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GLOBAL CHANGE RESEARCH

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Project Leader and Contact Details: Dr. Bhupendra Das, Center of Research for Environment, Energy and Water (CREEW), Nepal (bhupenids@gmail.com)

Collaborators and Contact Details:

- Dr. Dhundi Raj Pathak, Center of Research for Environment, Energy and Water (CREEW), Nepal (president@creew.org.np)
- Dr. Rajeev Kumar Singh, Department of International Relations, Kobe City University of Foreign Studies, Japan (singh@inst.kobe-cufs.ac.jp)
- Dr. Abdus Salam, Department of Chemistry, University of Dhaka, Bangladesh (anuroybd@gmail.com)
- Ms. Shatabdi Roy, Department of Chemistry, University of Dhaka, Bangladesh (asalam@gmail.com)

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Das, B., Pathak, D. R., Singh, R. K., Salam, A., Roy, S. (2025). Mitigation potential of GHGs from open waste burning under present scenario and future optimistic scenarios: cases of south Asian countries Nepal and Bangladesh. Technical Report. Asia-Pacific Network for Global Change Research.

1. Summary

Open burning of municipal solid waste (MSW) remains one of the least addressed yet significant sources of greenhouse gas (GHG) emissions in developing countries. The practice not only contributes to global climate change but also poses serious threats to public health, air quality, and urban liveability. This project investigates the extent and mitigation potential of GHG emissions resulting from open waste burning in two rapidly urbanizing regions of South Asia, Kathmandu Valley (KV), Nepal, and Dhaka City, Bangladesh. These two cities represent contrasting geophysical and socio-economic contexts: KV is in the foothills of the Himalayas, while Dhaka lies within the Ganges Delta's lowlands. Both areas face mounting challenges in waste management due to urban expansion, inadequate infrastructure, and limited enforcement of waste disposal regulations. The study employs a comprehensive methodological framework integrating household surveys, transect walks, and real-world field experiments to quantify the magnitude of open waste burning and its associated GHG emissions. A total of 385 households in KV and 397 households in Dhaka City representing low, middle, and high socio-economic strata were surveyed alongside 50 institutional and 50 commercial entities in each city. Field and laboratory experiments were conducted to determine key parameters such as the waste combustible fraction (WCF), burning oxidation factor, and emission factors (EFs) for carbon dioxide (CO_2). Likewise, EF for methane (CH_4) and nitrous oxide (N_2O) were obtained from the literature. The methods followed the established IPCC guidelines.

In 2024, an average of 16.39 Gg (4% of total waste generation) of waste was openly burned in KV, while 28.63 Gg (0.5% of total waste generation) was burned in Dhaka City. By applying the corresponding emission factors (EFs) to the mass of waste burned, CO_2e emissions were estimated to be 9.66 Gg for KV and 22.2 Gg for Dhaka City. The study also provides spatial CO_2e profiles, showing higher emissions in more densely populated areas. Looking ahead to 2050, under a Business-As-Usual scenario, CO_2e emissions are projected to reach 14.2 Gg for KV and 31.1 Gg for Dhaka City. The decarbonization impact from various interventions between 2025 and 2050 is expected to range from 0.8 to 8.9 Gg for KV and 2 to 21.2 Gg for Dhaka City. This study suggests that low collection coverage and lack of viable alternatives such as composting or recycling are major drivers of open burning across Asian cities. Building on empirical data, the study models four mitigation scenarios (Business-as-Usual, Low, Mid and High-Intervention) to estimate future emission trajectories. These scenarios assess the potential reduction of GHG emissions through policy, institutional, and technological interventions, such as improved collection coverage, decentralized composting, segregation at source, and enforcement of open-burning bans. The optimistic future scenario projects significant emission reductions achievable through integrated waste management systems and behavioural shifts among urban residents.

The project's multidisciplinary approach, combining scientific measurements, socio-economic assessments, and policy analysis provides a replicable framework for developing emission inventories and identifying mitigation strategies in other South Asian cities facing similar challenges. The outcomes are designed to inform national policy packages, enhance municipal waste management practices, and contribute to the regional climate mitigation agenda. Ultimately, this study underscores the urgent need for coordinated regional action against open waste burning. By quantifying emissions, identifying critical intervention points, and modelling feasible future scenarios, the project offers practical pathways for achieving low-carbon, climate-resilient urban waste systems in Nepal and Bangladesh.

2. Objectives

The overall objective of the study was to generate emission inventory and mitigation potential for greenhouse gas emissions from open waste burning for the municipalities of KV and Dhaka City under current and optimistic future scenarios.

The specific objectives are as follows:

1. To quantify and characterize municipal?solid waste in two megacities of Nepal and Bangladesh.
2. To understand contributing factors of open waste burning through a field study and real world-experiment and estimate mass of waste burning.
3. To develop an emission inventory of GHGs from open waste burning and construct spatio-temporal scenarios.
4. To formulate mitigation scenarios of open waste burning and GHGs emission considering policy, institutional and technological intervention to reduce its adverse impacts.

