

## Information series on geographical information and remote sensing systems in mountain environments

Geographical information and remote sensing systems play a special role in the Hindu Kush-Himalayan region in support of informed decision making. This series of information sheets presents information on basic technologies, approaches, and applications related to geographical information and remote sensing, and used or developed by ICIMOD, as a background for understanding for policy makers, development workers, and others.

As South Asia becomes more and more industrialised, issues associated with the fast-paced growth of its industrialised cities, like deteriorating air quality, are growing. By 2030, more than half of South Asia's population will probably live in urban centres. There is a growing awareness in the region that issues of air quality management will need to be addressed to ensure the wellbeing of the ever-increasing urban population, and the environment in general.

The Governing Council of the South Asia Co-operative Environment Programme (SACEP) adopted the '**Malé Declaration on Control and Prevention of Air Pollution and Its Likely Transboundary Effects for South Asia**' in 1998 at its 7th meeting. The Declaration stated the need for the countries of South Asia to carry forward, or initiate, studies and programmes on air pollution. The Malé Declaration outlines a process whereby first current knowledge and information and institutional capacity are documented and baseline studies are developed, and second action plans are developed to fill in gaps in current knowledge and create a solid scientific basis for the policy process. Ultimately, implementation of the action plans will put in place the basis for quantitative monitoring, analysis, and policy recommendations for prevention of air pollution. The Malé Declaration is the first regional environmental agreement in South Asia to tackle transboundary air pollution; the participating countries are Bangladesh, Bhutan, India, Iran, Maldives, Nepal, Pakistan, and Sri Lanka. UNEP is the Secretariat for the Malé Declaration programme.

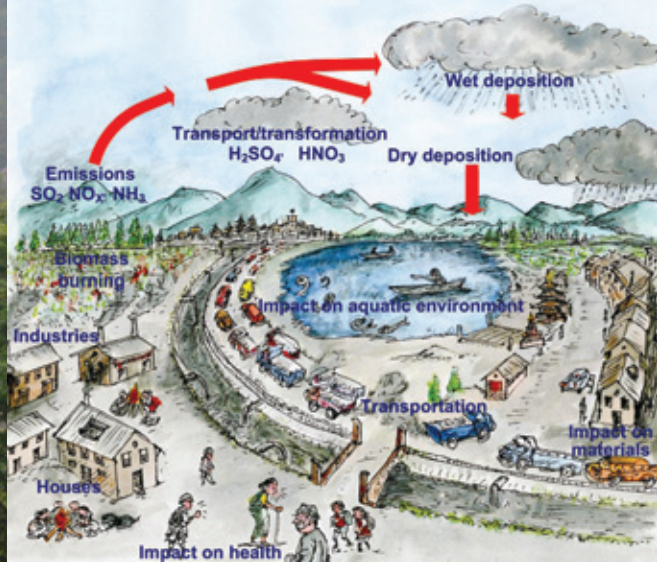
# Implementing the Malé Declaration on air pollution in South Asia

## Transboundary air pollution

In the past, air pollution was seen primarily as a local phenomenon consisting mainly of emissions from local sources. Now, a growing body of scientific research has shown that air pollutants can travel thousands of kilometres from their source with serious consequences for the global environment, irrespective of national boundaries, regions, or hemispheres. This is known as transboundary air pollution, the pollutants include sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>2</sub>), ammonia (NH<sub>3</sub>), organic pollutants, and carbonaceous particulate matter. Economic growth is generally linked with increased energy consumption, with increased combustion of fossil fuels leading to an increase in airborne pollutants. Pollutants can come from various sources, ranging from simple grinding of bulk matter by the transport sector, waste incineration, industrial processes using organic solvents, and a whole range of complicated chemical and biochemical processes. Ammonia is present even in unpolluted air because it is emitted by microorganisms involved in the decay of animal matter and in sewage treatment. Mass burning of forests and crop residues and domestic burning of wood also contribute to transboundary pollutants. The burgeoning economies of South Asia are justly concerned about their deteriorating air quality.



**Brick factory**



**Mechanism of transboundary air pollution**

## Impacts of air pollution

Elevated levels of harmful gases and particulates in the atmosphere are detrimental to both the environment and human health. People are affected by air pollution in different ways depending on their age, general health, the type of pollutant, and the duration of exposure. Air pollution is associated with an increase in respiratory and cardiovascular diseases; on a global scale, four to eight per cent of premature deaths are attributed to exposure to particulate matter in the ambient air. Vegetation and wildlife are also negatively affected by air pollution – sulphur dioxide and nitrogen oxides contribute to acid rain, which presents a whole new set of problems for the environment, lakes, trees and other forms of wildlife.

