

# A Clear View for Kathmandu

## Improving Air Quality in the Kathmandu Valley

### The State of the Air

The Kathmandu Valley in Nepal, a metropolitan area with a population of almost 4 million, is one of the most polluted urban areas in the world. A dominant concern in the valley is the extreme particulate matter (PM) pollution, which can be as severe as in cities like Beijing and Delhi. A particularly detrimental component of PM is black carbon (BC), commonly referred to as soot. BC is linked to cancer as well as respiratory and heart disease. Although data for the region is scarce, a 2007 study by Giri et al. estimated that PM in the Kathmandu Valley causes over 17 000 premature deaths per year. As a short-lived climate-forcing pollutant (SLCP), BC also leads to regional atmospheric warming, changes in the Asian monsoon rainfall patterns, and accelerated melting of snow and ice in the Himalayas. Another relevant SLCP is ground-level ozone, a pollutant that causes regional warming, damages the lungs, and notably has been shown to cause significant crop losses by damaging plant cells. The impacts of BC, ozone and other pollutants pose serious threats to food, water and energy security in the region, with repercussions for millions of people, as well as for the overall sustainable development of the region.



## Opportunities and challenges

SLCPs remain in the atmosphere for only a short time (for BC, typically a few days to a week; for ozone, typically several weeks), which means that action to reduce emissions of BC and ozone precursors can have relatively rapid effects on both climate and air quality. However, the path to achieving such emission reductions is not yet clear. The relative importance of local and regional emission sources (e.g. diesel vehicles vs. brick kilns) in the greater Kathmandu Valley has not been well quantified, making it difficult to design mitigation strategies that will have a large impact and still be cost-effective. An improved scientific understanding of the main sources and impacts of air pollution in the region is a prerequisite for designing effective mitigation options. Beyond scientific considerations, mitigation options need to be tailored to the political, social and economic context. Ultimately, the successful implementation of emissions reduction measures requires support and buy-in from key players in government, industry and society.

## Engagement in the Kathmandu Valley

In response to these challenges, the Institute for Advanced Sustainability Studies (IASS) and the International Centre for Integrated Mountain Development (ICIMOD) launched the Sustainable Atmosphere for the Kathmandu Valley (SusKat) project in 2012. SusKat is implemented as a joint project with 23 other partner institutions from within and outside of South Asia. By generating scientific knowledge, raising awareness, building capacity and engaging key stakeholders including local government authorities, SusKat aims to lay a solid foundation for the identification and ultimate implementation of air pollution mitigation measures that are both culturally and technically viable in the local context.

A brick kiln in the Kathmandu Valley.

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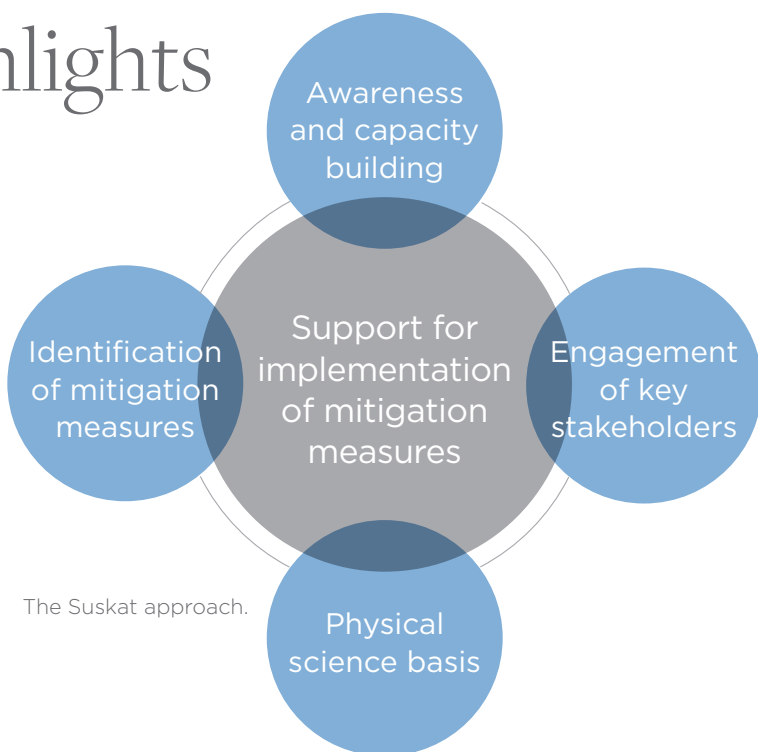
# SusKat Project Highlights

## Atmospheric measurements

In 2012 and 2013, the IASS and ICIMOD led the 6-month SusKat-ABC field campaign in which 40 scientists from 9 countries collected high-quality measurement data of meteorological and air quality parameters in the Kathmandu Valley and the wider region. The campaign, which was endorsed by the United Nations Environment Programme's Atmospheric Brown Cloud (UNEP ABC) Project, was the second largest international air pollution measurement campaign ever conducted in South Asia and it provides the most detailed air pollution data for the Kathmandu Valley to date.

## Understanding cause and effect relationships for air quality

SusKat's team of partners is performing focused modelling studies to improve our understanding of the physical and chemical processes that lead to poor air quality in the region. Models will also be used to assess the impact of air pollution on human health and climate, and to evaluate the effectiveness of potential mitigation measures.



