual* should be utilized to collect information on possible impacts.

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General information of tree decline symptoms in the participating countries:

21. Prior to discussion of air pollution/acid deposition impacts, general information of tree decline symptoms should be accumulated; where, from when, which tree species, how decline, what cause, etc. Since impacts of air pollution and acid deposition may appear in combination with other factors, such as meteorological events and insect/fungus infections, the information should be obtained widely. Literature surveys for scientific publications should be adopted to collect reliable information.

Ozone concentration in agricultural and forest areas and its effects:

22. High concentrations of ozone have become one of the hot topics in the EANET region due to increase in concentrations of its precursors, such as NO_x and Volatile Organic Compounds (VOCs). Effects of ozone on vegetation including agricultural crops should be discussed with those of acidic substances, since ozone formation in the troposphere is closely related to other air pollutants. To evaluate effects of acidic substances precisely, effects of ozone on vegetation should also be considered.

削除: NO_x

23. The data of ozone concentration in forest areas is very limited due to accessibility and lack of power supply in the EANET countries. Similar situation exists in agricultural and other rural areas where no power supply is available. Ozone concentration in those areas should be measured/estimated by utilizing various methods. Ozone concentrations could be measured in forest areas by using less-expensive methods, such as passive samplers, since diurnal variation may relatively be limited in forest/mountainous areas.

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24. However, hourly data is necessary to calculate indices of ozone concentrations, such as AOT40 and SUM06¹. In the case that electrical supply is available near those areas, the automatic ozone monitor should be installed. Low-cost sensors (LCSs), for which a technical manual and guideline were recently adopted by EANET, are another option. Moreover, numerical modeling of ozone concentrations may be useful to discuss spatial distribution and the regional risk on ecosystems.

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25. Visible ozone injury should be assessed by field observation or microscopic observation as field evidence of ozone effects. The International Co-operative Programmes in Europe, such as ICP Forests and ICP Vegetation, have been accumulating a lot of information on the visible injury. Referring to the knowledge in Europe, information of the visible injury should be accumulated in the EANET region. A case study or trial campaign for measurement of ozone concentrations in forest area and assessment of visible ozone injury should be promoted. The areas where tree decline symptoms were reported may be likely candidates for the case study.

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26. Further steps for assessment of ozone effects should be considered taking progress in other regions such as Europe and US into account. Effects on agricultural crops should also be discussed in the near future. Moreover, critical levels using AOT40 or POD_y² should be discussed with relevant EANET bodies, such as the Task Force on

¹ AOT40, Accumulated dose Over a Threshold of 40 ppb; SUM06, a cumulative index of ozone concentrations over a specified threshold (0.06 ppm).

² POD_y, Phytotoxic Ozone Dose above a threshold flux of Y nmol m⁻² PLA s⁻¹, where PLA is

Monitoring and Assessment of Atmospheric Environment.

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Potential effects of particulate matter on ecosystems

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27. Dry deposition of particulate matter is an important deposition process of sulfur and nitrogen, e.g. $(\text{NH}_4)_2\text{SO}_4$ and NH_4NO_3 . In terms of acidification and eutrophication also, particulate matter should be taken into consideration. Moreover, dry deposition of particulate matter into forest area is a removal process of those from the atmosphere, which may be considered as one of ecosystem services of forest, especially for urban trees. The information on concentration/flux of particulate matters in forest area, particularly those of fine particles, should be accumulated.

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28. It has been reported that occlusion of stomata due to deposited particles may occur resulting in acceleration of water loss from leaf surface, although relatively coarse particles ($> 10 \mu\text{m}$) may mainly be related to this mechanism. Effects of fine particles ($< 2.5 \mu\text{m}$, so-called $\text{PM}_{2.5}$) on tree species are still not well understood in the region, although both hygroscopic particles such as $(\text{NH}_4)_2\text{SO}_4$ and other particles such as black carbon (BC) and heavy metals may have harmful effects. Updated scientific information on laboratory/field studies should carefully be considered.

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29. Atmospheric aerosols and regional haze may decrease yields of agricultural crops due to reduction of surface irradiance, while the aerosols may increase the diffuse fraction of solar radiation that enhances photosynthesis. Both negative (by reduction of direct radiation) and positive (by increase of diffuse radiation) effects should be considered to evaluate net effects of radiation changes on crop yields. Updated scientific information should be considered.