3. Outputs, Outcomes and Impacts

Outputs	Outcomes	Impacts
- Baseline inventory of municipal solid waste (MSW) generation, composition, and burning practices in Kathmandu Valley (Nepal) and Dhaka City (Bangladesh). - Empirical emission inventory of GHGs from open waste burning using	-Quantified understanding of how open waste burning contributes to total waste-sector GHG emissions in both cities. -Validated emission factors and activity data for inclusion in national GHG inventories. -Enhanced municipal	-Reduced GHG emissions from waste burning through adoption of mitigation measures under optimistic future scenarios. -Health and environmental co-benefits, including improved air quality and reduced exposure to toxic pollutants.

field and laboratory-based emission factors. - Spatio-temporal maps of waste burning hotspots and GHG flux. - Mitigation scenarios (2024–2050) developed under BAU, low-, mid-, and high-intervention pathways using LEAP modelling. - Training and capacity-building of enumerators and early-career researchers on waste quantification and GHG estimation. - Stakeholder consultation and dissemination workshops in Nepal and Bangladesh.	capacity to monitor and report waste-related emissions and plan low-emission interventions. -Improved stakeholder awareness and data-driven decision-making for sustainable waste management. -Scenario results guiding urban waste management strategies (segregation, composting, collection coverage, enforcement). -Strengthened scientific collaboration between Nepal and Bangladesh on climate and waste governance.	-Contribution to national climate commitments (NDCs, SDGs) and low-carbon urban development. -Evidence-based policymaking at national and regional levels to curb open burning. -Replication potential of the framework across South Asian cities. -Increased regional cooperation on waste sector mitigation within the context of global climate targets.

4. Key facts/figures

- A total of 810 households, 100 commercial entities, and 100 institutions were surveyed across Kathmandu Valley (Nepal) and 799 households,100 commercial entities, and 100 institutions in Dhaka City (Bangladesh) were surveyed to assess waste generation, characterization and open burning practices.
- 18 transect routes were monitored in Kathmandu Valley and 22 wards in Dhaka City to map open waste burning hotspots.
- 16.39 Gg of MSW (4% of total waste generation) were found openly burned in Kathmandu Valley and 28.63 Gg (0.5% of total waste generation) in Dhaka City during 2024.
- The total estimated annual GHG emissions from open waste burning were 9.66 Gg CO_2e for Kathmandu Valley and 22.2 Gg CO_2e for Dhaka City.
- This study also presents spatial CO_2e profiles, indicating higher emissions in more densely populated areas.
- GHG emission inventory was developed for the base year 2024, and projected from 2012 to 2050 under four mitigation scenarios (BAU, Low-, Mid-, and High-Intervention).

- Under a Business-As-Usual scenario, CO_2e emissions are forecasted to reach 14.2 Gg for KV and 31.1 Gg for Dhaka City by 2050.
- The decarbonization impact from different interventions between 2025 and 2050 is estimated to vary from 0.8 to 8.9 Gg for KV and from 2 to 21.2 Gg for Dhaka City.
- One regional dissemination workshop was held in Kathmandu, Nepal to share preliminary findings and discuss mitigation roadmaps. Workshop discussions and comparative studies from Southeast Asia reinforced these findings, revealing exceptionally high black carbon emissions from household and dumpsite burning, underscoring the urgency of accelerating regional action on open waste burning
- Twenty enumerators and field researchers were trained on waste quantification, emission measurement, and digital data collection methods.
- Four Thesis has been completed - two in Nepal and two in Bangladesh.
- Two scientific papers and one conference presentation are in preparation/submission stages for peer-reviewed publication.

5. Publications

List all publications in APA6 Format (published and under review, with DOI if available) and attach them to the present report, where possible, for dissemination on the APN website. Please be sure to check the data sharing and management policy in your contract.

There are currently no publications released from this project; however, a manuscript, a science bulletin, and a technical report have been submitted for publication, as listed below.

1. Das, B., Pathak, D. R., Salam, A., Roy, S., Pathak, L., Baral, S., Omar, R., Malla, R., Singh, R. K. (2025). Emissions Inventory and Mitigation Potential of GHGs from Open Waste Burning in South Asian Cities of Nepal and Bangladesh. Waste Management.

Submitted to journal: To track the status of your paper, please do the following:
https://www.editorialmanager.com/wm/

← Submissions Being Processed for Author ⓘ

Page: 1 of 1 (1 total submissions) Results per page 10

Action	Manuscript Number	Title	Initial Date Submitted	Status Date	Current Status
View Submission View Reference Checking Results Send E-mail		Emissions Inventory and Mitigation Potential of GHGs from Open Waste Burning in South Asian Cities of Nepal and Bangladesh	Oct 31, 2025	Oct 31, 2025	Submitted to Journal

2. Das, B., Pathak, D. R., Pathak, L., Singh, R. K. (2025). Contributing Factors to Household Waste Generation and Open Waste Burning in Kathmandu Valley: A Cross-Sectional Analysis. Science Bulletin. Asia-Pacific Network for Global Change Research.

