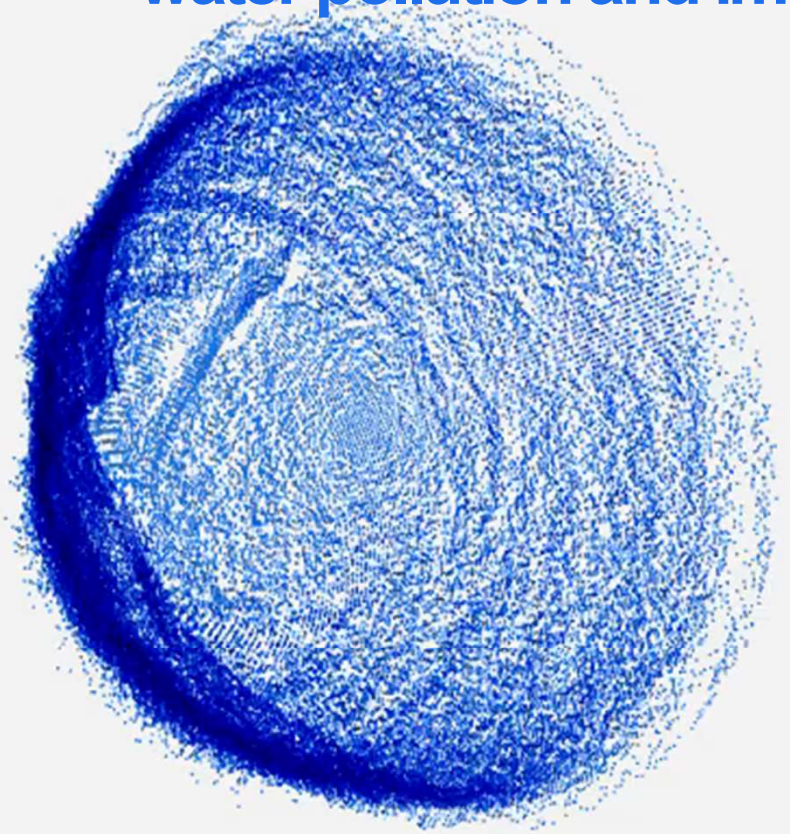
Compost from organic waste as an option for reducing water pollution and improving soil health in Sri Lanka



DR BEKCHANOV MAKSUD

CENTER FOR DEVELOPMENT RESEARCH (ZEF)/
UNIVERSITY OF BONN (GERMANY)

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Outline:

Introduction

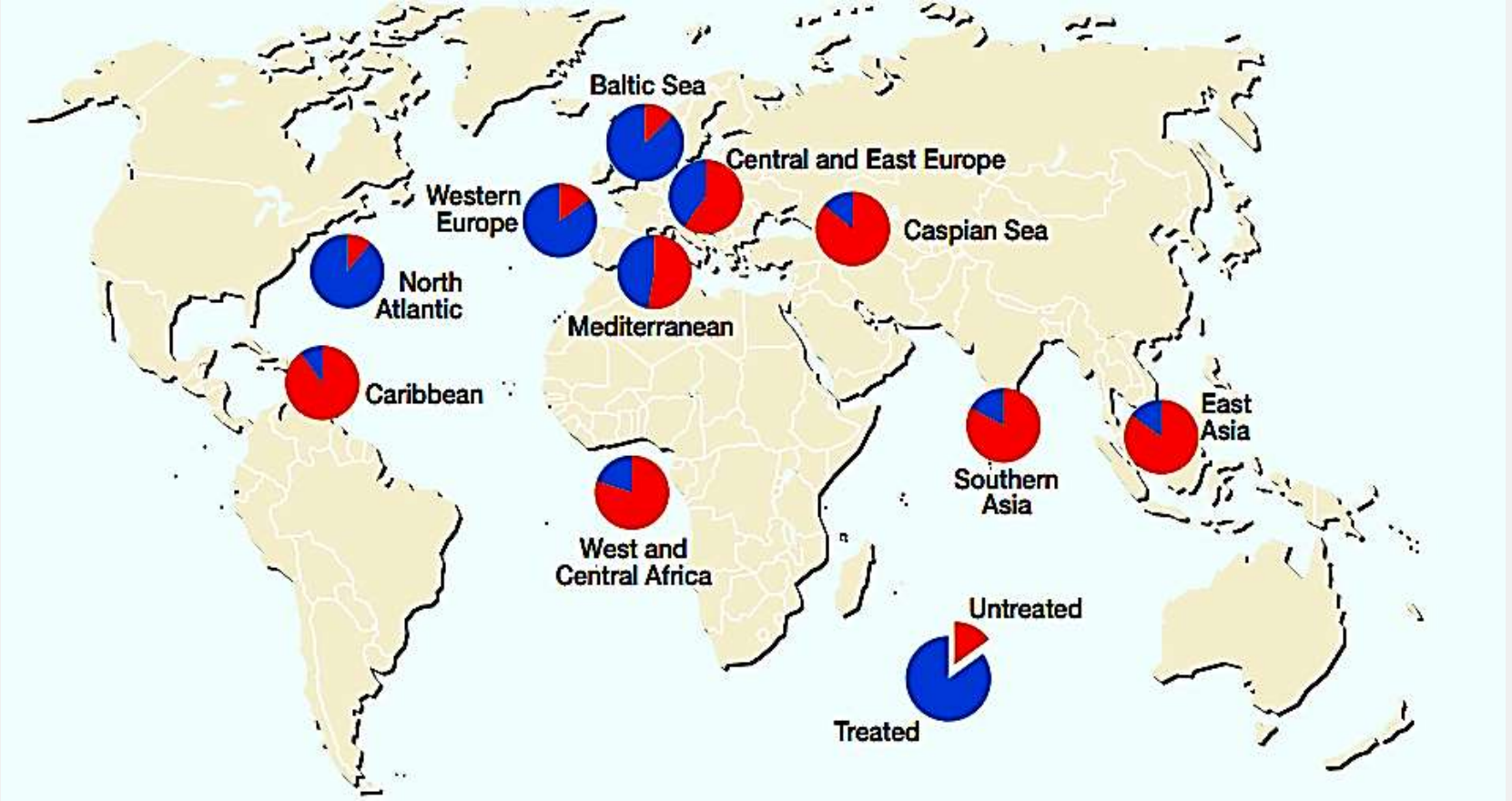
Study area

Method

Results

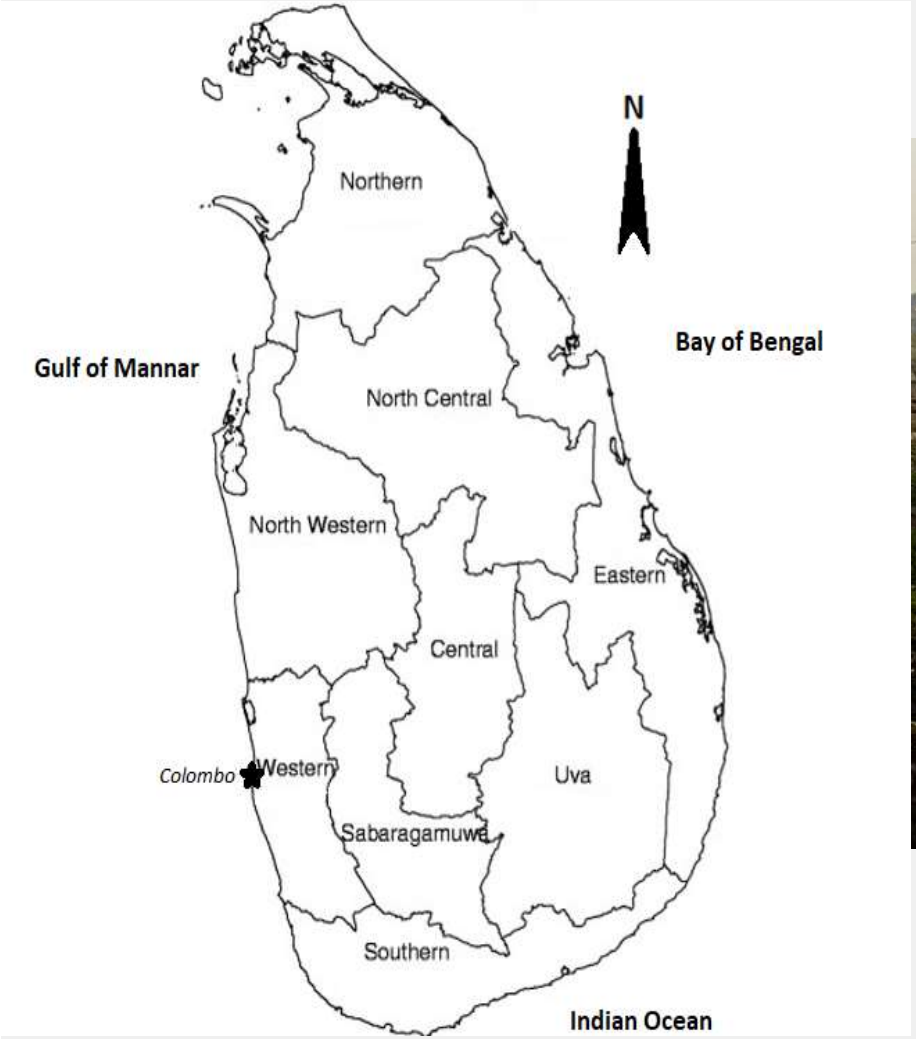
Conclusions

Environmental pollution and health degradation are acute issues related with inadequate treatment of wastewater in South Asia



Source: Corcoran et al. (2010)

Waste related pollution is vivid in most regions including Sri Lanka



