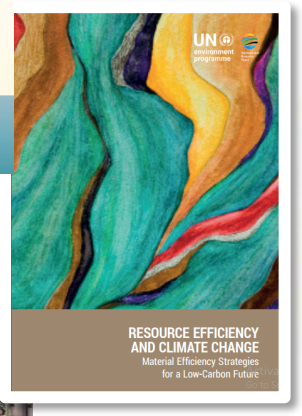
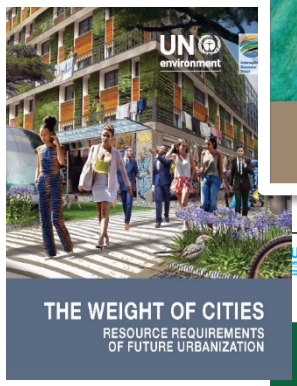
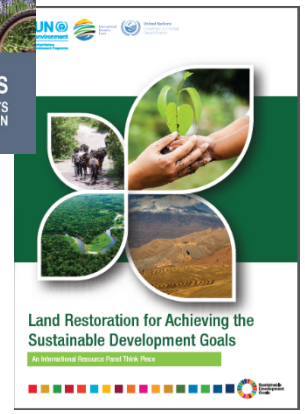
Highlights of 5 recently published/ in prep led or co-led by reports US authors

- **Re-defining Value – The Manufacturing Revolution: Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy**
  (2018 - Nabil Nasr – Rochester Institute of Technology – Lead)
- **Resource Efficiency and Climate Change: Material Efficiency Strategies for a Low-Carbon Future**
  (2021 - Reid Lifset – Yale – co-lead)
- **Weight of Cities: Resource Requirements of Future Urbanization**
  (2019 – Anu Ramuswami – Princeton - Co-Author)
- **Role of Resources in Environmental Displacement and Migration**
  (In preparation – Saleem Ali – U Delaware – Lead)
- **Land Restoration for Achieving the Sustainable Development Goals**
  (2019 – Jeff Herrick – USDA-ARS – Lead)







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Re-defining Value – The Manufacturing Revolution: Remanufacturing, Refurbishment, Repair and Direct Reuse in the Circular Economy

March 2, 2021

Nabil Nasr, Ph.D., Associate Provost and Director
Golisano Institute for Sustainability
Rochester Institute of Technology (RIT) – Rochester, NY USA

Context of the IRP study

Circular Economy (CE)

- CE seeks to maximize system efficiency through both resource utilization and value retention.

Value-Retention Processes (VRPs)

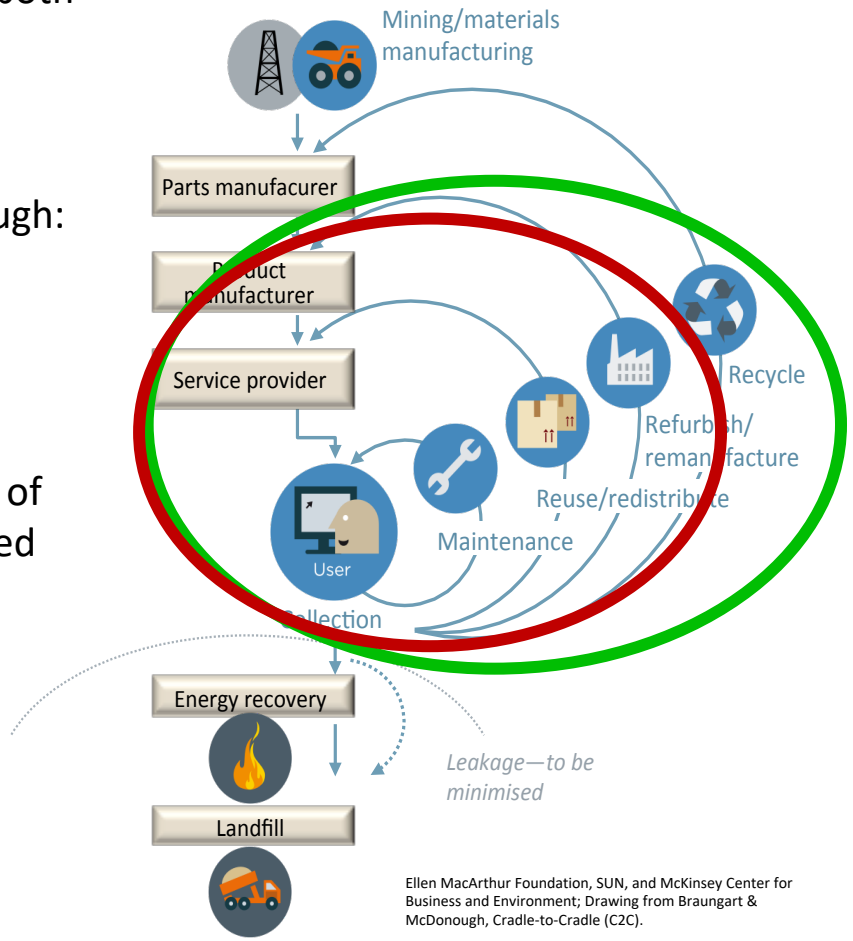
- Processes that retain value within a system through: **direct reuse**, **repair**, **refurbishment**, and **remanufacturing**.

Potential Benefits

- Offer substantial and verifiable benefits in terms of resource efficiency, circular economy, and reduced negative environmental impact.

Broader Impact

- Inform policy and guide private sector



Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment; Drawing from Braungart & McDonough, Cradle-to-Cradle (C2C).