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Compilation of information on early detection:

30. Procedures to collect information on plant sensitivities and dose-response relationships should be discussed. The information on ozone has been accumulated well in China and Japan. The dose-effect relationship for the air pollutants in other countries is necessary to discuss possible risks on plants on the regional scale. The information on epiphytic plant species, such as mosses and lichens, should also be collected since they have been used as indicators of air pollution including acid deposition. The *Sub-Manual* provides possible methodologies to collect the information on lichens. Practical solutions to utilize such methodologies should be

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projected leaf area.

discussed. It should also be discussed to collect basic information on fauna (e.g. forest insects).

Information on biomass burning:

31. Forest fire and/or burning of agricultural residues emit a large amount of greenhouse gases and gaseous/particulate air pollutants, resulting in significant increase in air concentrations of these pollutants. Simultaneously, air pollutants emitted from the fire affect remaining/surrounding forest trees and agricultural crops. People living in the area suffer from high concentrations of air pollutants. A large amount of emissions may affect global climate and air pollution of neighboring countries. Information of biomass burning in the region should be compiled and shared in the EANET community. Precise data on biomass burning may contribute to air pollution modeling in the region, too.

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III-2. Issues for the long-term objective

Promotion of regular catchment-scale monitoring

32. The case studies have been conducted in several reference catchment areas by the Network Center (NC) in cooperation with some participating countries. Elemental budget and biogeochemical processes have been discussed in the study catchments to evaluate effects of atmospheric deposition on the forest ecosystems. Based on the experience above, the *Guideline for Catchment-scale Monitoring (EANET 2010)* was developed by the Task Force and endorsed by the Scientific Advisory Committee of EANET at its 10th Session.

33. Regular catchment monitoring is conducted in the Lake Ijira catchment in Japan and the La Mesa Watershed in the Philippines in accordance with the Guideline for catchment-scale monitoring. The catchment-scale data are informative for discussion of atmospheric deposition impacts quantitatively and qualitatively. It is expected that the regular catchment monitoring will be conducted in other countries.

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Enhancement of reactive nitrogen monitoring in forest areas

34. The biogeochemical cycle of reactive nitrogen (Nr) is identified as one of the most important earth-system processes in the concept of "planetary boundaries" and has already transgressed its boundary. Atmospheric deposition is a major pathway of nitrogen transfer process from the atmosphere to terrestrial ecosystems. The EANET has been monitoring Nr species, including NO_x, NH₃ and their ionic species, as major

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components of acid deposition since 2001. The EANET therefore has the potential to contribute to a better understanding of regional nitrogen cycles in relation to atmospheric deposition.

35. For this purpose, as described in the MTP for the EANET (2026-2030), efforts should be made to obtain and assess data on atmospheric Nr deposition as well as its ecological effects within the scope of EANET. Total nitrogen deposition, as the sum of wet and dry deposition, should be assessed at rural and remote EANET sites where air concentrations of gaseous and particulate pollutants are monitored using the filter-pack method. In addition, NH₃, which is an important precursor of PM_{2.5}, is emitted in significant amounts from agricultural areas and undergoes bidirectional exchange (both deposition and emission) in forest areas. Therefore, monitoring of NH₃ air concentrations in rural and forest areas should also be promoted. ▽

Catchment analysis and simulation modeling on soil and inland water:

36. Based on the elemental budget and biogeochemical process in the study catchments, possible impacts of acid and nitrogen loads resulting from atmospheric deposition should be evaluated. Disturbance of biogeochemical processes due to atmospheric deposition, including “nitrogen saturation”, is also one of issues to be evaluated.
37. Isotope ratios of some elements, such as sulfur, nitrogen/oxygen of NO₃⁻ and metals, are specific for their sources and/or changes through biological, geochemical or geophysical processes. Isotopic analysis of the elements from rainwater to stream water in a catchment may be informative for discussion of possible sources and biogeochemical processes in the ecosystems. Use of such techniques should also be considered for catchment analysis.
38. Simulation models on soil and/or inland water acidification should be developed based on the catchment analysis above. Changes in chemical properties in the acidification process should be simulated in the model. Simulation modeling may help us evaluate the current situation of the ecosystems. A common simulation model applicable for the diverse ecosystems in the EANET region is highly desired. Trends of soil and/or inland water acidification should also be predicted in future.
39. Direct effects of air pollution on plants may also induce hydrological and biogeochemical effects in ecosystems. For example, it was suggested that ozone altered watershed hydrology due to its effects on leaf transpiration and water use of plants. Physiological changes of plants caused by air pollution may affect microbial communities in soil. In the future simulation model, direct effects of air

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pollution/acid deposition on plants, and their relations to hydrological/biogeochemical processes should also be considered.