3. Das, B., Pathak, D. R., Singh, R. K., Salam, A., Roy, S. (2025). Mitigation potential of GHGs from open waste burning under present scenario and future optimistic scenarios: cases of south Asian countries Nepal and Bangladesh. Technical Report. Asia-Pacific Network for Global Change Research.

6. Media reports, videos and other digital content

List and hyperlink all resources and/or attach them to the present report for dissemination on the APN website.

1. **Regional Workshop**: **Mitigation Potential of GHG Emissions from Open Waste Burning under Present and Future Scenarios**: **Cases of Nepal and Bangladesh**

[August 01, 2025, Sangam Hall, Holiday Inn Express, Naxal, Kathmandu, Nepal]

https://www.linkedin.com/posts/creewnepal_ghgmitigation-creew-sdg11-activity-7357361328853762048-vDsW?utm_source=share&utm_medium=member_desktop&rcm=ACoAAAdKB3kB1vyRu79zQq-0x0xzf68IQXnFDR8

https://www.facebook.com/creewresearch/posts/pfbid0CXoeBz5S5PTXsrasfmLfnJGwySCDdCKCqx4nn992nPP7CqJeY7WvEEuRBZRiZT5dl

2. National Daily Newspaper

As smog season looms, experts urge early action on air pollution

https://kathmandupost.com/climate-environment/2025/10/24/as-smog-season-looms-experts-urge-early-action-on-air-pollution

3. Online news

Calls to curb air pollution to safeguard tourism

https://english.aarthiknews.com/news/detail/18169/

4. National Daily Newspaper

Air pollution affects tourism sector

https://risingnepaldaily.com/news/60305

7. Pull quotes

"This project has provided the comprehensive scientific baseline on greenhouse gas emissions from open burning of waste in Nepal and Bangladesh. The evidence we generated is already helping cities recognize waste burning as a climate issue, not just a sanitation problem."
— Dr. Bhupendra Das, Project Leader, CREEW, Nepal

"By integrating field experiments, household surveys, and emission modelling, we were able to quantify how everyday waste burning contributes to climate change. The process has strengthened our capacity to develop practical, data-driven mitigation strategies."
— Dr. Dhundi Raj Pathak, CREEW, Nepal

"Participating in the fieldwork taught me how scientific data on waste burning can be used to inform real policy changes. It motivated me to continue working on sustainable waste management and climate research."
— Mr. Rakibul Omar Ovi, Department of Chemistry, University of Dhaka

"This study provides an excellent example of how locally generated data can inform national and regional climate strategies. By linking scientific research with policy discussions, the project contributes meaningfully to South Asia's collective effort toward low-carbon and resilient urban development."
— Dr. Madan Lall Shrestha, Academician, Nepal Academy of Science and Technology (NAST), and APN SPG Member for Nepal

"Through engagement in this project, I realize that open waste burning is more than a bad habit; it's a symptom of deeper struggles, the lack of reliable waste collection services, the daily pressure to make ends meet, and the absence of viable alternatives. To clear the air, our solutions must be as complex and human cantered as the problem itself. We must address the 'why' before we can change the 'what'."
— Mr. Lalit Pathak, CREEW, Nepal

"The findings from this project highlight the often-overlooked contribution of open burning of waste to urban air pollution and global greenhouse gas emissions. Translating such local evidence into global climate dialogues is crucial for achieving real progress on mitigation and sustainable urban development."
— Dr. Maheswar Rupakheti, Research Group Leader, Research Institute for Sustainability (RIFS), Germany

"What gets measured gets managed and open burning is finally being measured. As new emission data from Asian countries like Nepal and Bangladesh emerge, it is evident that curbing open waste burning is among the quickest and most cost-effective climate mitigation strategies."
— Dr. Rajeev Kumar Singh, Kobe City University of Foreign Studies (KCUFS), Japan

8. Acknowledgments

We sincerely thank the Asia-Pacific Network for Global Change Research (APN) for funding and supporting the project "Mitigation Potential of GHGs from Open Waste Burning under Present Scenario and Future Optimistic Scenarios: Cases of South Asian Countries Nepal and Bangladesh." We gratefully acknowledge Dr. Madan Lall Shrestha, Academician, Nepal Academy of Science and Technology (NAST) and APN SPG Member for Nepal, for his valuable guidance and encouragement throughout the study. Special thanks are extended to the Centre for Energy and Environment Nepal (CEEN) and Fare Lab Pvt. Ltd. for laboratory services. We also appreciate the cooperation of Kathmandu Metropolitan City, other local municipalities within the Kathmandu Valley, and the Dhaka North and South City Corporations for facilitating field activities and stakeholder interactions. We acknowledge the dedication of the enumerators, research assistants, and field technicians involved in the household surveys, transect walks, and experimental assessments. Finally, we extend our gratitude to the municipal officials, policymakers, academic experts, and community participants who contributed their time and insights to the workshops and consultations, helping translate scientific findings into actionable mitigation strategies for reducing GHG emissions from open waste burning in South Asia.