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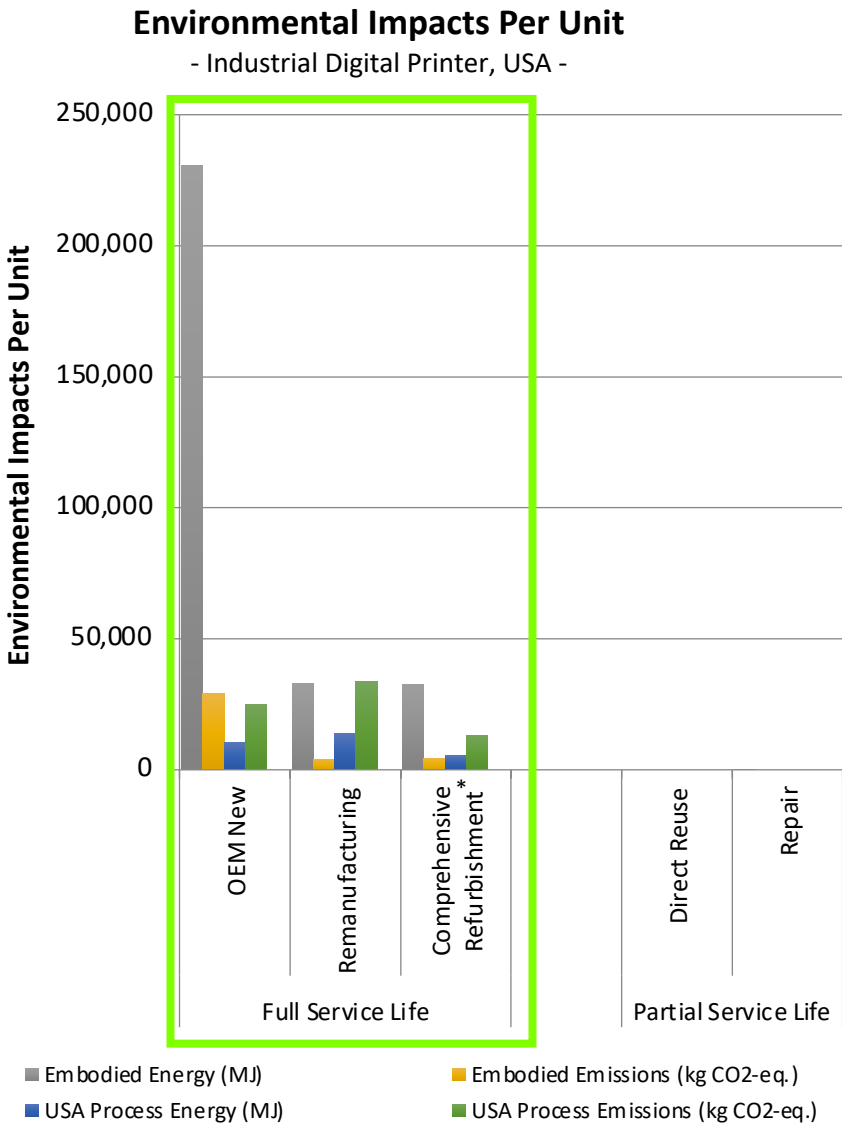
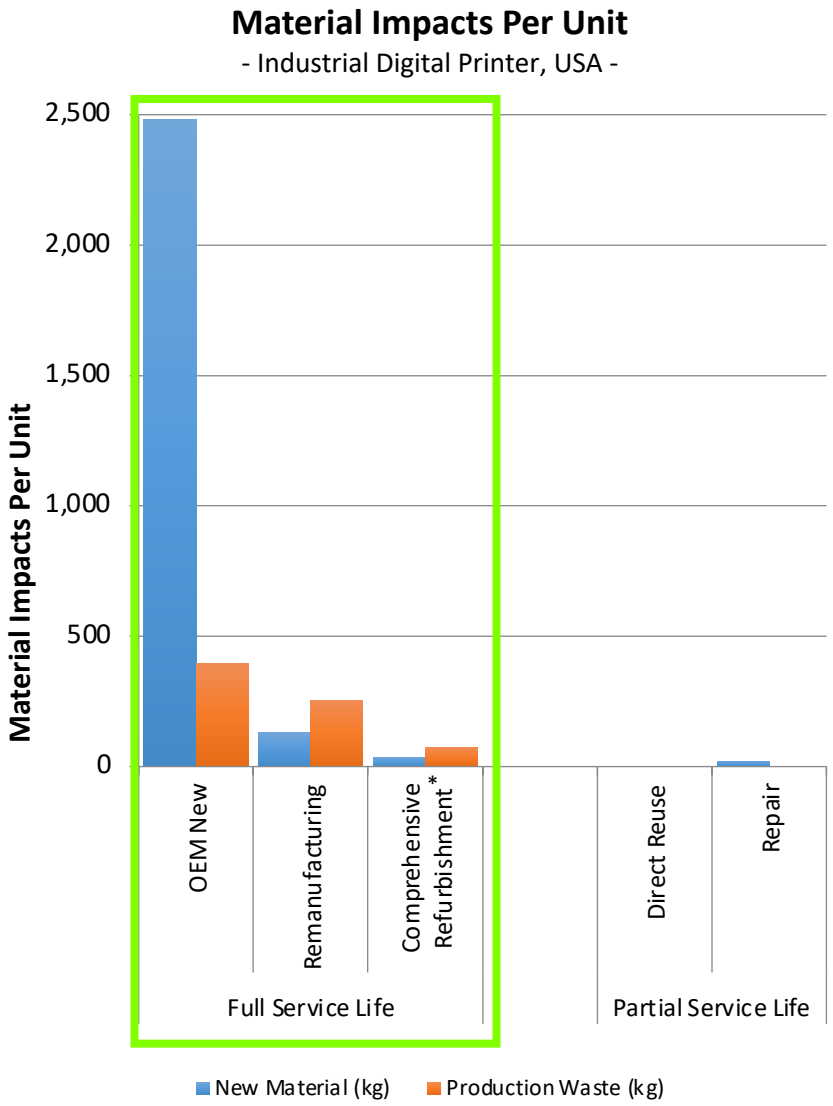
Product-Level Results: Digital Industrial Printer, USA