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40. The quality of inland waters is being measured at several sites under the inland aquatic environment monitoring of EANET. In the *Technical Manual for Inland Aquatic Environment Monitoring in East Asia-2010*, importance of rivers/streams and their catchments is highlighted. The manual should be referred for catchment monitoring in addition to the *Guideline*. Accordingly, in Russia, inland water data from the Komarovka River and Pereemnaya River have been assessed on a catchment scale to evaluate the impacts of atmospheric deposition.

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Identification of the areas susceptible to air pollution including acid deposition

41. Areas or regions susceptible to air pollution/acid deposition should be identified to conduct the monitoring effectively. As one of the previous activities in line with the *Strategy Paper*, a map of watershed sensitivity to acid deposition was developed by the NC in cooperation with the Task Force members, taking acid neutralizing capacity of soil and surface geology into consideration. The initial goal of the activity has been accomplished.

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42. However, spatial distribution of air pollution/atmospheric depositions should also be taken into account to identify actual risks in the region. As a trial harmonized with this subject, one of the EANET countries developed the risk maps on acidification of soil and watershed and the maps of estimated growth reduction by ozone for representative species in their country. In the case of ozone, sensitivity of each tree species was also taken into consideration. In the trial above, outputs from numerical models on atmospheric depositions and ozone concentration were utilized to estimate the risks.

43. Possibility of utilizing numerical models for spatial distribution should be considered to estimate actual risks at the national levels as well as regional levels. Moreover, spatial datasets on plant growth, such as NPP (net primary production), have recently been available by satellite observations for discussion on effects of climate change. Such datasets may also be informative for discussion on possible risks on nitrogen deposition, since the growth rate must be related to nitrogen uptake in plants.

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Up-scaling of the monitoring data and spatial evaluation

44. For spatial evaluation towards the long-term objective, up scaling of the monitoring data should be discussed as the next step. Use of the following methodologies should

be discussed.

45. Based on the data in the basic survey and the catchment analysis, the condition of the region should be estimated by the appropriate spatial modeling and then described on a map of the region. Regional data on air pollution and atmospheric deposition may also be required for the evaluation.
46. Regional assessment of possible impacts on ecosystems requires spatial data on air pollution atmospheric deposition. Emission inventory and numerical model on transport and chemical processes in the atmosphere are essential for this work. Further steps should be discussed in the EANET community.
47. Remote sensing technology may be helpful to describe the present condition on forest health decline based on the data from the basic survey. The *Sub-Manual* provides possible methodologies to utilize remote sensing technology. Satellite image analysis is one of the potential tools to detect changes in tree conditions, such as phenology, vitality of trees, etc. For the susceptible areas to air pollution/acid deposition, which were identified by the previous work in the Task Force, applicability of the technique should be considered. Use of the existing datasets by remote sensing technology should also be considered. Practical solutions to utilize such methodologies should be discussed in coming years.

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IV. Collaboration with relevant networks/organizations

48. In Europe and North America, much experience has accumulated. In particular, the Working Group on Effects (WGE) and its International Co-operative Programmes (e.g. ICP Forests, ICP Vegetation, ICP Waters, ICP Integrated Monitoring, etc.) under the CLRTAP (Convention on Long-range Transboundary Air Pollution) in Europe can provide much useful information for the East Asian activities, including its existing monitoring manual for UNECE region. Information exchange and scientific collaboration with regional networks should be further enhanced.
49. In the research field, the International Union of Forest Research Organizations (IUFRO) Research Unit 8.04.00, "Air pollution and climate change", the International Long-Term Ecological Research Network (ILTER), and its national networks, such as Japan LTER network (JaLTER) and Philippines LTER network, and Asian Air Pollution and Climate Change Workshop (AAPC), can provide access to the latest scientific information on terrestrial ecosystems. The latest scientific knowledge should be obtained through participation in relevant meetings and

workshops, subject to the availability of external funding.

50. Collaboration with these relevant networks/organizations should be promoted for future development of the EANET activities.

V. Overall strategy

51. The overall strategy to achieve the initial and long-term objectives described above can be described as shown in Figure 1.
52. The initial objective is to describe the present status on soil, vegetation, and inland water in the EANET region, and it can also be one of steps toward the long-term objective.
53. For the long-term objective, another approach should also be promoted, especially for description of present status on ecosystem. To achieve these steps, some issues, such as promotion of catchment analysis and modeling, should be implemented.
54. Then, up scaling of these data should be discussed for spatial evaluation of impacts of acidifying species and related chemical substances in the EANET region.