9. Appendices

Appendix 1: Project start-up meeting, December 11, 2023

A project start-up meeting was successfully held on 11 December 2023, marking a pivotal first step for the new initiative. The event successfully achieved its core objectives of informing stakeholders about the project, gathering valuable feedback, identifying potential risks, and fostering collaboration for successful implementation. The meeting was attended by a diverse delegation of 44 professionals from 21 different organizations, comprising representatives from government institutions, academic institutions, and NGOs and the private sector, with a gender diversity of 28% female and 72% male participation. Delivering the opening remarks, Dr. Madan Lall Shrestha, a Scientific Planning Group Member from the Asia Pacific Network for Global Change Research (APN), set the stage for the discussions. The technical session featured a presentation from Dr. Dhundi Raj Pathak on the status of waste management, open dumping, and open burning in Nepal, which outlined the project's rationale. Dr. Bhupendra Das, project lead, then presented a detailed introduction to the project, covering its objectives, methods, implementation strategy, and expected outputs. The meeting also included an engaging discussion session where experts provided constructive comments and suggestions. Key points raised included considerations for climate phenomena and transboundary pollutants, recommendations on proper sampling methodologies and a flexible monitoring network, the adoption of a Tier-2 methodology, and the importance of a problem-solving orientation aligned with the local context. The dynamic participation of all attendees and their exploratory discussions on future collaborations contributed significantly to solidifying the foundation for the project's upcoming activities.

Some glimpse of the event

All the participants of the event: Posing for group photo

Dr. Bhupendra Das, PI: Describing the project and objective of the project

Dr. Dhundi Raj Pathak, President, CREEW, Describing status of waste management, in Nepal

Dr. Madan Lall Shrestha, Academician, Nepal Academy of Science and Technology (NAST) and APN SPG Member for Nepal

Dr. Rejina Maskey, Professor, Central Department of Environmental Science, Tribhuvan University

Appendix 2: Regional workshop, December 11, 2023

A regional workshop on "*Mitigation Potential of GHGs from Open Waste Burning Under Present Scenario and Future Optimistic Scenarios: Cases of South Asian Countries Nepal and Bangladesh*" was organized in Kathmandu, Nepal. The event was jointly hosted by the Centre for Research for Environment, Energy and Water (CREEW), Nepal, Dhaka University (Bangladesh), and the Kobe City University of Foreign Studies (Japan) with support from the Asia-Pacific Network for Global Change Research (APN). The workshop gathered more than 60 participants, including researchers, policymakers, municipal officials, and environmental practitioners from Nepal, Bangladesh, Japan, and other South Asian countries. It served as a vital platform to present research findings, share experiences, and deliberate on strategies for reducing greenhouse gas emissions from open waste burning, one of the region's most neglected yet pressing environmental challenges. The workshop featured presentations and policy reflections from distinguished experts, including Dr. Madan Lall Shrestha (NAST and APN SPG Member for Nepal), Prof. Nguyen Thi Kim Oanh (AIT, Thailand), and Dr. Maheswar Rupakheti (RIFS, Germany), who emphasized the importance of linking scientific data with evidence-based policymaking. Project researchers shared empirical results showing alarming trends in open waste burning in Kathmandu Valley and Dhaka City, with measurable increases in GHG emissions over the past decade. The participants endorsed the project's recommendations to strengthen data-driven waste policies, promote 3R practices, adopt low-emission waste technologies, and integrate black carbon into national climate commitments (NDCs). The event concluded with a discussion that underscored the need for regional cooperation, institutional capacity building, and community-level interventions to achieve long-term waste-sector decarbonization and sustainable urban development in South Asia.

Some glimpse of the regional workshop

All the participants of the event. Posing for group photo

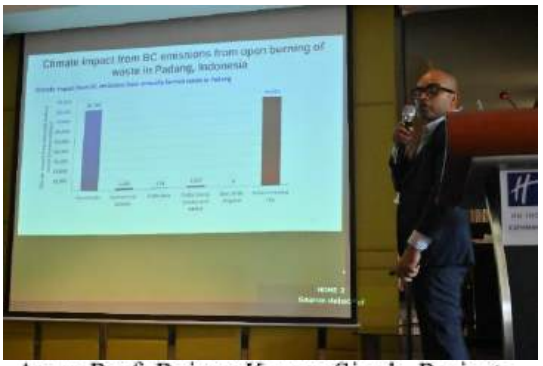
Gyanraj Subedi, Director General, Department of Environment, Ministry of Forest and Environment

Dr. Madan Lall Shrestha, Academician, Nepal Academy of Science and Technology (NAST) and APN SPG Member for Nepal

Dr. Bhupendra Das, PI: Presenting the project results

Dr. Dhundi Raj Pathak, President, CREEW, Moderating the open discussion session

Prof. Abdus Salam, Project Collaborator, Dhaka University, Bangladesh
Sharing key insights from Dhaka and how the results will be helpful in policy intervention level.



Asso. Prof. Rajeev Kumar Singh, Project Collaborator, KCUFS, Japan, Project Collaborator, Presenting Insights into Open Burning Emissions and Roadmap Recommendations based on cases from Asian Cities







APN
Workshop

Appendix 3: Abstract of Publications

There are currently no publications released from this project; however, one manuscripts and other science bulletin have been submitted for publication. The abstracts are listed below.