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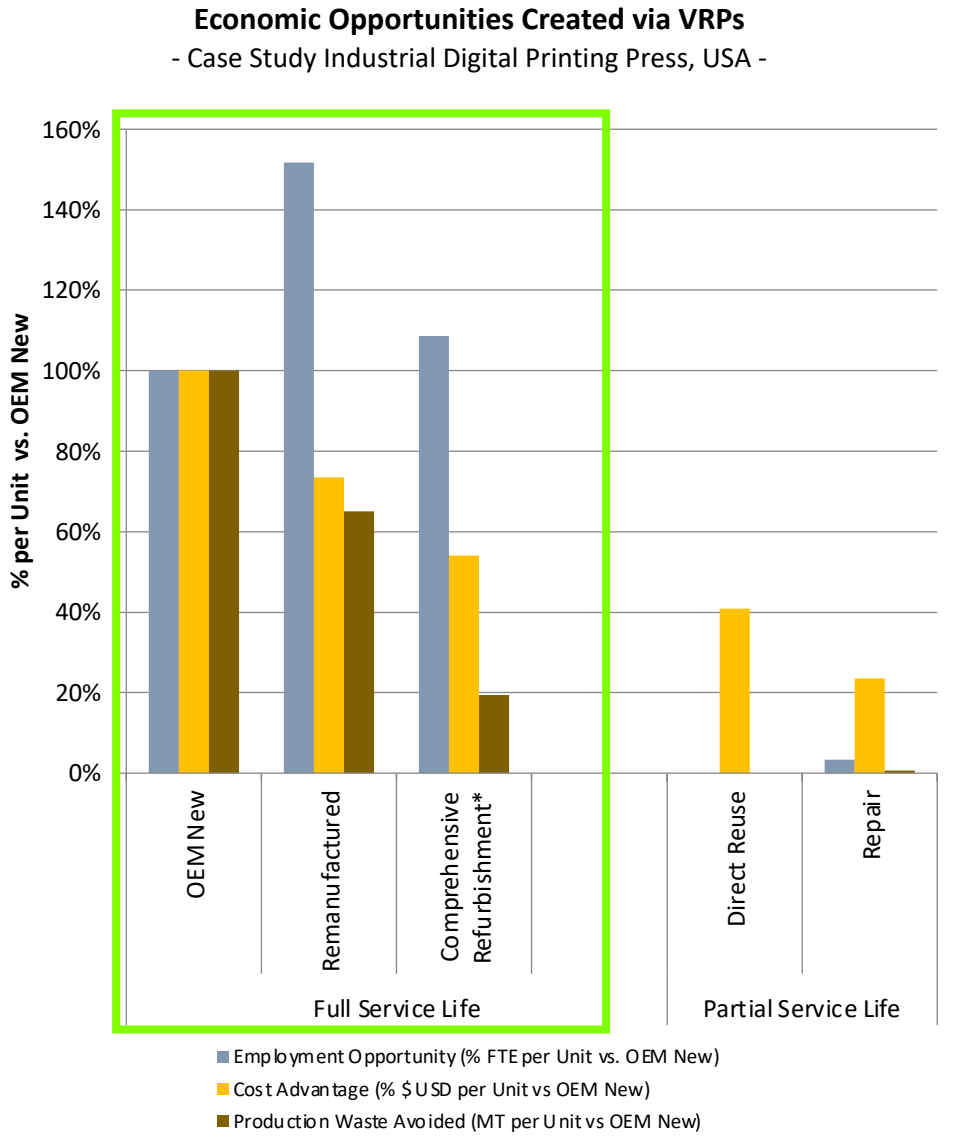
** Does not enable full new service life*

Product-Level Results: Digital Industrial Printer, USA

- Employment opportunity
  - Group 1/ Full Service Life VRPs have relatively greater skilled labor requirements;
- Cost advantage
  - All VRPs offer a cost advantage;
  - Advantage stems from offset inputs and requirements;
  - Magnitude of advantage inversely relates to value and utility-retained:
    - Higher cost-advantage: lower value and utility retention
- Production waste
  - Production waste avoidance suggests efficiency;
  - Production waste avoidance leads to operating cost avoidance.



** Does not enable full new service life*

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Thank you

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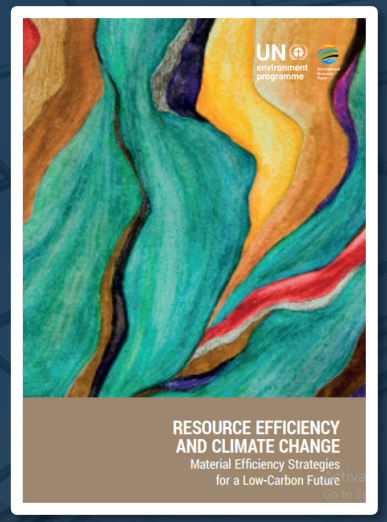
RESOURCE EFFICIENCY AND CLIMATE CHANGE:

Material Efficiency Strategies for a Low-Carbon Future

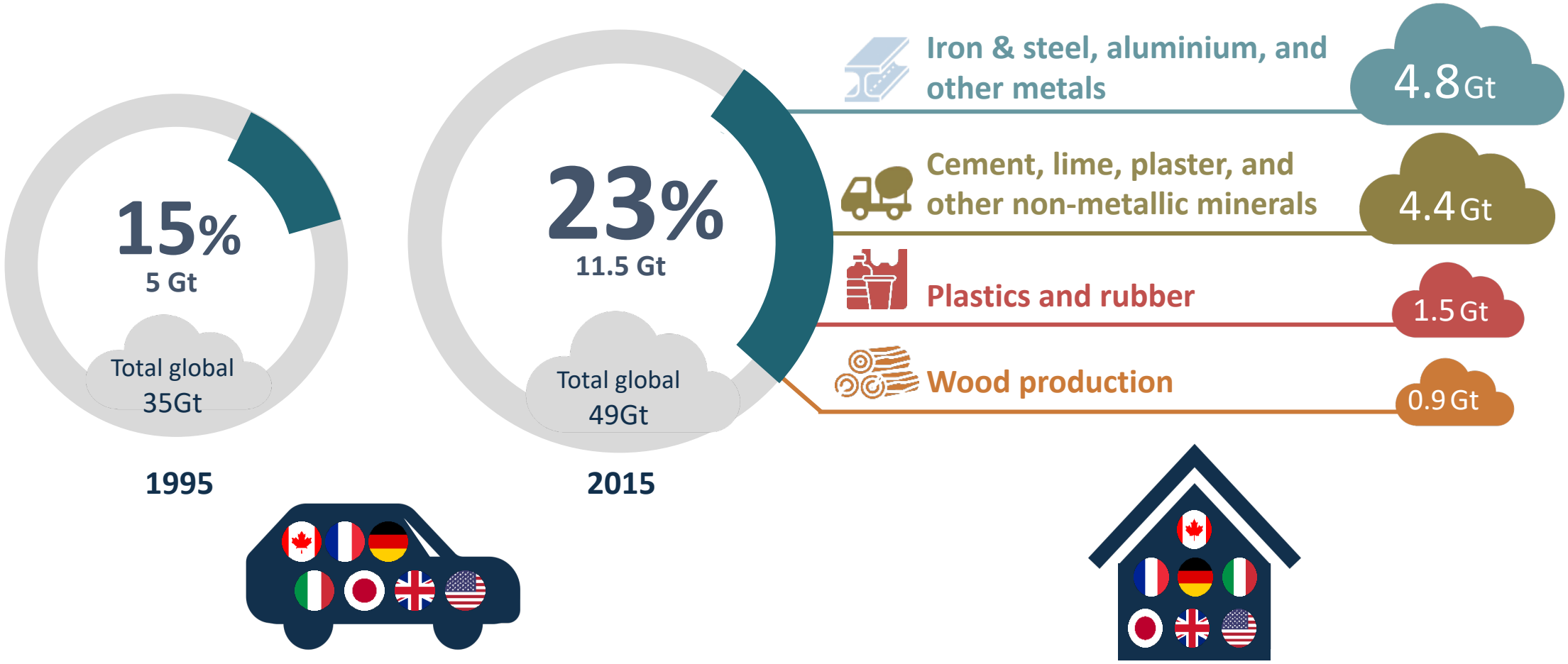


Lead authors and IRP Members

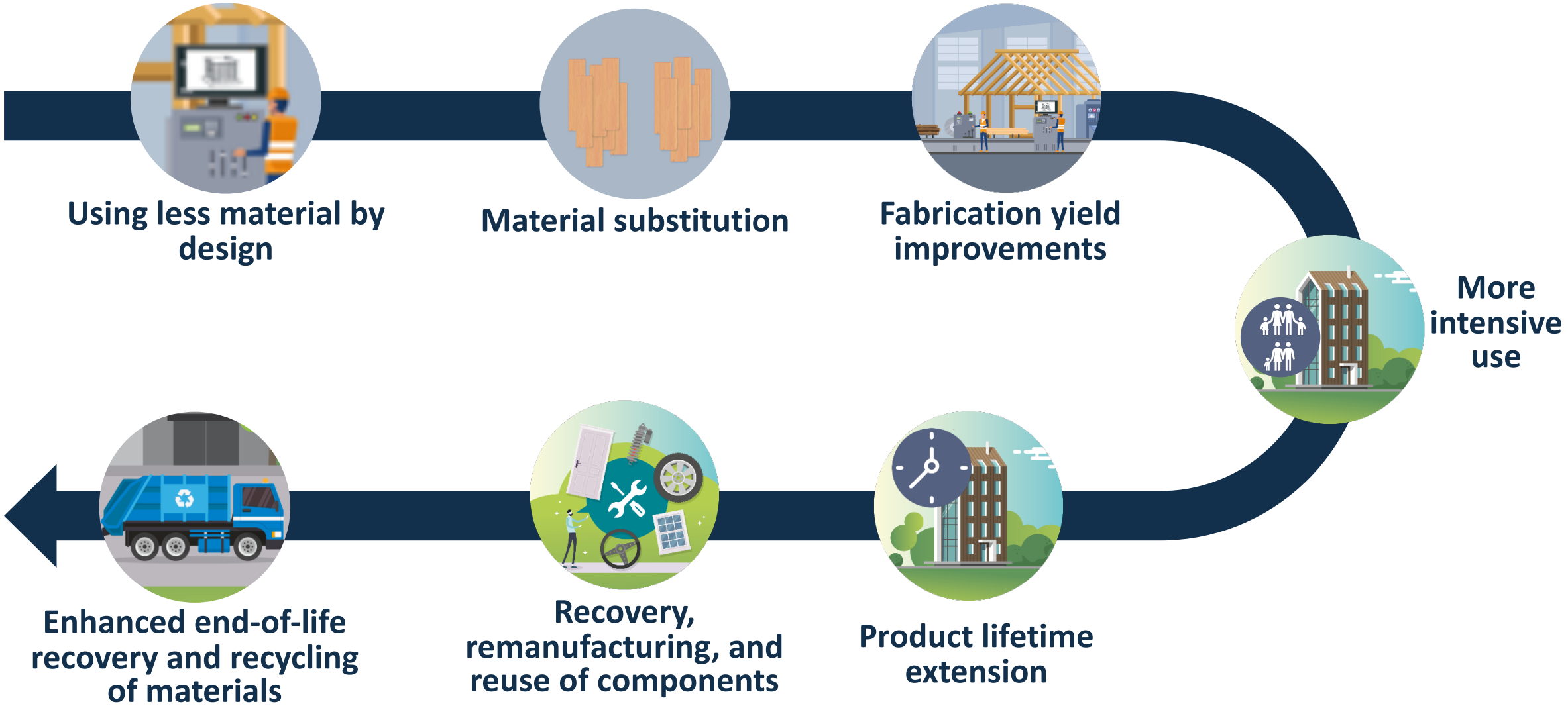
- **Edgar Hertwich**
  Professor at Norwegian University of Science and Technology
- **Reid Lifset**
  Research Scholar at Yale University