The other major impact of air pollution is on climate change. The impact of greenhouse gases on the atmosphere and the consequences for climate change are well-known. Similarly, particulate matter can be transported and land on snow and glaciers changing their albedo and causing them to melt more quickly.

## The Malé Declaration: a phased-in approach to implementation

The Malé Declaration recognised the need for research to address the problem of air pollution in South Asia and envisioned that each participating country would carry forward, or initiate, studies and programmes on air pollution in a phased approach.

### Phase 1 – Baseline information and awareness raising

- Create a network and database of experts and institutions.
- Initiate baseline studies and create a database on air pollution.
- Prepare national and sub-regional action plans.

### Phase 2 – Capacity building

- Develop the expertise and equipment needed for the quantitative monitoring and analysis of air pollution;

use the information generated from these quantitative studies to make informed policy recommendations for the prevention/control of air pollution.

- Establish and strengthen monitoring facilities.
- Analyse the transboundary effects of air pollution.

### Phase 3 – Tackling air pollution problems through impact assessment studies

- Design and implement solutions to address air pollution.
- Establish a scientific base for prevention and control of transboundary air pollution.
- Use information gathered in the first two phases as a basis to give feedback to decision makers and policy planners in the region.
- Prepare emission inventories and model the atmospheric transfer of air pollutants.
- Monitor pollutant depositions and concentrations.
- Assess the risk to health, crops, materials, and ecosystems; devise mitigation options; and develop or use integrated assessment models as ways of presenting the information on air pollution to policy makers.

### Phase 4 – Strengthening initiatives and developing new ones

- Determine further steps for the implementation of the Malé Declaration which will include working out viable financing mechanisms.
- Expand the network of monitoring stations and establish regional centres of excellence for different types of monitoring, modelling and other needed analysis. Specific suggestions include dry and wet deposition monitoring; soil and vegetation monitoring; corrosion impact studies; health impact studies; emission inventory and modelling; and pollution reduction policies/strategies.
- Develop a regional framework for reducing air pollution in South Asia.
- Continue to conduct impact assessments.
- Continue raising awareness about the hazards of air pollution in South Asia.

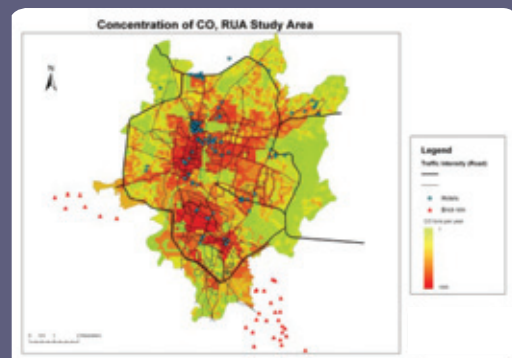
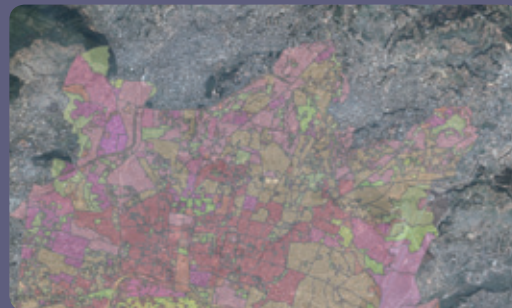
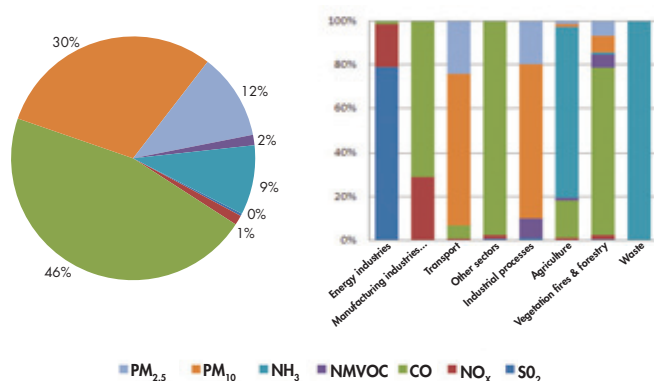
Rapid Urban Assessment (RUA) is an inexpensive method with a fast turn-around time which can be used to locate pollution hotspot areas in urban areas and identify the major pollutants and their concentrations. It was developed to study air pollution in the urban areas of South Asia and is resourced through the Regional Air Pollution in Developing Countries of the Malé Declaration. The RUA was first tested in Hyderabad, India; a modified version was developed for Kathmandu in close collaboration with the Swedish Environmental Research Institute. The RUA pollutant concentration maps can be used in any decision-support system which aims to achieve air quality goals at a low cost since they provide the link between emissions and ambient concentrations.