1. Manuscript

The uncontrolled burning of solid waste is a significant source of greenhouse gas emissions, which affect both climate and public health in various ways. This study focuses on two major urban areas in the developing world: Kathmandu Valley (KV) in Nepal (located in the foothills of the Himalayas) and Dhaka City in Bangladesh (situated in the lowlands of the Ganges Delta). The methods include field surveys and transect walks conducted during the dry and wet seasons, as well as real-world experiments to estimate burning parameters for open waste burning and CO_2 emissions. Additional activity data and emission factors for CH_4 and N_2O were obtained from the literature. On average, 16.39 Gg (4% of total waste generation) of waste was burnt openly in the KV in 2024, and 28.63 Gg (0.5% of total waste generation) in Dhaka City. After multiplying the amount of open-burned mass of waste by the respective EFs, CO_2e was estimated to be 9.66 Gg for KV and 22.2 Gg for Dhaka City. This study further present spatial profiles of CO_2e, showing higher in more inhabited area. The CO_2e is projected to be 14.2 Gg for KV and 31.1 Gg for Dhaka City by 2050 referring to Business-As-Usual scenario. The decarbonization due to various interventions from 2025 - 2050 ranges in between 0.8 – 8.9 Gg for KV and 2 - 21.2 Gg for Dhaka City. The outcomes of this study provide a valuable information for national policy package and interventions to reduce GHGs in the regional context.

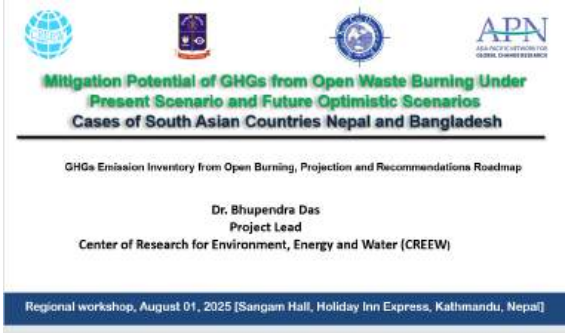
2. APN Science Bulletin

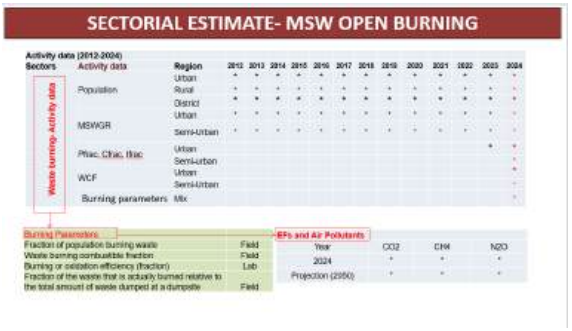
Open burning of waste poses significant environmental and public health risks in rapidly urbanizing cities of developing countries. This study estimates various parameters as well as seasonal variations associated with waste generation rates and burning practices in the Kathmandu Valley (KV), Nepal. A cross-sectional 775 household survey was conducted across eight municipalities in the KV during dry and wet seasons. Structured questionnaires captured socio-demographic characteristics and waste management practices. Statistical analyses included chi-square tests, ANOVA, t-tests, and OLS regression.

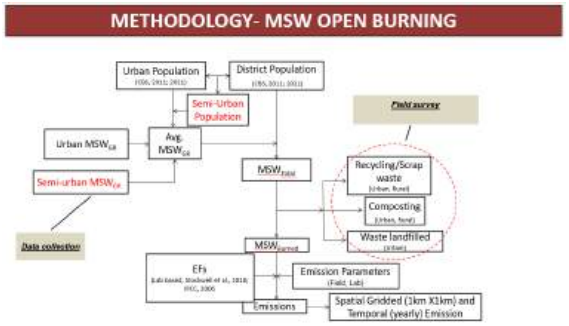
The overall open burning prevalence was 16.7%, with higher rates in the dry season (19.1%) than wet season (14.7%). Mean household waste generation was 0.62 kg/day (0.16 kg/capita/day). Household size showed the strongest positive association with waste generation ($\beta = 0.081$, $p < 0.001$). Lower-income households (10,000 - 20,000 NPR) had 100% burning prevalence, while higher-income households (> 50,000 NPR) had only 9.9%. Irregular waste collection services were significantly associated with higher burning rates (35.3% vs 5.4% for twice-weekly collection, $p < 0.001$). Socioeconomic disparities, inadequate waste collection services, and limited environmental awareness drive open burning practices in the KV. Targeted interventions

should focus on improving waste collection frequency in low-income areas, enhancing environmental education, and strengthening waste segregation programs.