The production of materials causes 23% of global GHG emissions

Global GHG emissions from a value-chain perspective

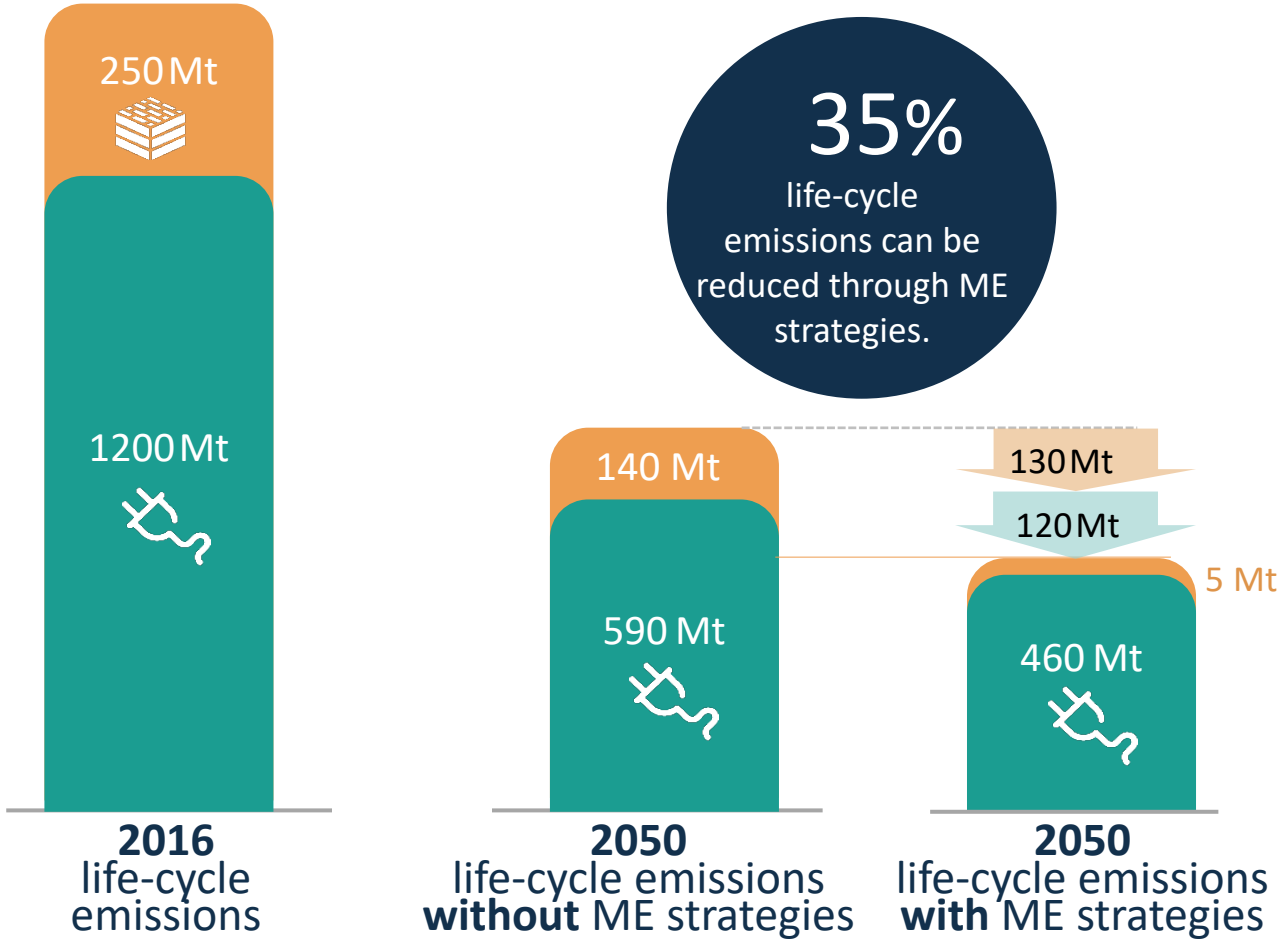


Report assesses seven crucial Material Efficiency Strategies to reduce emissions



Material Efficiency (ME) Strategies can reduce **35-40%** of lifecycle emissions from **homes** in **G7 countries** in 2050

- Material cycle emissions
- Emissions from operational energy use
- Material cycle emission reductions
- Operational energy use emission reductions



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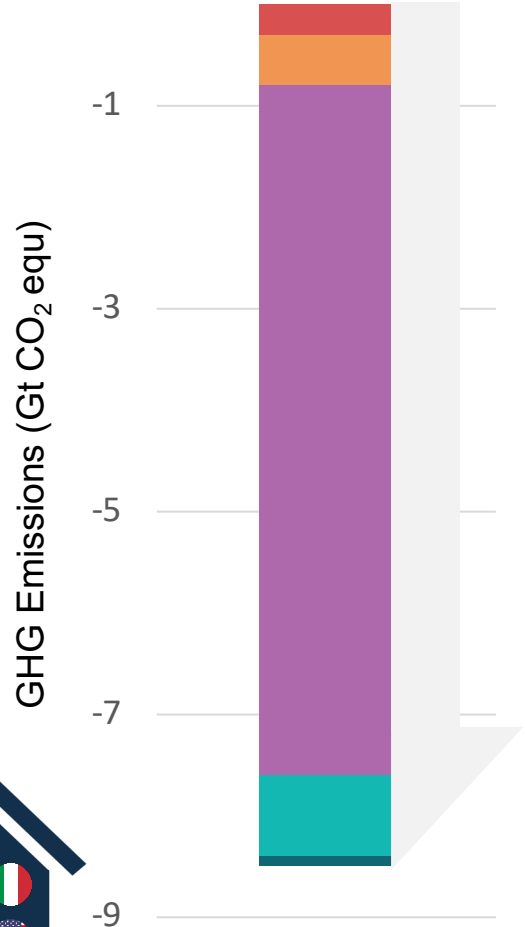
Download the report: bit.ly/IRPrecc

More intensive use and recycling are the most important strategies

Potential GHG savings from material efficiency strategies for homes in G7 (2016-2060)



- Using less material by design
- Material substitution
- More intensive use
- Enhanced end-of-life recovery and fabrication yield improvements
- Product lifetime extension and reuse

**The reduction potentials shown here are for strategy cascades, i.e. implementing one strategy after the other, therefore having synergetic effects.*

Most of the strategies reduce predominantly material related emissions

Some affect materials and operational energy use

✓ **More intensive use reduces materials and heating/cooling needs**

✓ **Material substitution (wood instead of cement) can increase energy use**

Ca. 20% cumulative savings

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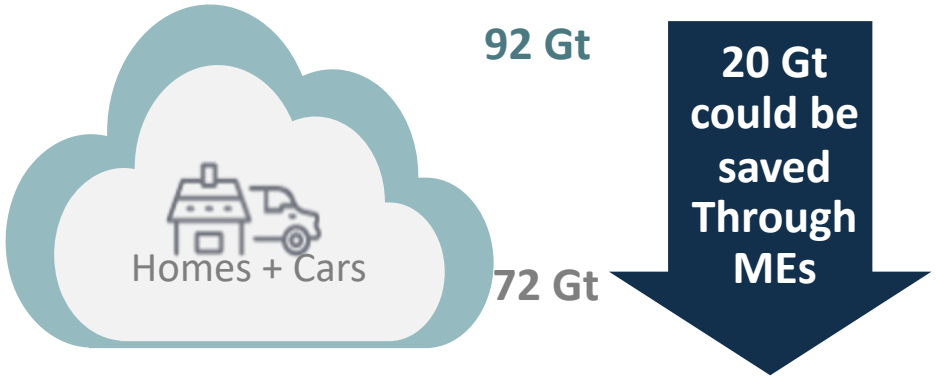
Cumulative savings from both sectors are 20Gt -36Gt

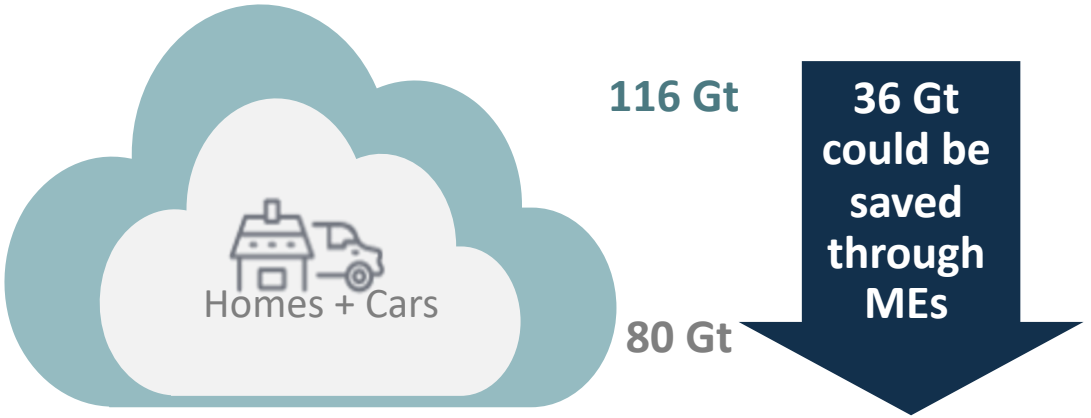
2016-2060 cumulative emissions **with energy measures** but **without** Material Efficiency (ME) strategies

2016-2060 cumulative emissions if **Material Efficiency (ME)** strategies are applied **on top of energy measures**