Despite availability of massive amounts of nutrients from organic waste fertilizer for agriculture is mostly imported in Sri Lanka

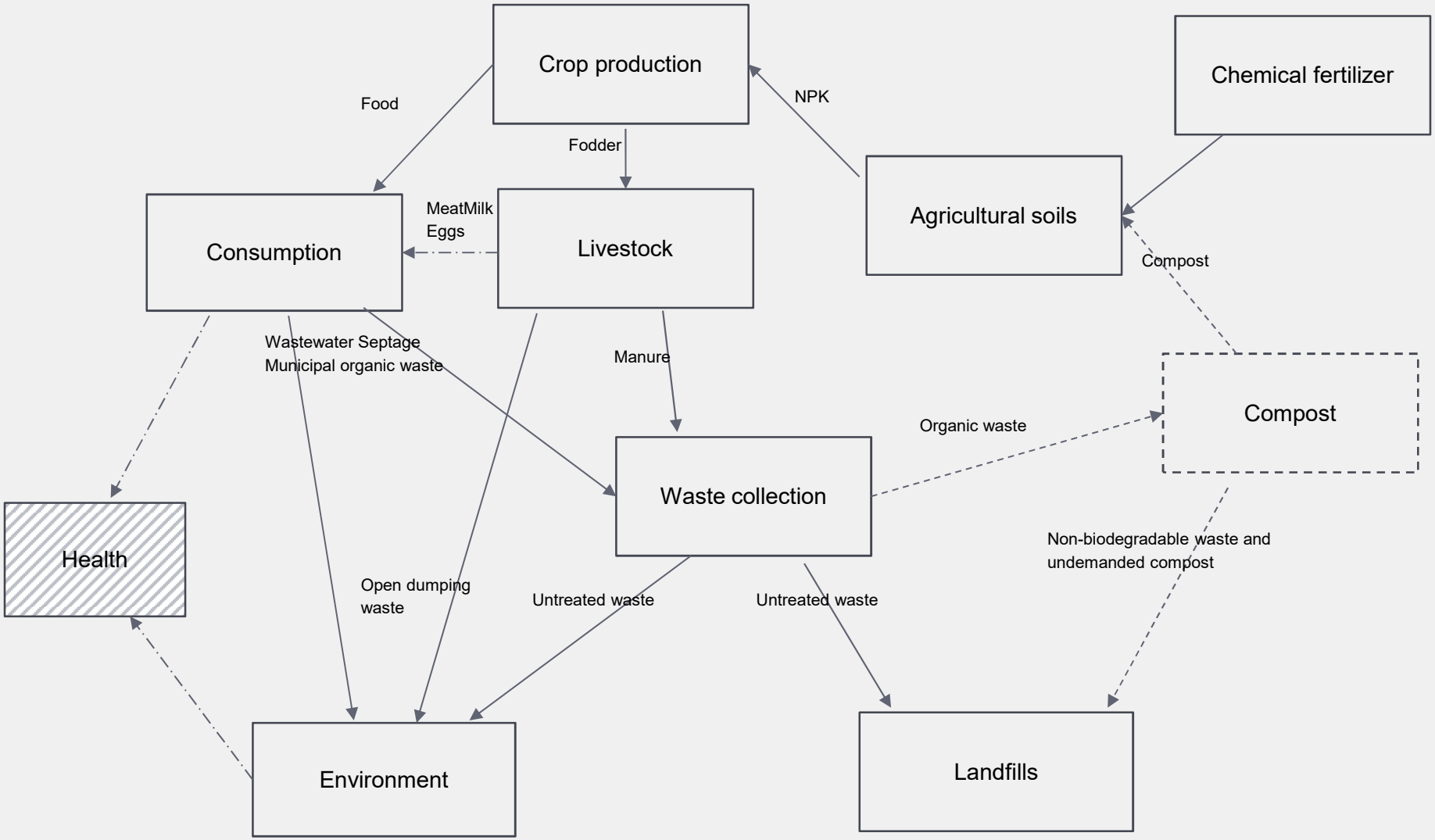
Year	Production	Exports	Imports
Nitrogen fertilizers			
2005	0.0	0.0	159.6
2010	0.0	0.0	166.1
2014	0.0	0.0	227.4
Phosphate fertilizers			
2005	11.0	0.0	22.6
2010	10.0	0.0	40.7
2014	1.0	0.0	45.4

