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NUTRIENTS FROM ORGANIC WASTE TO IMPROVE SOIL HEALTH AND ENHANCE FOOD SECURITY IN SRI LANKA

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Poor sanitation and inadequate treatment of organic waste are key factors for environmental pollution and health degradation

Inadequate waste and wastewater management

-Open defecation (Lack of latrines and septic tanks)

-Lack of waste collection and transportation

-Lack of treatment or minimal treatment

Environmental effects:

-Water and air pollution (GW contamination, eutrophication)

-Land degradation and biodiversity loss

Health effects:

-Water-borne diseases due to water quality degradation (Hasan 2017)

-Diseases related with consuming contaminated food (Vangani et al 2017)

Economic effects:

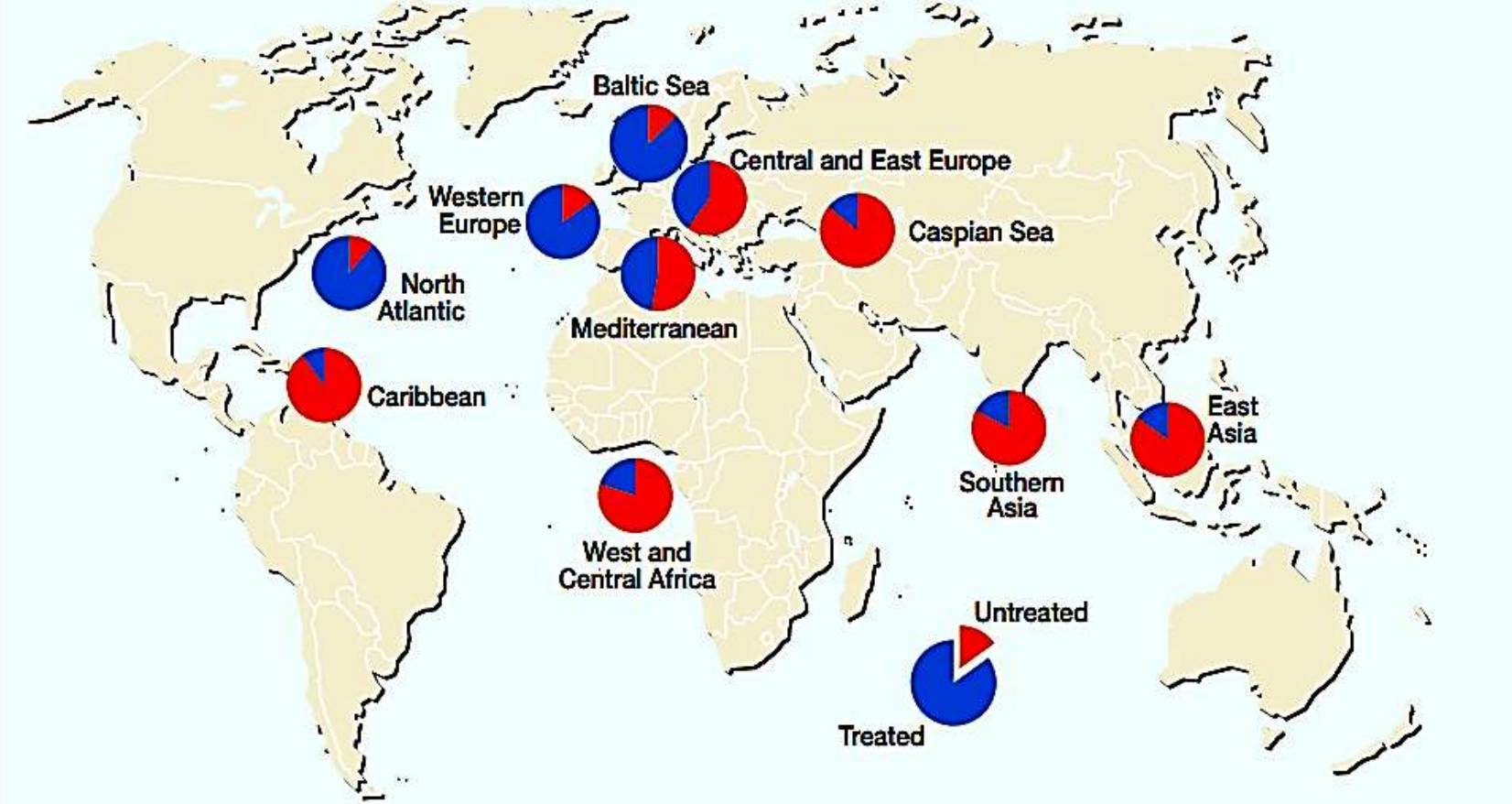
-Reduced agricultural and industrial productivity