G7 countries



China and India



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THANK YOU

Download the full report, Summary for Policymakers and other material at:

www.resourcepanel.org/reports

For questions and engagement please contact

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The Weight of Cities
&
Integrated Infrastructure Systems Innovation for a Sustainable Future

Dr. Anu Ramaswami

Member, International Resource Panel, UN Environment
Director, NSF Sustainable Healthy Cities Network, USA
Professor of Engineering and India Studies, Princeton University

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PRINCETON UNIVERSITY

Sustainable Healthy Cities

NSF

The Weight of Cities
Resource Requirements of Future Urbanization

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Mark Swilling (South Africa), Maarten Hajer (The Netherlands), Blake Robinson (South Africa), Serge Salat (France), Tim Baynes (Australia), Josephine Musango (South Africa), Anu Ramaswami (USA), Sangwon Suh (USA), Joe Bergeson (USA), Françoise Labbé (France)

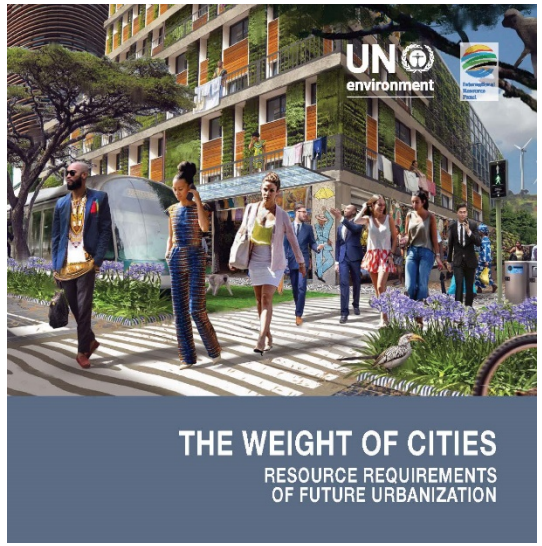
The Weight of Cities: Three Questions

Q1: How much material will be required for future urbanization?

Q2: What are the environmental and wellbeing implications of current urbanization trends?

Q3: Are there pathways to reduce resource use by a factor of 5 or more, with high urban wellbeing (decoupling)?

Four Levers: Interconnected Infrastructure Pathways for Decoupling



Factor of 5-10 reduction is envisioned and maybe feasible

Lever 1- Strategic Intensification/Compact Urban Development

- Spatial restructuring
- Human scale design

Lever 2- Sector Specific Strategies and Technologies

- Renewable Energy and Building Efficiency
- Non-motorized Transportation

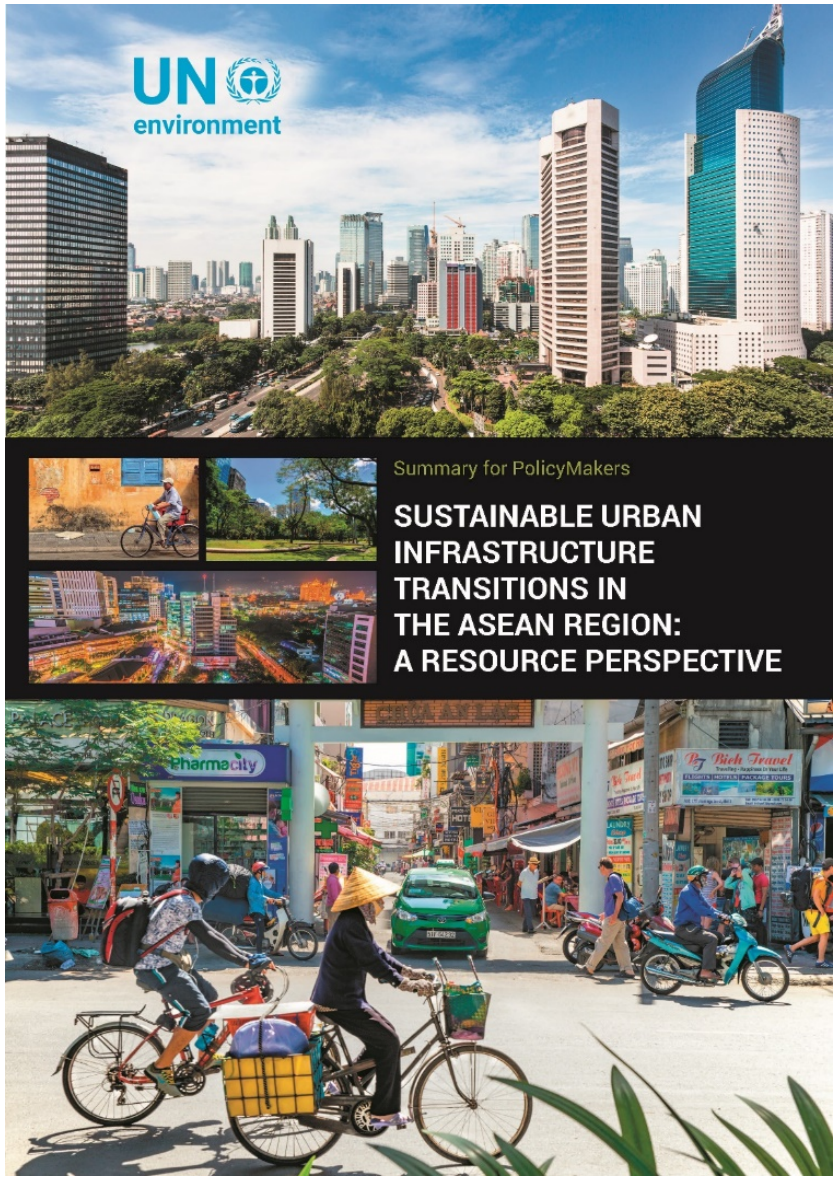
Lever 3- Cross-sector Strategies to Leverage Resource Exchanges

- Waste heat exchange for district energy
- Power plant fly ash in construction materials

Lever 4-Sustainable Behavior Change

- Energy conservation
- Mode choice

From Global to Regional Contexts- ASEAN Report



Collaborative Regional Report for UNEP Cities Unit;

Led by Ramaswami with researchers in the US Sustainable Healthy Cities Network - A network of university researchers, cities and industry practitioners working together to build better cities

Sustainable Healthy Cities
A National Science Foundation-supported Sustainability Research Network (SRN)

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Sustainable Healthy Cities

Role of natural resources in environmental displacement and migration

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IRP Panel lead authors Dominic Kniveton and Riyanti Djalante

Additional lead authors: Oli Brown, Caroline Zickgraff, Kyle Davis, Noam Levin, Jesus Cuaresma