Note: The unit of fertilizer volume is in 1000 tons
Source: Bekchanov (2018)

Composting organic waste to supply nutrients for agriculture has been expanding across Sri Lanka

Source: Based on Central Environmental Authority (2015)

Composting is an option of returning nutrients back to the agricultural soils



Source: Bekchanov (2018)

Objective function of the optimization model

$$\sum_r \sum_w \left(xp_{r,w}^{UC}\left(1 - g_{r,w}^{DOM}\right) Q_{r,w}^{UC}\right)$$

Waste collection

$$+ \sum_r \sum_w xp_{r,w}^{C}\, Q_{r,w}^{C}$$

Open dumping

$$+ \sum_r \sum_w xp_{r,w}^{UR}\, Q_{r,w}^{UR}$$

Sanitary land-filling

Waste management

$$+ xp_{r,w}^{R}\, Q_{r,w}^{R}$$

Compost production

$$+ \sum_r \sum_q t_{r,q}\, QM_{r,q}^{TRN}$$

Compost transportation

Compost

$$+ \sum_r xp_r^{MUS}\, QM_r^{USE}$$

Compost application

$$+ \sum_r \sum_f p_{r,f}^{FER}\left(1 - fert_{r,f}^{SUB}\right) Q_{r,f}^{FER} \rightarrow MIN$$

