The Impact of Solid Wastes on the Atmosphere and Coastal Areas of Developing Countries: Issues and Emerging Solutions

Martin Medina

NOAA NESDIS - IIA

Let's Talk Trash

- Waste Generation:
  * Population Size
  * Production and Consumption (per capita income)

Population Growth

- World population grows by more than 200,000 each day: 1 Billion every 12-14 years
- By 2030, the world's urban population is expected to reach 5 Billion: 2 Billion in Slums

Waste Generation

1) Developed Countries – High Income

- Population – 1.0 Billion
- Waste: 3 lbs/capita/day

2) Developing Countries – Middle Income

- Population - 3.0 Billion (~ 30% live in slums)
- Waste: 1.7 lbs/capita/day

3) Developing Countries – Low Income

- Population - 2.4 Billion (~ 65% live in slums)
- Waste: 1.3 lbs/capita/day

Waste Collection and Disposal

1) Developed Countries – High Income

Collection – 100%

Proper Disposal – 100%

2) Developing Countries – Middle Income

Collection – 60%

Proper Disposal - 30%

3) Developing Countries – Low Income

Collection – 40%

Proper Disposal – 5%

Main Problems in Developing Countries

- Insufficient Collection
- Inappropriate Final Disposal
- Worsening Trend in the Near Future, particularly in Slums and Low-Income Neighborhoods

Uncollected Waste

- Accumulates on the streets
- Dumped on Vacant Land or Bodies of Water
- Burned by Residents in their Backyards

Typical Low-Income Neighborhood

Cairo, Egypt

Douala, Cameroon

New Delhi, India

Jakarta, Indonesia

Amman, Jordan

Manila, Philippines

Waste Disposal

- Most Waste in Developing Countries is sent to Open Dumps
- Sanitary Landfills have:
  * Bottom Liner
  * Daily Cover
  * Methane and Leachate Collection Systems

Waste Disposal: Sanitary Landfill in Guangzhou, China

Waste Disposal: Open Dump in Manila, Philippines

Waste Disposal:
Open Dump in Phnom Penh, Cambodia

Bali, Indonesia

Bali, Indonesia

Impact of Waste Management Practices on the Atmosphere

- Open Burning:
  * Gaseous Emissions: some Toxic, some Greenhouse Gases
  * SO_2
  * NO_x
  * CO_2
  * Acids: HCl, HF, SO_3

Impact of Waste Management Practices on the Atmosphere

- Open Burning:

  * Heavy Metals: Pb, Hg, Cd, As
  * Particulates

Impact of Waste Management Practices on the Atmosphere

- **Open Dumps: Gaseous Emissions**

  *** VOCs**

  Methane (GHG)

  Benzene (Cancer)

  Toluene (Cancer)

  Xylene (Leukemia)

  *** Some VOCs react with NO_x to form O_3**

Waste Management and Climate Change

- Decomposition of Organic Waste in Dumps and Landfills in Anaerobic Conditions Generates Methane
- Methane is about 21 Times Stronger than CO_2 as a GHG
- Landfills / Dumps Account for about 11% of Anthropogenic GHG Emissions