VI. Acknowledgements

55. This *Strategy Paper* is a product of the scientific discussions of the members of the Task Force on Monitoring and Assessment of Environmental Effects. The brief history of the *Strategy Paper* is as follows:
- *Strategy Paper for Future Direction of Soil and Vegetation Monitoring of EANET*: adopted by SAC at its 2nd Session in 2002
 - *Strategy Paper for Future Direction of Soil, Vegetation and related Ecosystems Monitoring of EANET (2009-2014)*: adopted by SAC at its 8th Session in 2008
 - *Strategy Paper for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forests and Inland Water by Acidifying Species and Related Chemical Substances*:
 - The first edition: adopted by SAC at its 14th Session in 2014
 - The updated version in 2020: adopted by SAC at its 20th Session in 2020
 - The update version in 2026: (to be) adopted by SAC at its 26th Session in 2026

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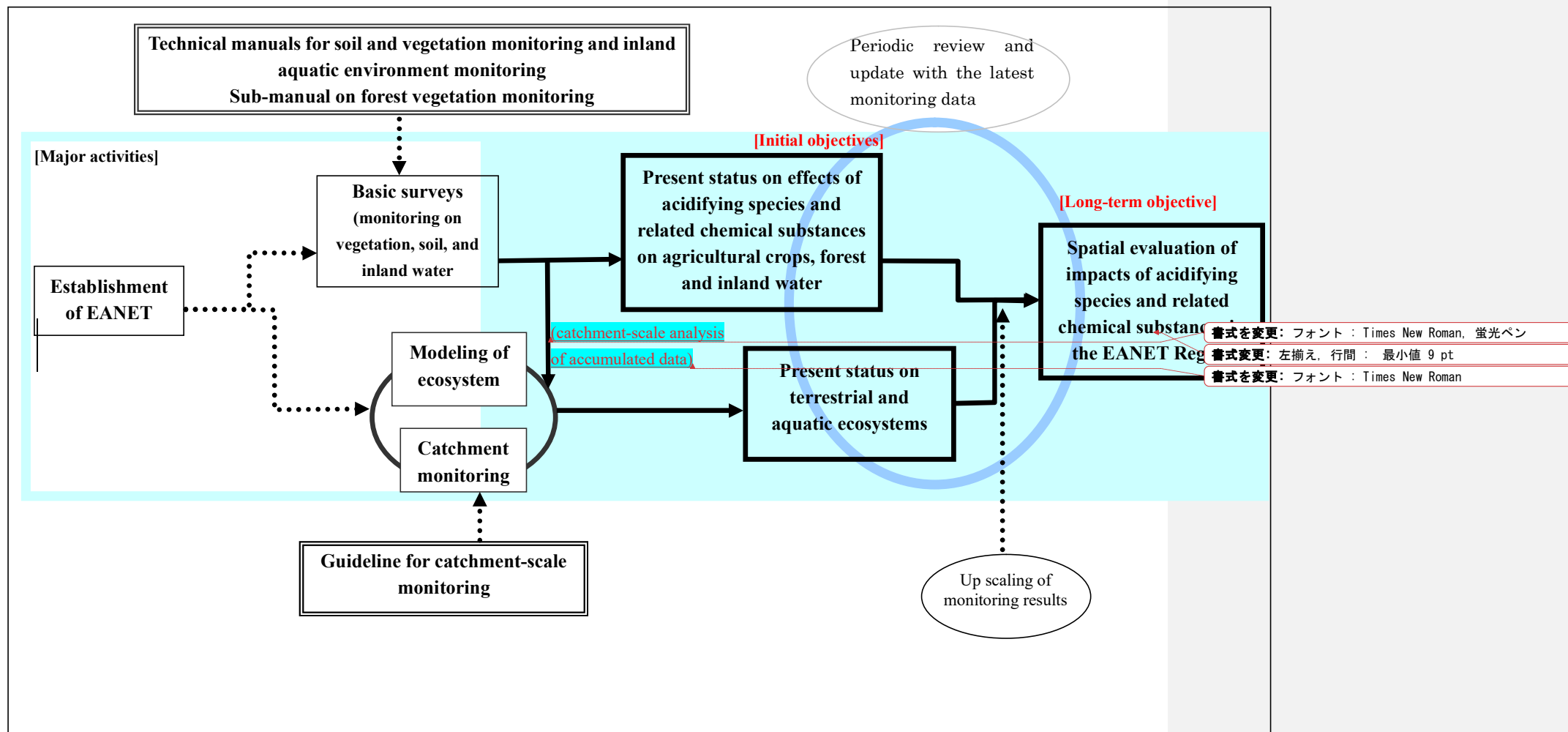