Purchasing chemical fertilizers

Fertilizer uses

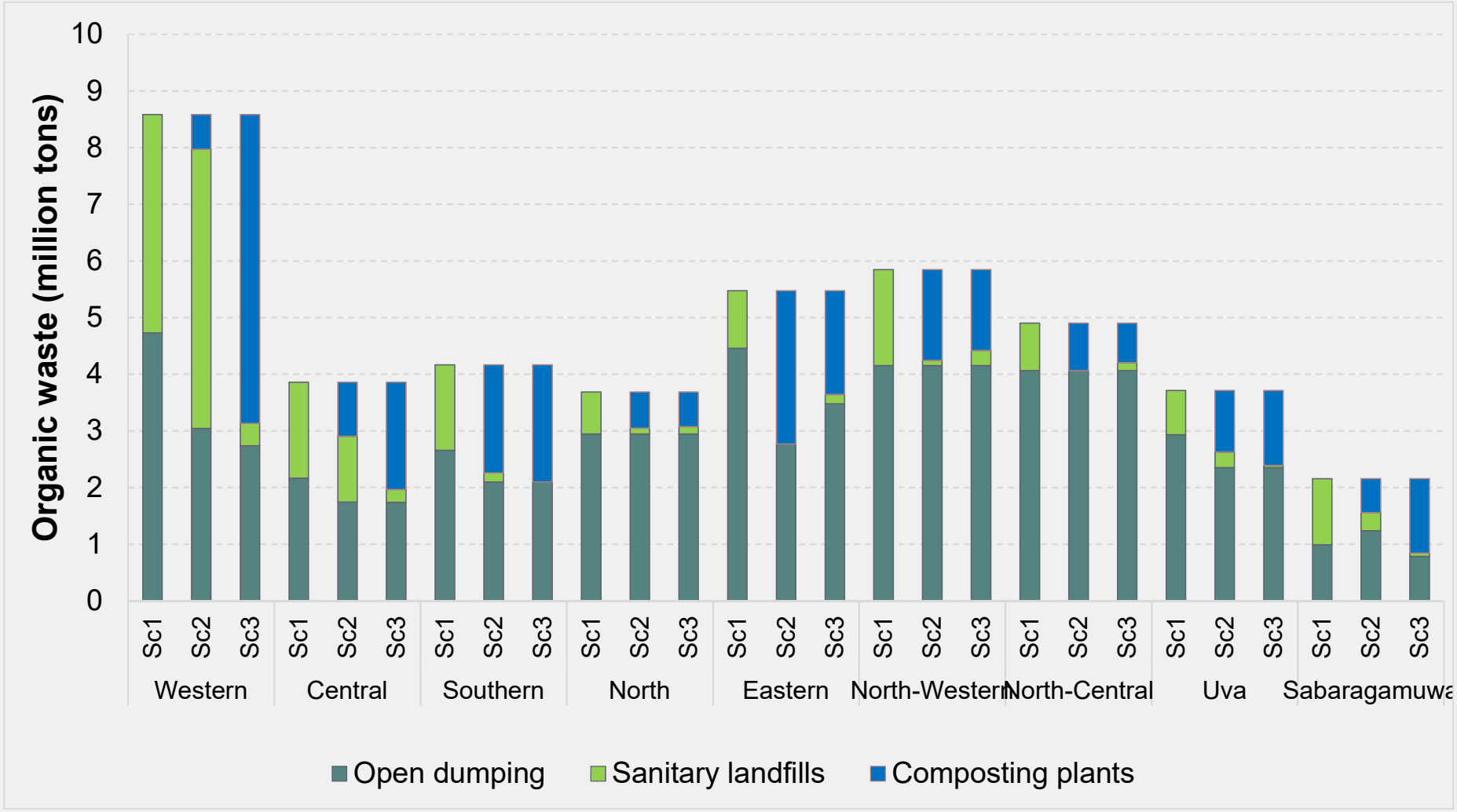
Scenarios

Sc1 - No waste recycling (composting);

Sc2 – Waste recycling (composting) without the possibility of inter-regional transfer of the compost;

Sc3 – Waste recycling (composting) with the possibility of inter-regional transfer of the compost.