## Implementing the Malé Declaration in Nepal

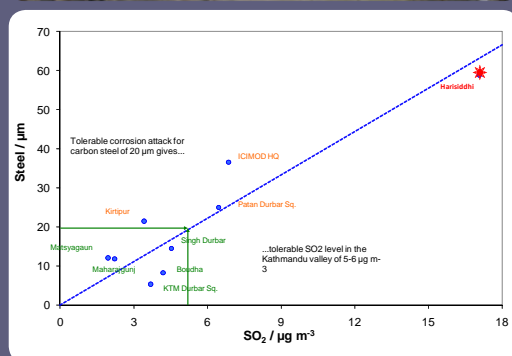
ICIMOD is facilitating the monitoring, analysis, and impact studies of air pollution in Nepal on behalf of the Nepal Ministry of the Environment, the focal point for the implementation of the Malé Declaration. Air pollution is measured at a transboundary monitoring station at the Institute of Agriculture and Animal Sciences (IAAS) in Rampur, Chitwan (close to the Nepal/Indian border). The instruments at the site monitor both wet and dry depositions. Meteorological parameters are recorded using an automatic weather station installed at the site. These instruments help understanding of the ambient air quality and meteorological information. A high volume sampler (Envirotech) measures both particulate matter of up to 10 microns diameter (PM<sub>10</sub>) and total suspended particulate matter (TSPM). Diffusion samplers from the Swedish Environmental Research Institute IVL are used to measure concentrations of sulphur dioxide (SO<sub>2</sub>), nitrogen oxides (NO<sub>2</sub>), and ozone (O<sub>3</sub>). Rainwater samples are collected using automated wet-only collectors and bulk collectors, and the samples analysed for anion and cation content.

ICIMOD has also conducted various impact assessments in Nepal such as a rapid urban assessment in the Kathmandu area, studies on corrosion, and studies on the effects of ozone on crops.

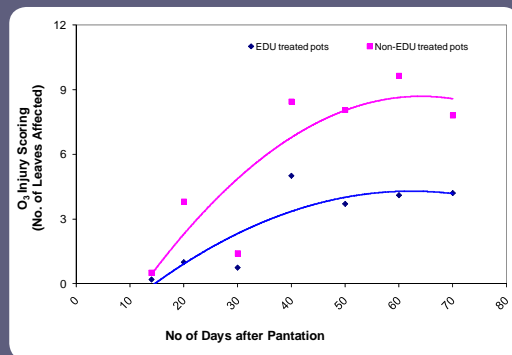
Total anthropogenic emissions, Nepal 2000



Rapid urban assessment of Kathmandu and Patan



Corrosion study



Impacts on crops



**High volume sampler**



**Wet only collector**



**Automatic weather station**

## The way forward

With the establishment of a scientific base for measuring transboundary air pollution, Phase 3 of the Malé Declaration has been successfully completed in Nepal. To implement the next phase, participating countries must continue assessing air pollution and also look into how air pollution can be prevented and reduced in practice. Some of the activities that can be undertaken are as follows:

- The number of monitoring stations should be increased throughout the region. The data gathered at these stations should be used to compile a comprehensive spatial database of air pollutants that can be the basis for continued informed planning and mitigation measures.
- Since vehicles are the major sources of urban pollution, measures that help to reduce vehicular emissions need to be considered. These measures could include such approaches as decreasing vehicular emissions by encourage more public transport, more black topping of roads to reduce airborne particulate matter, and encouraging 'greener' means of transport such as cycling by providing cycling lanes.
- Integrated action plans need to focus on improving air quality by promoting approaches such as improved road planning for cities, better overall urban planning, cleaner fuels and cleaner production industries, emission standards for large-scale industries, and stricter rules for phasing-out older vehicles that do not have pollution-controlled emissions.
- Mass awareness programmes should be implemented for policy makers, government agencies, and the general public on the hazards of air pollution and the need to implement mitigation measures.



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