## Characterising emissions

In the spring of 2015, research teams from ICIMOD, the University of Montana, the University of Iowa, the University of Virginia, Drexel University and the IASS will lead a campaign to characterise the emissions from important but understudied emission sources in Nepal, including cooking fires, brick kilns, waste burning and traffic. From this data, and drawing on sources including fuel-use data from a SusKat survey of brick factories in the Kathmandu Valley as well as activity data collected by ICIMOD and its partners, an improved, high-resolution emissions inventory for the region will be developed. The data collected will form an important basis for understanding the relationship between pollutant emissions and their impact on air quality and thus for the development of mitigation scenarios.

### Investigating health impacts

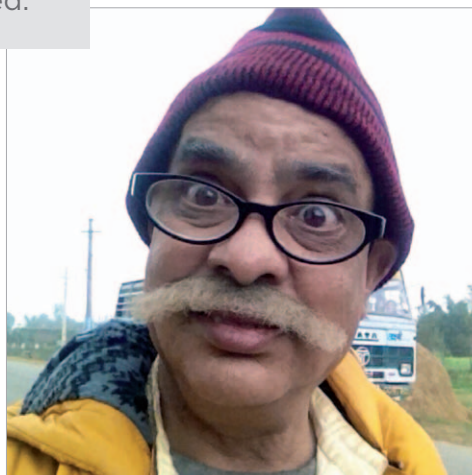
In 2014, IASS teamed up with the University of Massachusetts-Amherst, ICIMOD and the Nepalese National Health Research Council (NHRC) to monitor the exposure of traffic police in Kathmandu and Lalitpur to air pollution and to track the associated health impacts. Traffic police, who are stationed at busy roads and therefore a potentially vulnerable group, were asked to wear portable air pollution sensors and heart monitors while they worked. Additional health indicators including lung function and blood pressure were monitored pre- and post-shift. An analysis of the observed high exposures and the health outcomes will be published.

### Consultations with key global and local stakeholders

The IASS and ICIMOD organise dialogues on the topics of air quality and climate change in Nepal, bringing together stakeholders from the research community, government, the private sector and NGOs. Past examples include the 2012 Meeting “Opportunity to Integrate Atmospheric Pollution Control and Climate Change Adaptation and Mitigation in Nepal,” which was co-organised by the Climate and Clean Air Coalition (CCAC) and the Nepalese Ministry of Science, Technology and Environment (MoSTE), and the 2013 “High Level Update on Atmospheric Research in Nepal”. These events provide an important forum for exchange and support the coordination of action on air quality and related topics in Nepal.

### Awareness-raising via popular media

In SusKat, the IASS and ICIMOD are producing the film “DHUWA” (“SMOKE” in English), starring the famous Nepalese comedy actors Madan Krishna Shrestha and Hari Bansha Acharya, who together form the comedy duo MaHa Jodi. The film, which will convey the harmful impacts of air pollution and stress how individuals can help, will be shown on Nepalese television and later screened for audiences worldwide.



Actor Hari Bansha Acharya on the set of the film “DHUWA”. © H. Acharya





View from the ICIMOD rooftop at Khumaltar in the Kathmandu Valley. On a clear day (right), the majestic snow-covered Himalayan mountains can be seen in the distance. But such days are rare. On a more typical polluted day (left), the Himalayas and even the nearby hills disappear.

### The way forward

With its multifaceted approach, SusKat will move forward together with stakeholders and partners to design and take action on air pollution mitigation measures that are tailored to local circumstances. SusKat aims to reduce air pollution in the Kathmandu Valley and simultaneously achieve benefits for public health, food security, and local and regional climate change. In this vision for the Kathmandu Valley, the majestic Himalayas will once again be visible nearly every day.

### SusKat Partners

[Aerosol d.o.o., Slovenia](#), Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, India, [Asian Institute of Technology \(AIT\), Thailand](#), [Central Department of Physics, Tribhuvan University \(TU\), Nepal](#), Ev-K2-CNR, Italy, [Federation of Nepalese Brick Industries \(FNBI\), Nepal](#), Indian Institute for Science Education and Research (IISER-Mohali), India, [Institute for Advanced Sustainability Studies \(IASS\), Germany](#), Institute for Tibetan Plateau, Chinese Academy of Sciences (CAS), China, [Institute of Engineering, Tribhuvan University \(TU\), Nepal](#), International Centre for Integrated Mountain Development (ICIMOD), Nepal, [Karlsruhe Institute of Technology \(KIT\), Germany](#), Mountain Wave Project (MWP), Germany, [National Aeronautic and Space Administration \(NASA\), USA](#), National Atmospheric Research Laboratory (NARL), India, [National Institute for Environmental Research \(NIER\), Korea](#), Physical Research Laboratory (PRL), India, [Project Atmospheric Brown Cloud \(ABC\) of UNEP](#), Seoul National University (SNU), Korea, [Stockholm University \(SU\), Sweden](#), University of Mainz, Germany, [University of Massachusetts \(U. Mass\), Amherst, USA](#), University of Montana, USA, [University of Virginia \(UVA\), USA](#), Yale University, USA

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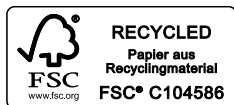
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