Figure 1. Overall strategy for Future Direction of EANET on Monitoring of Effects on Agricultural Crops, Forest and Inland Water by Acidifying Species and Related Chemical Substances

Annex

Specific activities for the period from 2026 to 2030

1. The following activities were selected as the specific works to be promoted for the period from 2026 to 2030, in accordance with recommendations of the MTP for the EANET (2026-2030). Most of the activities may need additional external funds to reach their milestones. To realize them, the activities are expected to be implemented by forming sub-groups, if necessary. The interactions between air pollution and climate change should also be taken into consideration for the subjects above.

i. Strengthening efforts to obtain and assess data on atmospheric Nr deposition

2. Total nitrogen deposition, defined as the sum of wet and dry deposition, will be assessed particularly at rural and remote EANET sites. Air concentration data for gaseous and particulate pollutants obtained using the filter-pack method can be applied to estimate dry deposition fluxes by the inferential method. Efforts should be made to obtain meteorological data, with as high a time resolution as possible, in the vicinity of EANET sites to calculate deposition velocities.

3. The NC should provide technical support to experts in the Participating Countries (PCs) to implement flux estimation. If the budget is available, the NC's technical missions will be dispatched to the PCs for this purpose. Implementation target years: from 2026 onward

4. NH₃, an important precursor of PM_{2.5}, is emitted in significant amounts from agricultural areas and tends to remain in the gas phase as emissions of SO₂ and NO_x have decreased. In addition, NH₃ undergoes bidirectional exchange (both deposition and emission) in forest ecosystems. Thus, the behavior of NH₃ in rural and forest areas has not yet been sufficiently clarified. Monitoring of NH₃ air concentrations in these areas should therefore be further promoted for sustainable nitrogen management.

5. To obtain additional NH₃ data in rural and forest areas where electricity is unavailable, passive samplers can be utilized. Project-based activities led by the NC, in cooperation with voluntary PCs, will be considered for conducting passive NH₃ sampling. Methodological studies, including comparisons with other observational techniques, such as the filter-pack method and the denuder method, as well as assessments using satellite observations, should be implemented in collaboration with external researchers. Implementation target years: from 2027 to 2029 (through the launch of an EANET Project or other external research projects)

6. Atmospheric Nr data in rural and forest areas should be shared with other regional networks, such as ICP Forests, to gain broader perspectives on the global issue of

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sustainable nitrogen management. Online or hybrid workshops, as well as collaborative research papers, should be developed using the accumulated data. Implementation target years: 2029/2030.

ii. *Compilation of scientific knowledge on air pollutants, including acidifying species, ozone, and PM, in agricultural and forest areas.*

7. Effects of air pollutants on agricultural crops and forest trees remain a major concern for the EANET Participating Countries. Scientific knowledge on the impacts of air pollutants, including acidifying species, ozone, and PM, on agricultural crops and forest ecosystems needs to be further consolidated. In addition, linkages between individual plant responses at the stand scale and broader ecosystem responses at the catchment scale should also be taken into consideration.

8. Ozone is currently the most serious phytotoxic stressor at present. In fact, the recently updated ozone air quality standard in Japan aims to address effects on vegetation in addition to impacts on human health. Information on ozone concentrations and their effects on crops and trees in rural and forest areas will be accumulated as extensively as possible. Combined effects of ozone and nitrogen deposition should also be considered.

9. Forest fires emit substantial amounts of PM into the atmosphere, which is closely linked to air quality and climate change. Satellite observations, low-cost sensors (LCS), and simulation modeling are useful tools for evaluating regional PM conditions, including haze events.

10. An online seminar on effects of air pollutants, including acidifying species, ozone, and PM, will be planned to share the latest scientific knowledge. Implementation target years: 2028/2029.

iii. *Confirmation of ecosystem recovery from acidification and eutrophication.*

11. Phenomena suggesting ecosystem recovery associated with reductions in air pollution and atmospheric deposition should be continuously investigated. This is also important for validating relevant measures and policies in the region and in each country. Not only acidification, mainly due to sulfur deposition, but also eutrophication (or disruption of nitrogen biogeochemical cycles) caused by nitrogen deposition in forest ecosystems should be carefully assessed based on long-term data.