Impact of Waste Management Practices on Coastal Areas

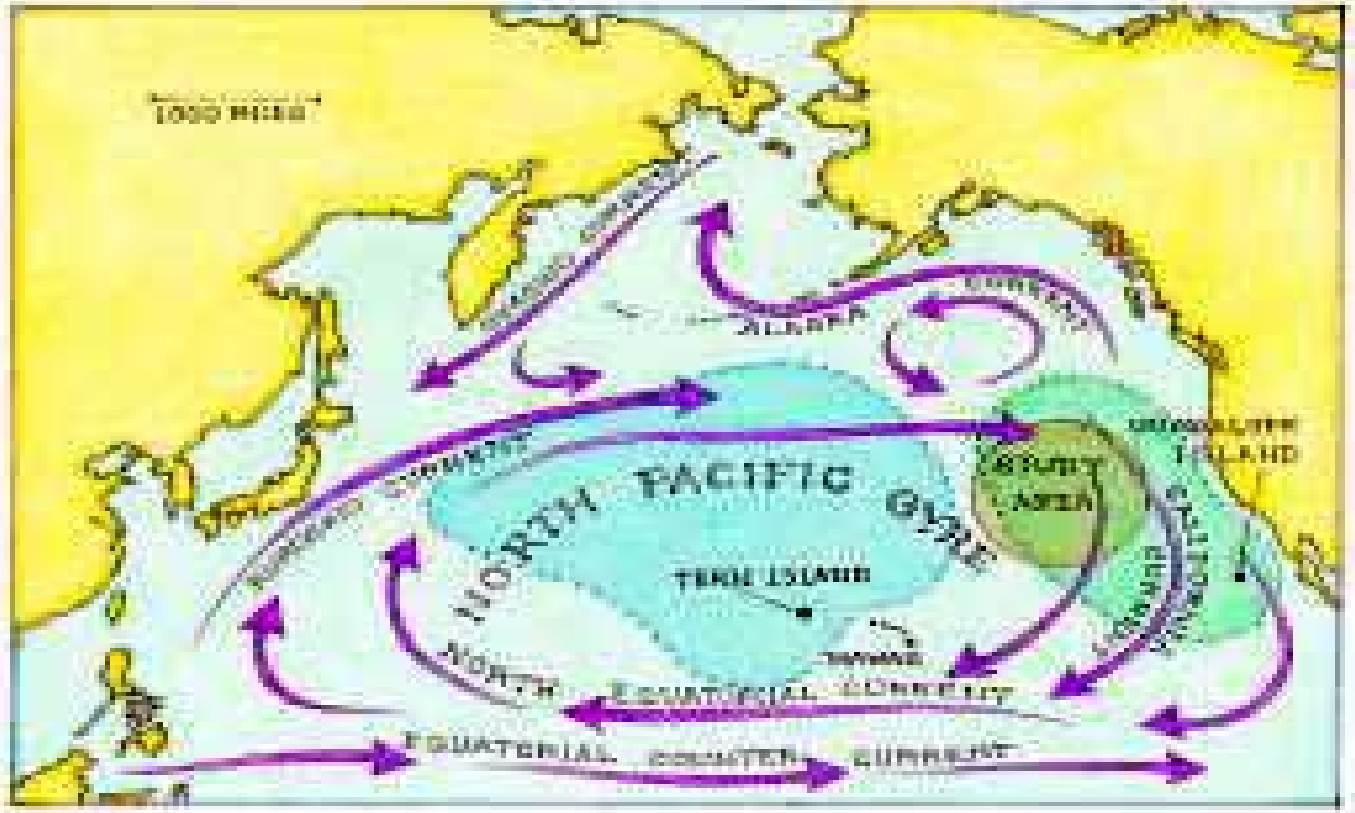
- Canals and Rivers Carry Garbage into Coastal Areas
- High Coliform Count, other Bacteria
- High BOD, which can Deplete Oxygen

Impact of Waste Management Practices on Coastal Areas

- Dumps Generate Leachate (Pesticides, Solvents, Heavy Metals, other), which Pollutes Bodies of Water
- Wildlife can Suffer Injuries by Eating Plastics, Metals, other materials

Impact of Waste Management Practices on the Oceans

"Great Pacific Garbage Patch"



Impact of Waste Management Practices on the Oceans

Beach in Albania

Manila Bay

Maldives

Maldives

Maldives

Maldives

Maldives

Maldives

Maldives

Emerging Solutions

1) Working with Scavengers
2) Wet / Dry Collection Systems
   * Inorganic Waste Recycled
   * Organic Waste Composted or for Pig Farms
3) Low-Tech, Low-Cost, and Labor-Intensive Systems More Appropriate to Low-Income Communities

Emerging Solutions: Working with Scavengers

1) Micro-enterprises

2) Co-operatives

3) Public-Private Partnerships

The Informal Recycling Sector in Developing Countries

- 1% of the Urban Population: up to 15 Million Worldwide, with an Economic Impact of US $ Billions
- Scavengers Traditionally Poor

When the Informal Recycling Sector is Supported:

- Create Jobs
- Reduce Poverty
- Supply Inexpensive Materials to Industry
- Reduce Pollution

When the Informal Recycling Sector is Supported:

- Conserve Natural Resources
- Save Cities in Waste Collection and Disposal
- Reduce Imports, Increase Exports
- It can Reduce Greenhouse Gas Emissions

Economic Impact of Informal Recycling Activities

- In Brazil, 90% of the Materials Recycled by Industry are Recovered by *Catadores* (30,000 tons / day)
- In Buenos Aires, an Economic Impact of US $ 170 Million / Year

Bali, Indonesia

Cali, Colombia

Buenos Aires, Argentina

Haiti

Palestine

1) Micro-enterprises

- Informal Refuse Collection

  In Mexico City 1,700 Informal Refuse Collectors Earn Up to 7 Times the Minimum Wage, with an Economic Impact of Nearly US $ 15 Million a Year

Mexico City: Informal Waste Collection

2) Scavenger Co-operatives

- In Colombia, more than 100 Scavenger Co-operatives exist, Recovering over 300,000 tons of recyclables / year
- They have a National and Regional Associations
- Recovery is legal, and they focus on Source Separation Programs