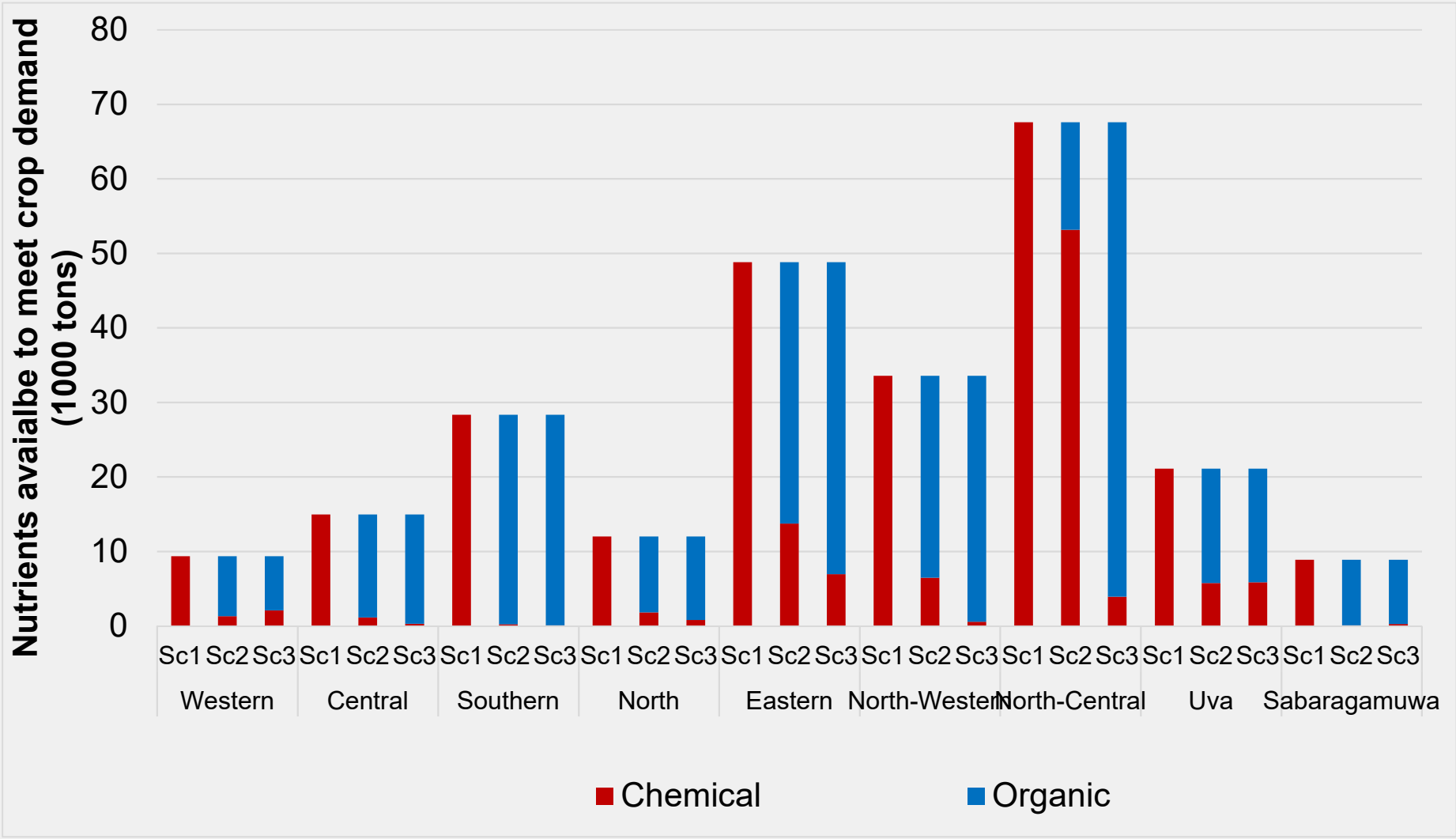
Destinations of organic waste



Potentials of producing compost are much high in urban areas

Source: Bekchanov (2018)