-Reduced environmental and recreation benefits

-Increased costs of healthcare (Hutton et al 2007)

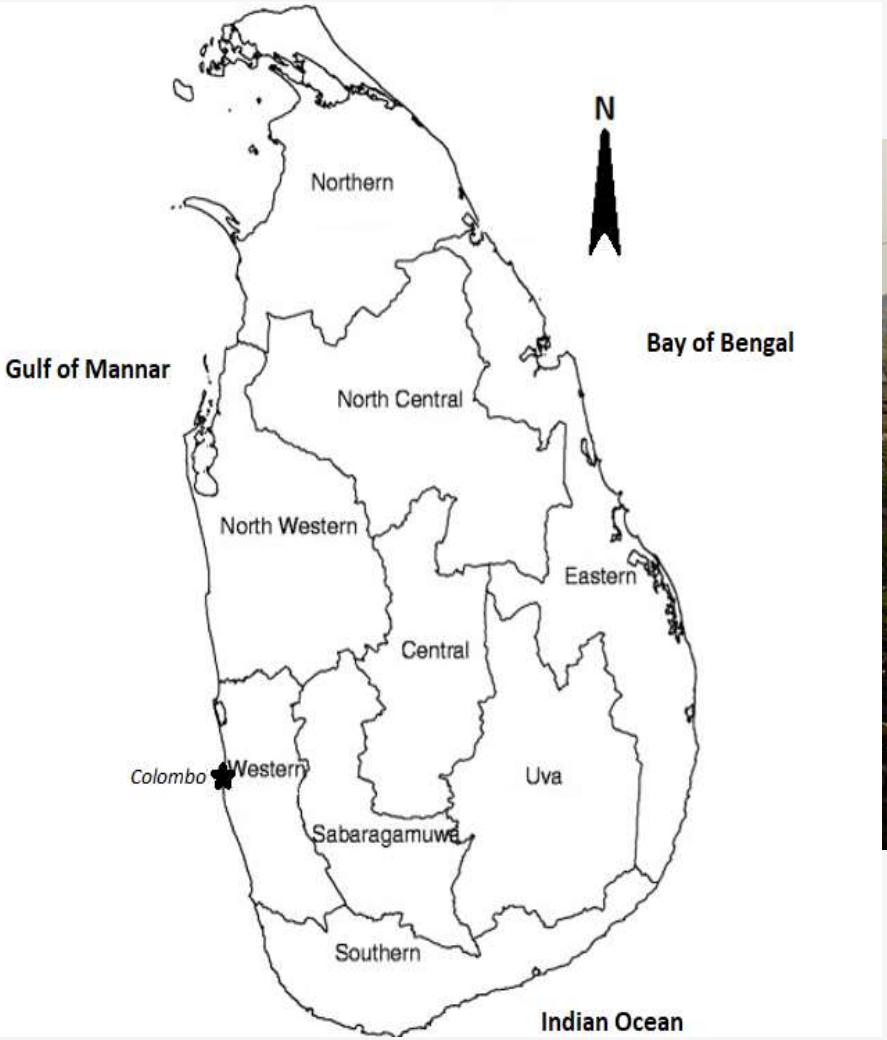
Source: UNWATER (2017), Bekchanov (2017), WSP (n.d.)