2) Scavenger Co-operatives

- 1,000 Cooperatives in South America
- In Brazil, Scavengers Organized a National Movement, with 500 Cooperatives and 60,000 Members

National March in Brasilia

“Grito dos Excluidos” in Brazil

“Grito dos Excluidos” in Brazil

Meeting with President Lula da Silva

2) Co-operatives

- National Movements in Argentina, Colombia, Brazil, Chile, and Uruguay
- In process in India and Paraguay
- Latin American Network Created in 2005

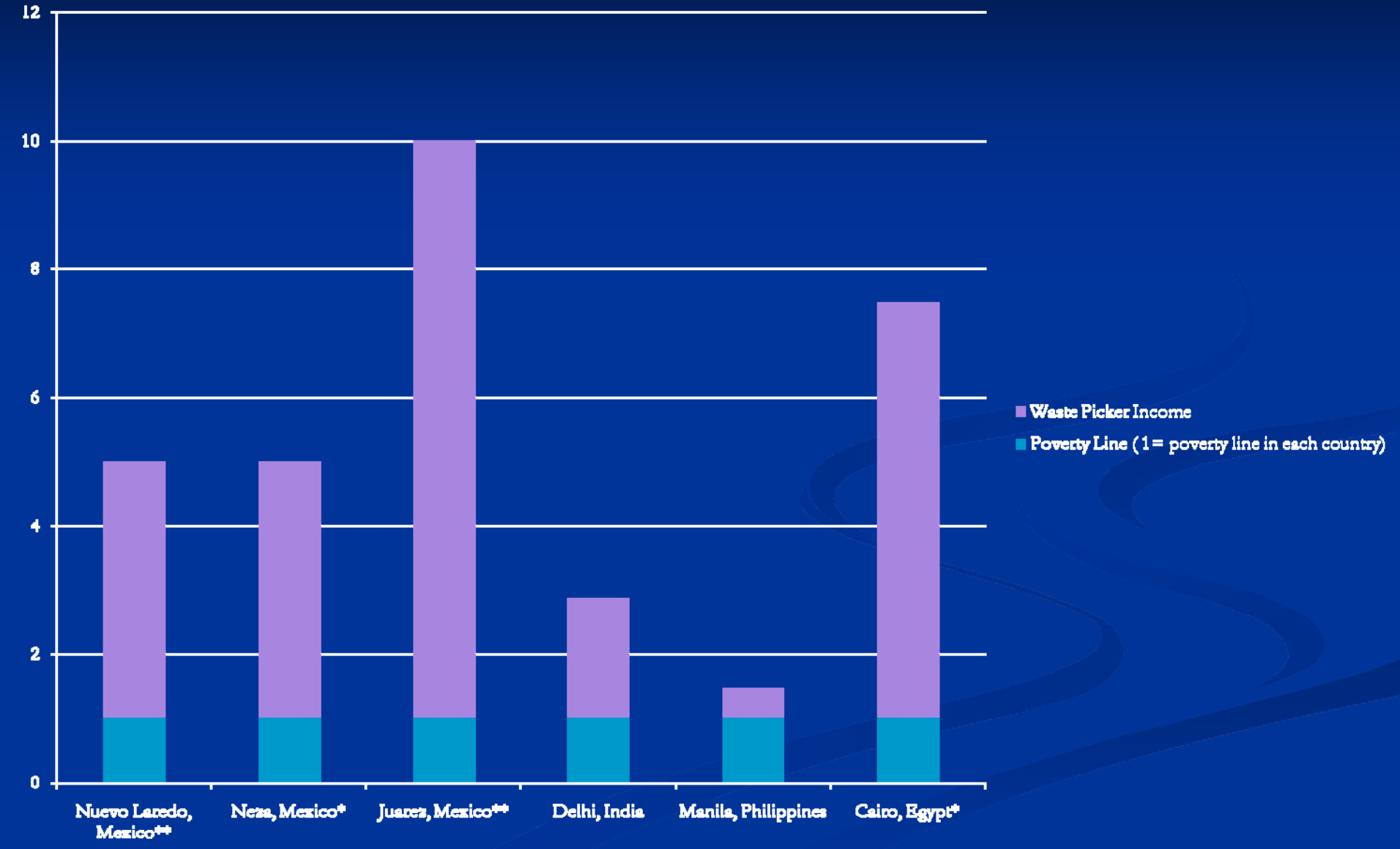
Scavenger Co-op in Manila

3) Public-Private Partnerships

3) Public-Private Partnerships

Housing for Scavengers in Bogota

Scavengers and Poverty



Waste Management and Climate Change: Opportunities

- Recycling: Source Separation
- Diversion of Organic Waste from Dumps and Landfills:
  * Pig Farms
  * Composting