Appendix 4: Conference Presentation







DATA AND METHODS OF GHGS INVENTORY

Amount of waste open-burned (HHs)

$$MSW_H = P \cdot P_{frac} \cdot MSW_P \cdot B_{frac} \cdot 365 \cdot 10^{-6} \quad (1)$$

Amount of waste open-burned (Commercial)

$$MSW_B = Commercial\ No. \cdot Cfrac \cdot MSW_P \cdot B_{frac} \cdot 365 \cdot 10^{-6} \quad (2)$$

Amount of waste open-burned (Institutional)

$$MSW_B = Institutinal\ No. \cdot Ifrac \cdot MSW_P \cdot B_{frac} \cdot 365 \cdot 10^{-6} \quad (3)$$

Source: IPCC, 2006/2019

$$CO_2\ Emissions = MSW \cdot \sum_i (WF_i \cdot dm_i \cdot CF_i \cdot FCF_i \cdot OF_i) \cdot \frac{44}{12} \quad (4)$$

Where,
CO_2 Emissions = CO2 emissions in inventory year, Gg/yr
MSW = total amount of municipal solid waste as wet weight incinerated or open-burned, Gg/yr
WF_i = fraction of waste type/material of component i in the MSW (as wet weight incinerated or open-burned)
$(dm)_i$ = dry matter content in the component i of the MSW incinerated or open-burned, (fraction)
CF_i = fraction of carbon in the dry matter (i.e., carbon content of component i)
FCF_i = fraction of fossil carbon in the total carbon of component i
OF_i = oxidation factor, (fraction)
44/12 = conversion factor from C to CO_2
with $\sum WF_i = 1$
i = component of the MSW incinerated/open-burned such as paper/cardboard, textiles, food waste, wood, garden (yard) and park waste, disposable nappies, rubber and leather, plastics, metal, glass, other inert waste.

$$CH_4 Emissions = \sum_i (IW_i \cdot EF_i) \cdot 10^{-6} \quad (5)$$

$$N_2O\ Emissions = \sum_i (IW_i \cdot EF_i) \cdot 10^{-6} \quad (6)$$

COMPUTATIONAL TOOLS

1. Base year calculation
   - ❑IPCC 2.93 version
   - ❑LEAP
2. Temporal/Scenarios projection and analysis
   - ❑LEAP
3. Gridded Emission Inventory: Fine resolution (1km × km)
   - ❑ Arc-GIS (Version 10.4.2)

TRANSECT WALK: FRACTION OF WASTE BURNING

Pfrac, Kathmandu Valley | Pfrac, Dhaka City Corporation

Kathmandu Valley		Burnt Fraction
HH	Pfrac	0.03
Inst	Ifrac	0.10
Comm	Cfrac	0.11

Dhaka City Corporation		Burnt Fraction
HH	Pfrac	0.020
Inst	Ifrac	0.028
Comm	Cfrac	0.031

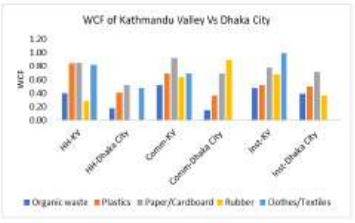
LABORATORY EXPERIMENT

Emission Factors for CO2: Laboratory based experiment, India

Other Emission Factors, based on literature

EFs	Sources
CH4	Stockwell et al., 2016; Jayarathne et al., 2018; Nepal
N2O	IPCC, 2001

FIELD EXPERIMENT: WASTE COMBUSTIBLE FRACTION

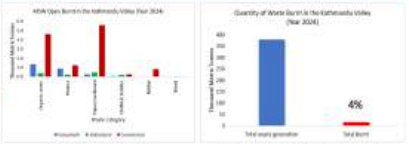


In overall WCF: Paper > Plastics > Textiles> Organic waste
WCF value ranges from approx. 0.1 to 0.9.

QUANTITY OF WASTE BURNT

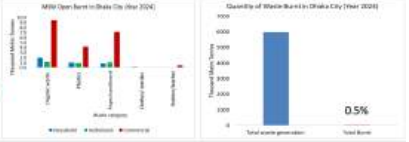
Kathmandu Valley (21 Municipalities/RM):

- Total waste generation in 2024: 380,000 MT
- Total waste burnt: 16,389 MT

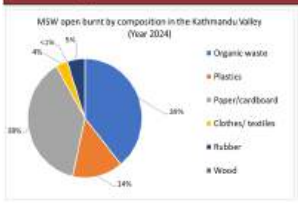


Dhaka City (North and South Corporation):

- Total waste generation in 2024: 599,7267 MT
- Total waste burnt: 28,629 MT



QUANTITY OF WASTE BURNT BY COMPOSITION



Kathmandu Valley:

- Organic waste > Paper > Plastics > Rubber

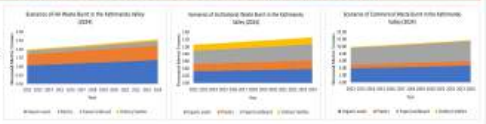
Dhaka City:

- Organic waste > Paper > Plastic > Rubber

TREND OF WASTE BURNING (2012-2024)

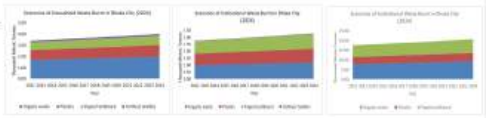
Kathmandu Valley:

- HHs: Waste burning growth 29% in 13 yrs.
- Commercial and institutional: 19% in 13 yrs



Dhaka City:

- HHs: Waste burning growth 17.4% in 13 yrs.
- Commercial and institutional: 18.7% in 13 yrs.