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 areas including Sri Lanka

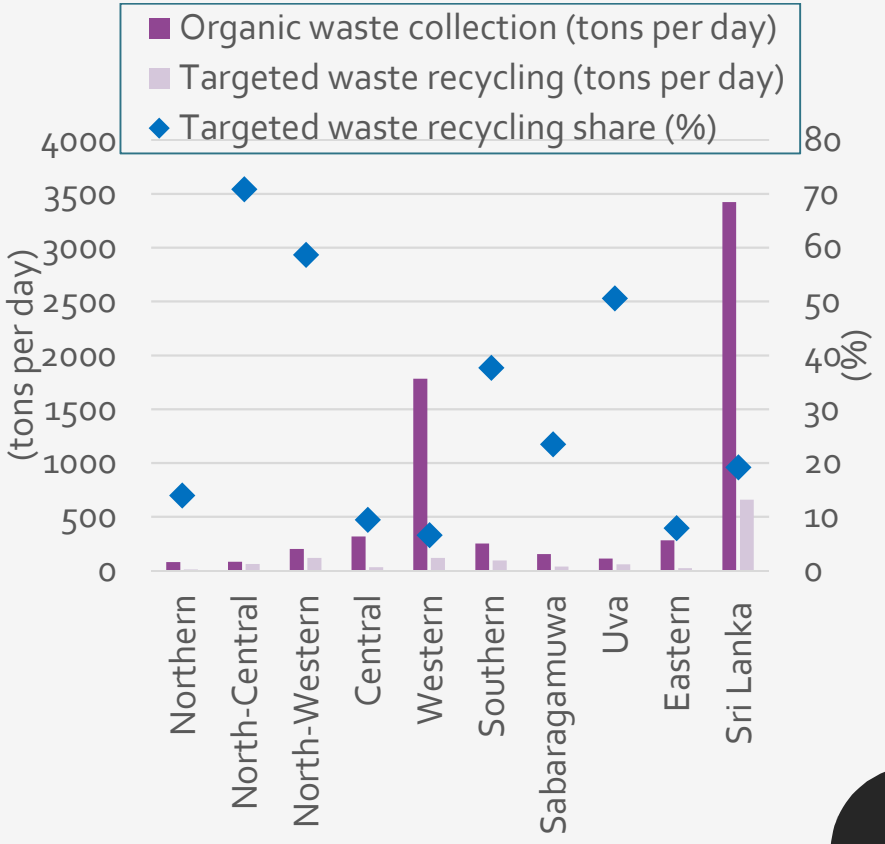


Despite availability of massive amounts of nutrients from organic waste fertilizer for agriculture is mostly imported

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

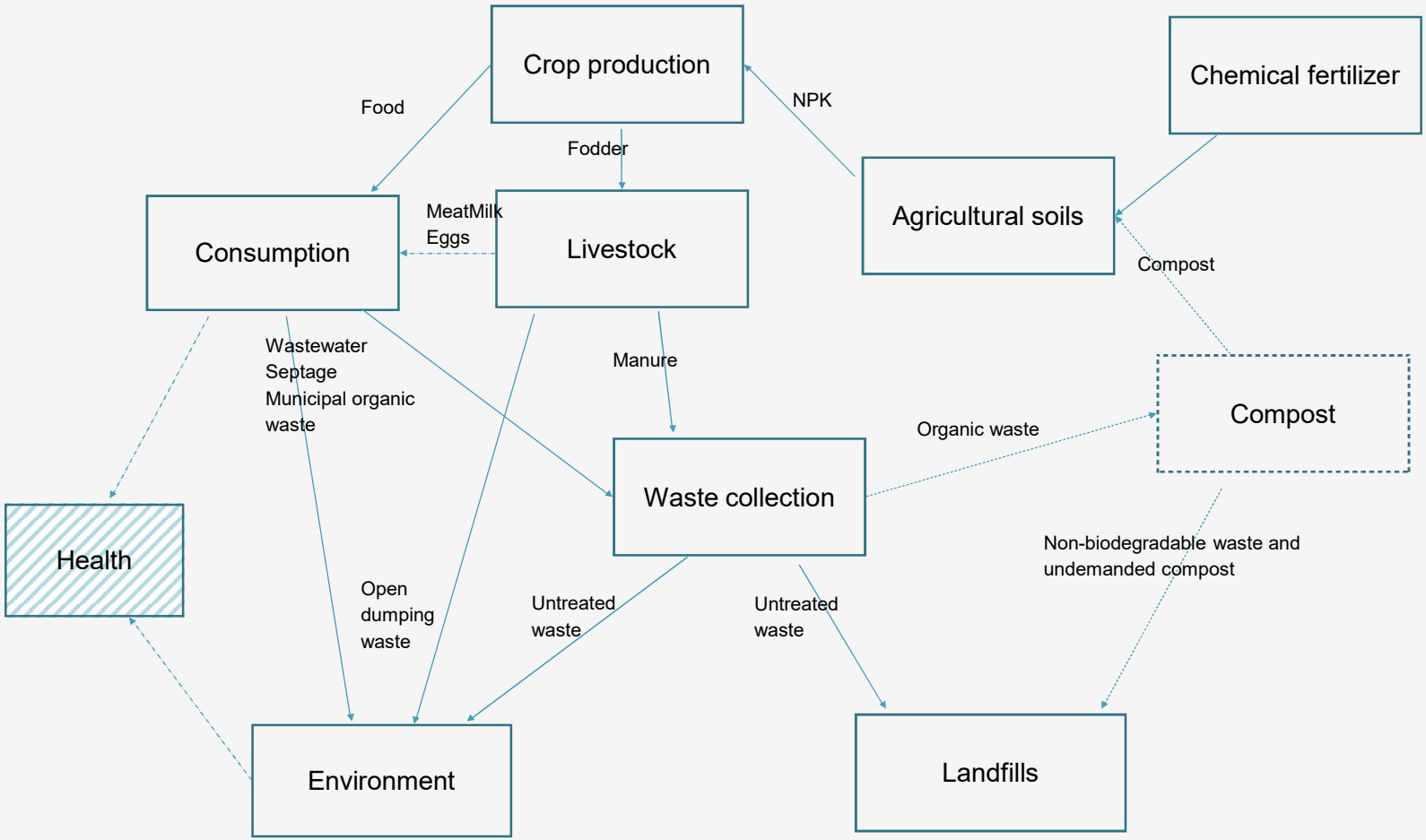
Note: The unit of fertilizer volume is in 1000 tons
Source: Bekchanov (2018)