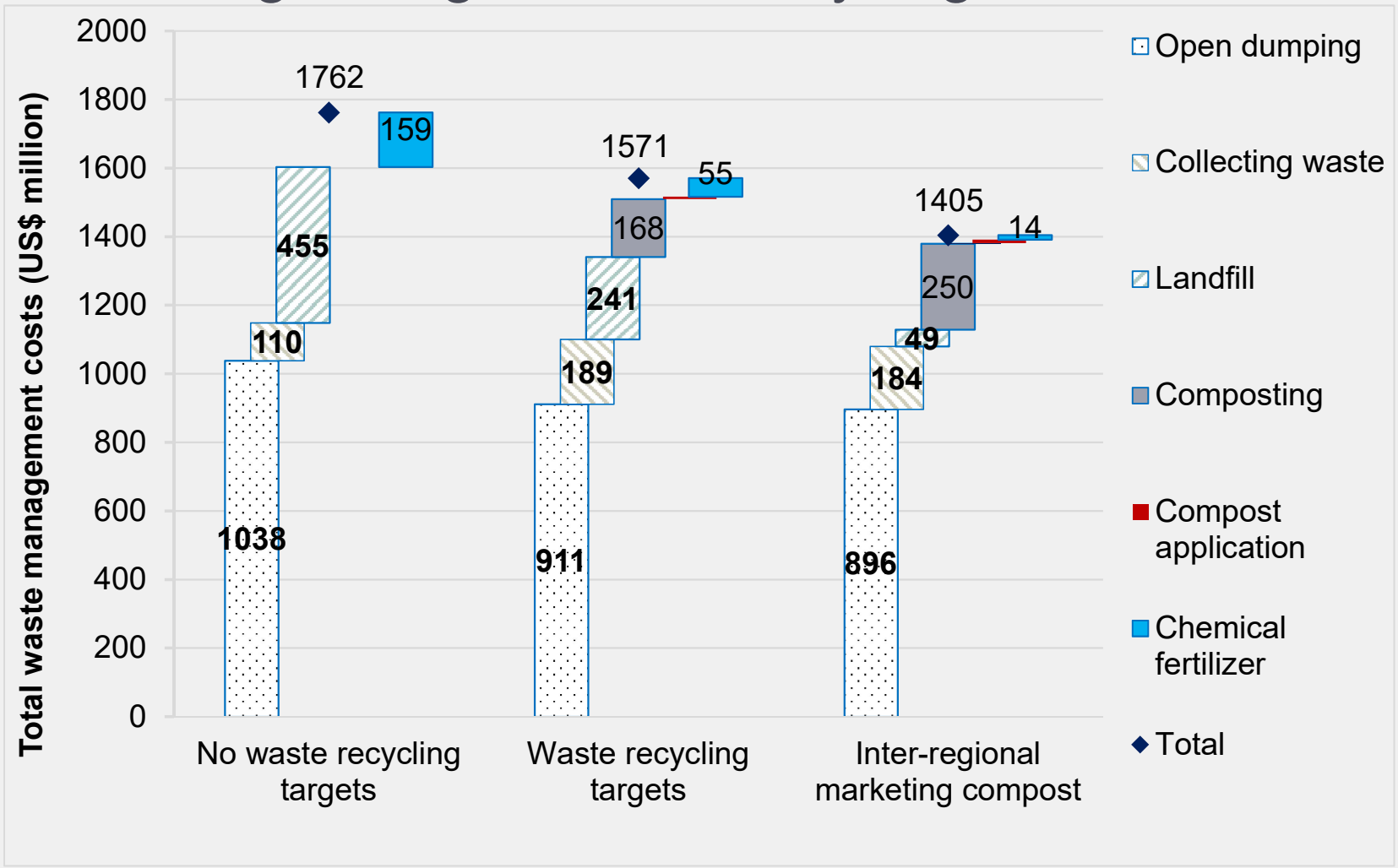
Chemical and organic fertilizer nutrient uses



Trading in compost is expected to increase the compost uses

Source: Bekchanov (2018)

Costs along the organic waste recycling chain



Compost production and trading can considerably reduce landfilling and chemical fertilizer application costs

Source: Bekchanov (2018)

Conclusions of modeling outcomes

Composting can considerably reduce open dumping and environmental pollution

Composting may help in saving the costs of importing chemical fertilizers (more than US$ 104 million)

Permitting inter-regional transfer of composting reduces environmental burden of waste in densely populated areas and improves access to nutrients in rural areas

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Circular economy of composting in Sri Lanka: Opportunities and challenges for reducing waste related pollution and improving soil health

M. Bekchanov*, A. Mirzabaev

Center for Development Research (ZEF), Bonn University, Genscherallee 3, Bonn 53113, Germany

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ABSTRACT

Inadequate management of organic waste is a key cause of environmental pollution and nutrient loss in developing countries. Composting is a win-win option that allows for not only reducing environmental pollution derived by open dumping of waste but also recovering nutrients essential for crop production, consequently enhancing crop yields and reducing expensive chemical fertilizers usage. Considering these environmental and economic benefits, this study develops an economic optimization model to assess the impact and financial feasibility of compost production and marketing in Sri Lanka. The analysis does not treat compost production as an isolated sector, but traces the combined relationship between compost and chemical fertilizer applications for sustainable crop production. The findings indicate that establishing compost facilities to recycle organic waste in Sri Lanka will decrease total waste management and chemical fertilizer use costs by US$191 million. Facilitating inter-provincial trade in compost will further expand the composting potential in the country, reducing waste management and chemical fertilizer use costs by US$357 million. Successful implementation of wide-scale composting projects will require better accounting and planning in the waste management system, greater public awareness about waste derived environmental pollution, and better working conditions and safety in the sector. Increased use of compost in crop production in Sri Lanka depends on improved mechanisms for monitoring and certifying compost quality, more effective compost subsidy policies and increased knowledge and application of Integrated Nutrition Management measures.