12. Regular catchment-scale monitoring at existing EANET sites will be continued by the respective countries. Long-term inland water data will also be assessed at the catchment scale. Technical and scientific cooperation among relevant countries is

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important for the continuous monitoring and assessment of the data obtained. Online technical meetings led by the NC may be held periodically to discuss technical issues related to field monitoring and data assessment.
Implementation target years: from 2026 onward, at least once a year.

13. Efforts should be made to obtain competitive research grants to further promote catchment analysis under changing meteorological conditions, such as increases in extreme weather events.
Implementation target years: from 2026 onward

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<#>Effects of air pollution (such as ozone) on individual trees may also affect hydrological processes on the catchment scale, which is closely related to climate change. Multiple factors including climate change will be taken into consideration for assessment of air pollution impacts on forest catchments. New design/scheme on integrated assessment and monitoring will be discussed inside/outside the EANET community.

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<#>*Promotion of regional impact assessment*

<#>The data on regional air pollution are expected to be compiled and accumulated in the EANET region in the near future. Accordingly, air pollution modeling will be actively utilized in the EANET community. This will also contribute to regional assessment of air pollution impacts on forest ecosystems and crops. Referring to

13

Appendix

Member list of the Task Force on Monitoring and Assessment of Environmental Effects

<u>Cambodia</u>	<u>Mr. Yim Raksmei</u> <u>Deputy Director of the Department of Air Quality, Noise and Vibration Management</u>
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<u>Malaysia</u>	<u>Dr. Siti Aisah binti Shamsuddin</u> <u>Senior Research Officer, Environment and Climate Change Programme, Forestry and Environment Division, Forest Research Institute Malaysia (FRIM)</u>
<u>Mongolia</u>	<u>Mr. Barkhasragchaa Baldorj</u> <u>Head of Environmental Monitoring Division,</u> <u>Central Laboratory of Environment and Metrology</u>
<u>Myanmar</u>	<u>Ms. Wittyi Soe</u> <u>Assistant Director, Department of Meteorology and Hydrology</u>
<u>Philippines</u>	<u>Dr. Wilfredo M. Carandang (Chairperson)</u> <u>University of the Philippines Los Baños</u>
<u>R. of Korea</u>	<u>Prof. Sang-Deok Lee</u> <u>Division of Forest Science, Kangwon National University</u>
<u>Russia</u>	<u>Dr Ekaterina Zhigacheva</u> <u>Institute of Global Climate and Ecology (IGCE)</u>
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<u>Viet Nam</u>	<u>Ms. Ngo Thi Van Anh</u> <u>Vietnam Institute of Meteorology, Hydrology, and Climate change (IMHEN)</u>

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Asia Center for Air Pollution Research

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Dr. Roland Kueh Jui Heng (Alternate for Prof. Majid)
Faculty of Forestry, Universiti Putra Malaysia, Malaysia

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Japan Environmental Sanitation Center

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ページ 13: [1] 削除	SASE H	2026/05/18 15:43:00
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ページ 13: [2] 削除	SASE H	2026/05/18 15:42:00
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ページ 13: [3] 削除	SASE H	2026/05/18 15:18:00
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ページ 13: [4] 書式変更	SASE H	2026/05/18 16:08:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 13: [5] 書式変更	SASE H	2026/05/18 16:04:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 13: [6] 書式変更	SASE H	2026/05/18 16:27:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 13: [7] 書式変更	SASE H	2026/05/18 15:48:00
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標準, 段落番号 + レベル：1 + 番号のスタイル：1, 2, 3, … + 開始：1 + 配置：左 + 整列：0 mm
+ インデント：7.4 mm

ページ 13: [8] 書式変更	SASE H	2026/05/18 16:49:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 14: [9] 書式変更	SASE H	2026/07/01 17:21:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 14: [10] 書式変更	SASE H	2026/05/18 17:42:00
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インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 14: [11] 書式変更	SASE H	2026/05/18 18:17:00
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標準, インデント：左： 7.4 mm, 行頭文字または番号を削除

ページ 14: [12] 書式変更	SASE H	2026/05/18 15:20:00
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段落番号 + レベル：1 + 番号のスタイル：1, 2, 3, … + 開始：1 + 配置：左 + 整列：0 mm + イ

ンデント： 7.4 mm

ページ 15: [13] 削除	SASE H	2026/05/18 15:16:00
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ページ 16: [14] 削除	SASE H	2026/05/19 10:29:00
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