Recycling

- Energy Savings from Recycling:

* Glass	4 - 32 %
* Paper	23 - 74 %
* Steel	47 - 74 %
* Aluminum	90 - 97 %

- Energy Savings: Fewer Power Plants, Less Burning of Fossil Fuels ⟶ Reduced GHG Emissions

Bali, Indonesia

- Most Important Tourist Destination in the Country: Over 2 Million Visitors a Year

Bali, Indonesia

Bali, Indonesia

Bali, Indonesia

Bali, Indonesia

Pig Farms / Composting

- Benefits:
  * Can Reduce Substantially the Volume of Wastes for Disposal
  * Extends the Life of Disposal Sites
  * Prevents Pollution at the Disposal Sites
  * Prevents Generation of Methane (GHG) ⟶ Fight Global Warming

Bali: Pig Farming

Bali: Pig Farming

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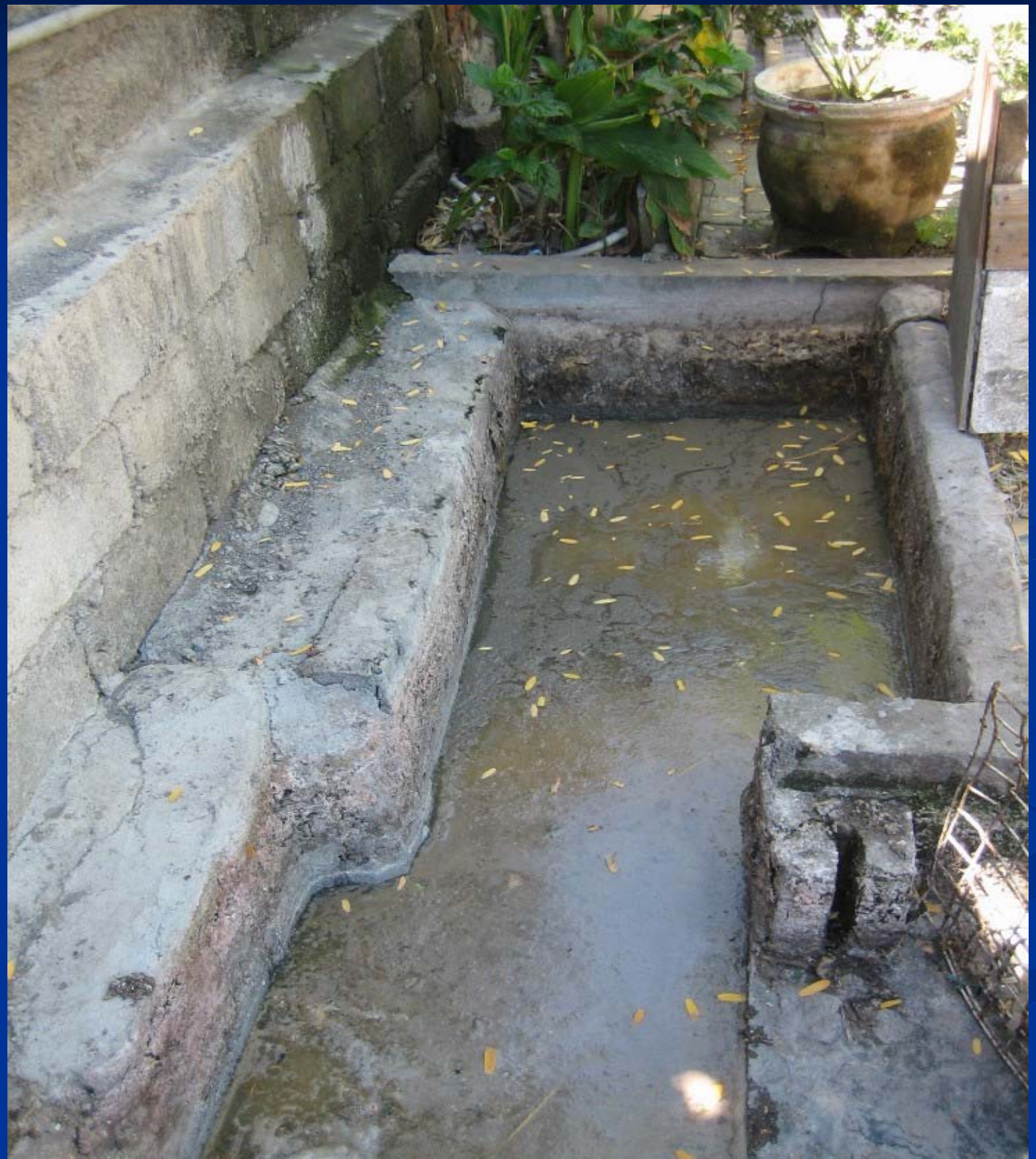
Bali: Pig Farming