Researchers: Martin Clifford, Sonja Ayeb-Karlsson, Kopo Oromeng

IRP Secretariat coordinator: Christina Bodouroglou

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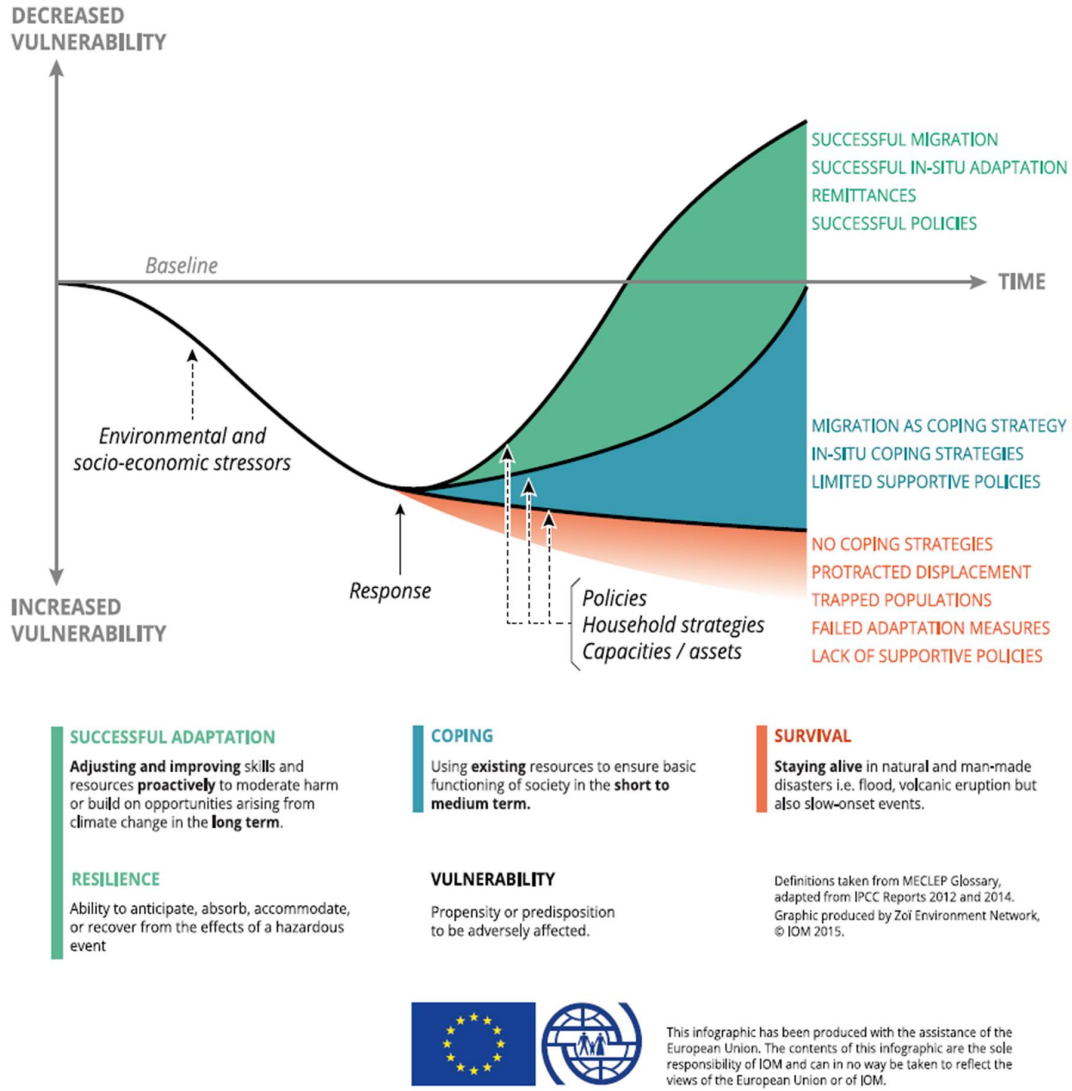
Our lens on migration / mobility

- Complex adaptive systems
- Avoiding linear causality but considering dominant variables
- Internal and international mobility are both considered
- Not reinventing the wheel – for example, learning from World Bank Groundswell report
- Data-driven approach – largely ex post analysis. Any further ex ante analysis would be presumptuous except with hydropower

Figure 2. Migration and environmental change: vulnerability and resilience scenarios



Source: Figure created for the IOM Project - Migration, Environment and Climate Change: Evidence for Policy (MECLEP) (2014-2017).

Six Chapters of Assessment

- Introduction – conceptual approach
- Systematic literature review
- Ex post spatial analysis
  - Hydropower projects
  - Mineral rushes
  - Refugees and resource impacts at destination
- Econometric analysis of various resource variables linked to migration
- Systems linkages maps
- Policy Recommendations

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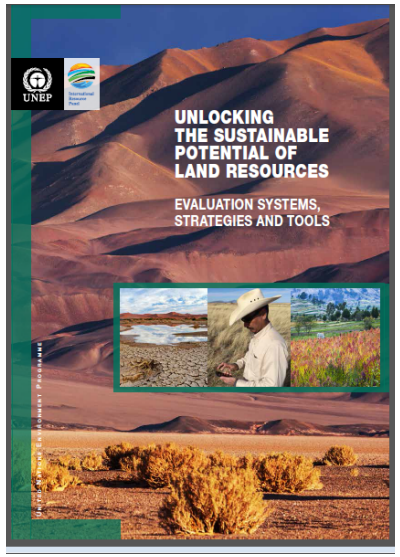
United Nations Convention to Combat Desertification