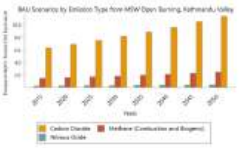


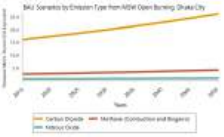
EMISSIONS FROM MSW OPEN BURNING

Kathmandu Valley:

Dhaka City:

BAU SCENARIOS BY EMISSION TYPE





Kathmandu Valley:

CO2 growth:52%
CH4 growth: 41%
N2O growth: 33%

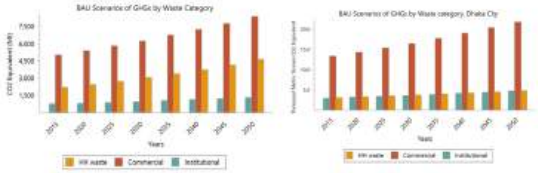
(In between 2024-2050)

Dhaka City:

CO2 growth:61.6%
CH4 growth: 41.3%
N2O growth: 33%

(In between 2024-2050)

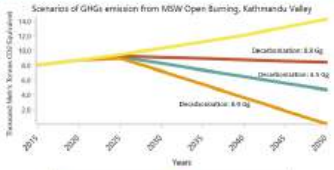
BAU SCENARIOS OF GHGS BY WASTE CATEGORY



Kathmandu Valley:
Commercial > HH > Institutional

Dhaka City:
Commercial > HH > Institutional

MITIGATION POTENTIAL OF GHGS: KATHMANDU VALLEY



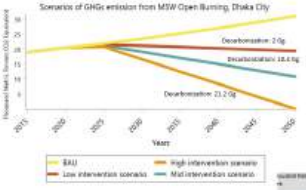
High Intervention:
Pfrac/Ifrac/Cfrac to be 0 or WCE to be 100%; 100% waste segregation at sources; Zero open burning, considering Paris agreement, and supported by SDGs, NDC-3, 2025.

Low Intervention Scenario:
Waste reduction to 10% by 2030 by SDGs; and continued until 2050.

Mid Intervention Scenario: Assumption in between High and Low Intervention Scenarios.

For projection of BAU Scenario (2012-2050), LEAP:
HH waste burnt: Population Growth Rate: 2.11%
Commercial waste burnt; Urban Growth Rate: 1.46%
Institutional waste burnt: Urban Growth Rate: 1.46%

MITIGATION POTENTIAL OF GHGS: DHAKA CITY



High Intervention:
Pfrac to be 0; WCE to be 100%; 100% waste segregation at sources; Zero open burning considering SDGs, Paris agreement, NDC,2021.

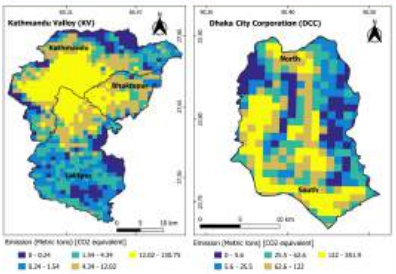
Low Intervention Scenario:
Waste reduction to 10% by 2050; while all other variables to be same ; Waste reduction to 10% by 2050.

Mid Intervention Scenario: Assumption in between High and Low Intervention Scenarios.

For projection of BAU Scenario (2012-2050), LEAP:
HH waste burnt: Population Growth Rate: 1.33%
Commercial: Urban Growth Rate: 1.42%
Institutional: Urban Growth Rate: 1.42%

SPATIAL ALLOCATION OF GHGS (YEAR 2024)

Reasons behind more GHGs in the Core area of Kathmandu Valley and West Dhaka City are due to consideration of factors:
(i) Population/household density
(ii) Grid (1 km x 1 km)



STUDIES COMPARISON

Comparative estimates of emissions from global perspective	MSW open burnt (Gg)
Kathmandu valley municipalities (2024)a	10.4
Dhaka City Corporation (North and South) (2024)a	26.6
Kathmandu valley municipalities (2016)b	7.4
Delhi (2015)b	79.6
Agra (2015)b	81.4
Kanpur (2005)b	25.0
Mumbai (2005)b	352.6
Dhanbaotar (2005)b	31.5
Mexico City (2006)b	1,460
World (2014) b	972,190
b This Study; b Das et al., 2018	

Reasons behind increase in waste burning and decrease in CO2 in Kathmandu Valley compared to past study are due to consideration of:
(i) Study specific EFs of CO2
(ii) Exclusion of biogenic CO2 from food waste.