Bali Hotel Waste Management Program

Bali Hotel Waste Management Program

Bali Hotel Waste Management Program

Bangladesh: Waste Concern Program

- First Composting Project Using CDM
- Reduction of 90,000 tons of CO_2 equivalent per year
- Created 1,000 Jobs

Bangladesh: Waste Concern Program

Description: Collection of Waste

Bangladesh: Waste Concern Program

Description: Collection of Waste

Conclusions

- Solid Waste Management is a Serious Problem in Developing Countries
- Improper Waste Management Pollutes the Environment and Poses Risks to Human Health
- An Increasing Number of Experiences Show that it is Possible to Protect the Environment, Reduce Poverty, and Improve the Economy

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GLOBALIZATION | AND THE ENVIRONMENT

Richard Wilk and Josiah Heyman, Series Editors

"There are two reasons to be interested in scavenging as a phenomenon. First, it is of significance in and of itself as a source of income for the urban poor. Second, it is an example of the operation of what is sometimes termed the 'informal' economy. This book makes a significant contribution in both these senses. Policymakers interested in improving the well-being of scavengers and analysts interested in the nature of the informal economy will learn a lot from this well-researched volume."

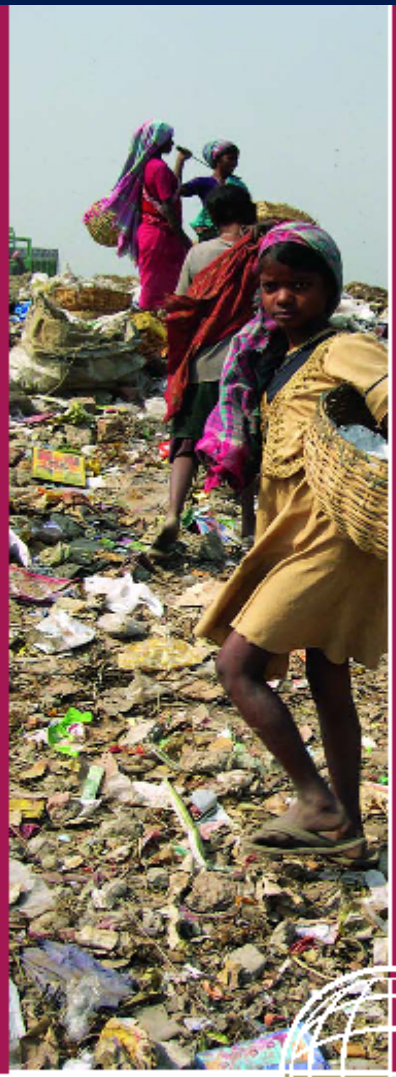
—RAVI KANBUR, T. H. Lee Professor of World Affairs, Cornell University

Martin Medina tells us that up to 2 percent of the urban population in developing countries survives by salvaging materials from waste for recycling, which represents up to 64 million scavengers in the world today. Despite these numbers, we know little about the impact of scavenging on the development of global capitalism. The author examines the historical evolution of scavenging and its linkages with formal and informal sector productive activities in capitalist and noncapitalist societies through case studies from Mexico, Brazil, Colombia, Argentina, Egypt, the Philippines, and India. His new book radically alters popular perceptions on scavenging, demonstrating that scavenging is not primarily the activity of the poor, or even a strictly marginal activity; the economic impact of scavenging is significant and can increase industrial competitiveness; and scavenging can be compatible with a sustainable waste management system. Scavenging represents an adaptive response to poverty and can be a resource for cities, and its contributions should be recognized and understood.

MARTIN MEDINA is the director of Ecoparque, El Colegio de la Frontera Norte, Tijuana, Mexico.

MEDINA

The World's Scavengers



The World's Scavengers

Salvaging for Sustainable Consumption and Production

MARTIN MEDINA

For orders and information please contact the publisher
A Division of
Rowman & Littlefield Publishers, Inc.
1-800-462-6420
www.altamirapress.com

ISBN-13: 978-0-7591-0741-4
ISBN-10: 0-7591-0741-7
90000
9 780759 107414

Cover photo: "Female dumpsite scavenger in Kolkata, India" by Jessica Koehs
Cover design by Piper E. Wallis

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