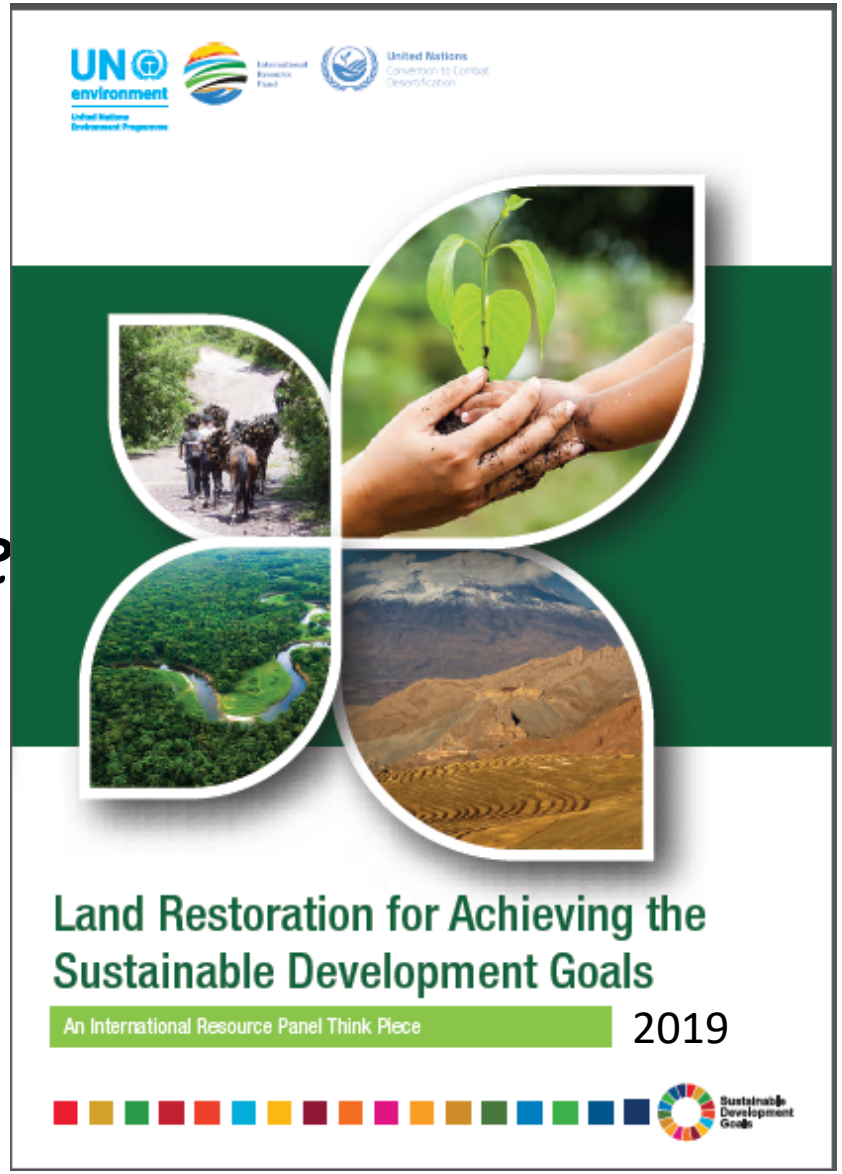
Land Restoration for Achieving the Sustainable Development Goals

An International Resource Panel Think Piece

Jeff Herrick- IRP Panel Member/Report Lead Author
USDA Agricultural Research Service (Jornada)

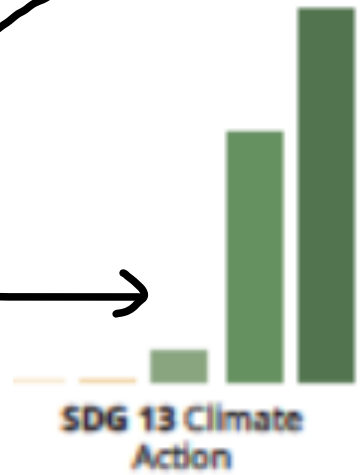


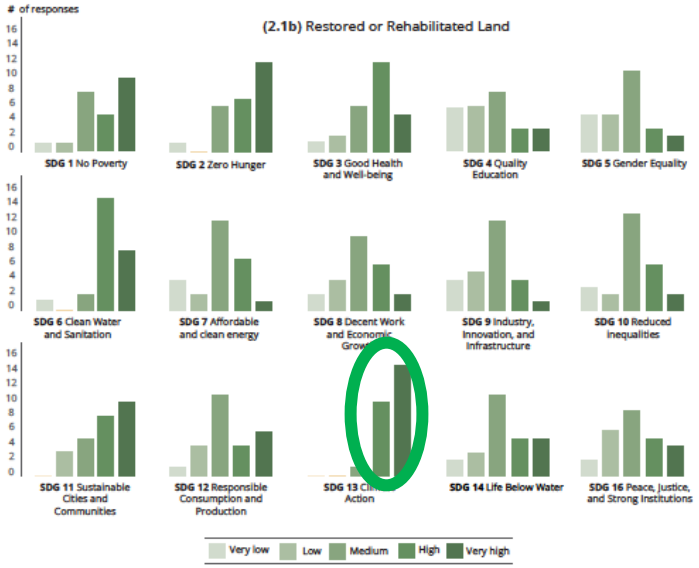
Builds on previous (2016) IRP report focusing on decoupling land use from environmental impacts by matching land use with its sustainable potential

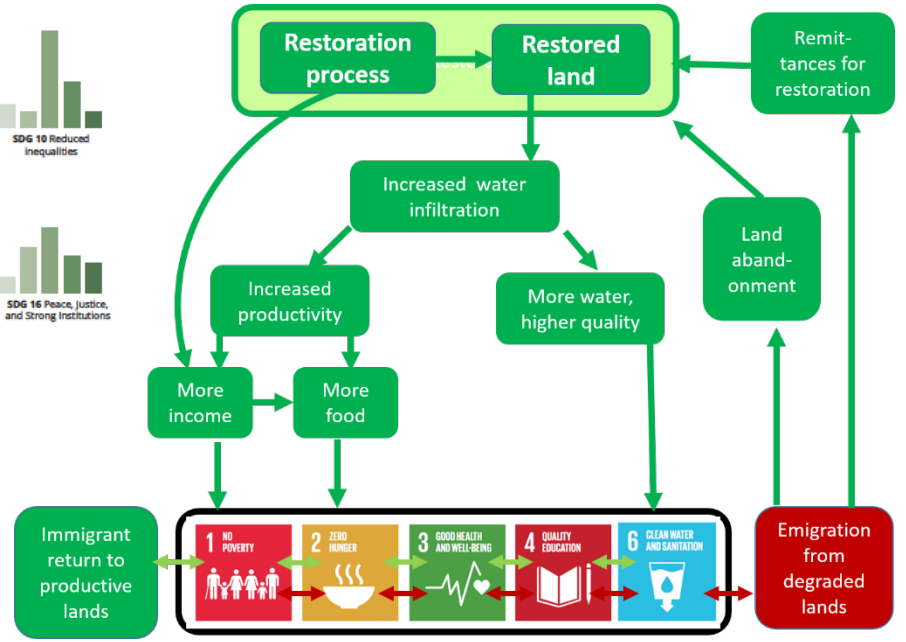


Conclusions:

1. ***Land restoration and rehabilitation can have significant co-benefits for ALL SDGs.***
2. The extent of the restoration co-benefits and the potential risks and trade-offs ***vary widely among the SDGs*** and their respective targets.
3. The ***co-benefits of the restoration process are often much different than those of the restored land,*** AND often work at different temporal scales.
4. ***Quantitative and qualitative modelling,*** including scenario development, at local to global scales can help guide future investments.
5. An ***integrated landscape approach,*** including targeting research and investments, is key to increasing the total return on land restoration investments.







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