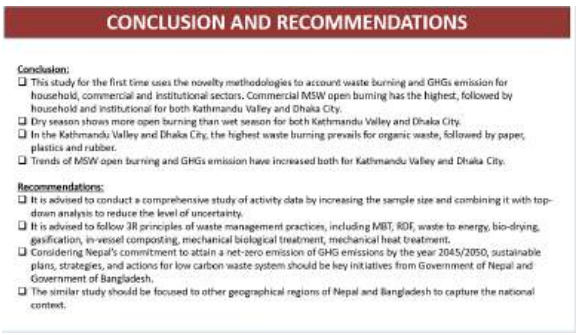
Comparative estimates of emissions (Metric Tonnes) from global perspective

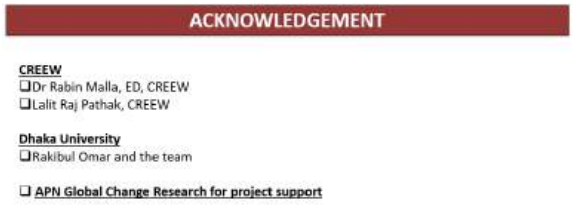
Emission sources from MSW open burning	CH4	CO2	N2O
Kathmandu Valley Municipalities (2024)a	65.11	7,361	1.81
Dhaka City Corporation (North and South) (2024)a	113.62	18,213	3.04
Kathmandu valley municipalities (2016)b	29.50	11,913	
World (2014)c	3,597,103	1,412,592,128	

a This study; b Das et al., 2018; c Wiedinmyer, 2014

MITIGATION OPTIONS

Mitigation scenarios	Waste category	Treatment	Intervention target	Technology	International commitments
Low Intervention Scenarios (LIS)	Food waste	Composting	10%	MBT	Waste reduction to 10% by 2030 by SDGs
	Plastic	Recycling	10%		
	Paper	Recycling	10%		
	Textiles	Recycling	10%		
	Rubber and leather	Landfill	100%		
	Wood	Insignificant	Energy sources		
Mid Intervention Scenarios (MIS)	Food waste	Composting, biogas	50%	MBT, RDF, waste to energy, bio drying, gasification, in-vessel composting, mechanical biological treatment, mechanical heat treatment	
	Plastic	Recycling	50%		
	Paper	Recycling	50%		
	Textiles	Recycling	50%		
	Rubber and leather	Landfilling	100%		
	Wood	Insignificant	Energy sources		
High Intervention Scenarios (HIS)	Food waste	Composting, biogas	100%	MBT, RDF, waste to energy, bio drying, gasification, in-vessel composting, mechanical biological treatment, mechanical heat treatment	100% waste segregation at sources; Zero open burning considering Paris agreement, supported by SDGS up to 2030
	Plastic	Recycling	100%		
	Paper	Recycling	100%		
	Textiles	Recycling	100%		
	Rubber and leather	Landfill	100%		
	Wood	Insignificant	Energy sources		





Appendix 5: List of young researchers

Name of Young Scientist	Institute	Country	Contact detail
Mr. Lalit Pathak	CREEW	Nepal	lalit@creew.org.np
Ms. Samikshya Baral	CREEW	Nepal	samikchhyabaral@gmail.com
Mr. Rajish Shrestha	Golden Gate International College	Nepal	rajishshrestha4@gmail.com
Ms. Asmita Duwadi	CDES, Tribhuvan University	Nepal	Duwadiasmita9@gmail.com
Ms. Bijaya Timilsina	CREEW	Nepal	Timilsinabijaya20@gmail.com
Ms. Kamana Joshi	CDES, Tribhuvan University	Nepal	Jkamana512@gmail.com
Ms. Purnima Regmi	CDES, Tribhuvan University	Nepal	Regmipurnima234@gmail.com
Ms. Sulakshya Bhandari	CDES, Tribhuvan University	Nepal	Bhandarisulu22@gmail.com

Mr. Pratik Bhattarai	IoE, Pulchowk	Nepal	Pratikbhattarai115@gmail.com
Md. Sahin Ahmed	Department of Chemistry, University of Dhaka	Bangladesh	shahinahmed2490@gmail.com
Mr. Siful Islam	Department of Chemistry, University of Dhaka	Bangladesh	siful-2018726761@chem.du.ac.bd
Mr. Md. Mahanur Islam	Department of Chemistry, University of Dhaka	Bangladesh	mdmahanur-2018426827@chem.du.ac.bd
Most. Sumaiya Faruki	Department of Chemistry, University of Dhaka	Bangladesh	sumaiyafaruki03911@gmail.com
Mr. Rakibul Omar	Department of Chemistry, University of Dhaka	Bangladesh	rakibulovi268@gmail.com
Mr. Meerajul Azam	Department of Chemistry, University of Dhaka	Bangladesh	merajulazam17@gmail.com
Ms. Pragya Ghimire	Khwopa College, Tribhuvan University	Nepal	pragyaghimire25@gmail.com
Mr. Md. Al-amin Hossen	Department of Chemistry, University of Dhaka	Bangladesh	alaminhossenalamin06@gmail.com
Mr. Riajul Haque	Department of Chemistry, University of Dhaka	Bangladesh	riajultanjil@gmail.com
Ms. Sonia Gadal	Tri-Chandra Multiple Campus, Tribhuvan University	Nepal	soniyagadal321@gmail.com