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

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

Compost production

Waste management

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

Compost transportation

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

Compost application

Compost

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

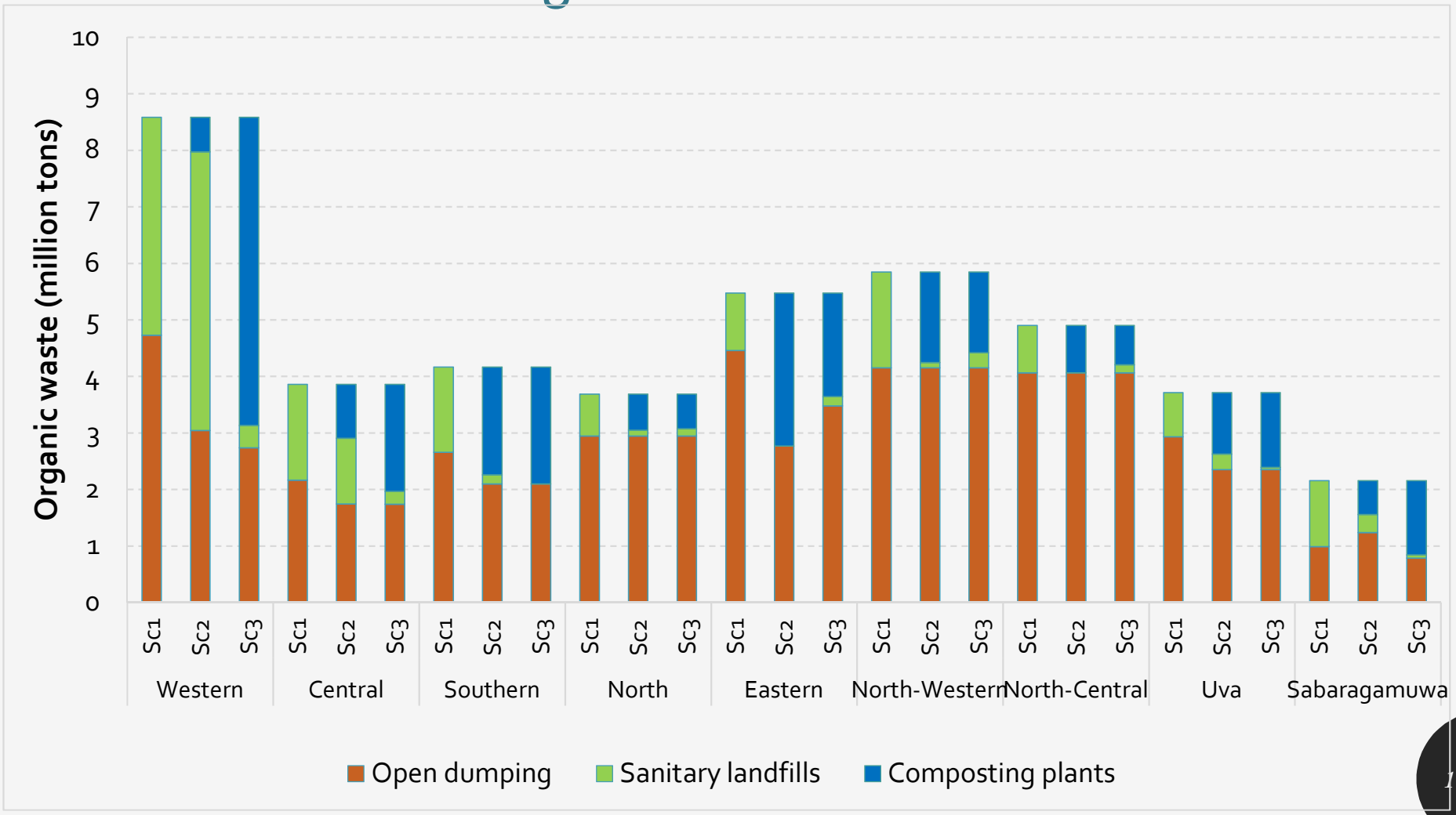
Purchasing chemical fertilizers

Fertilizer uses

Scenarios

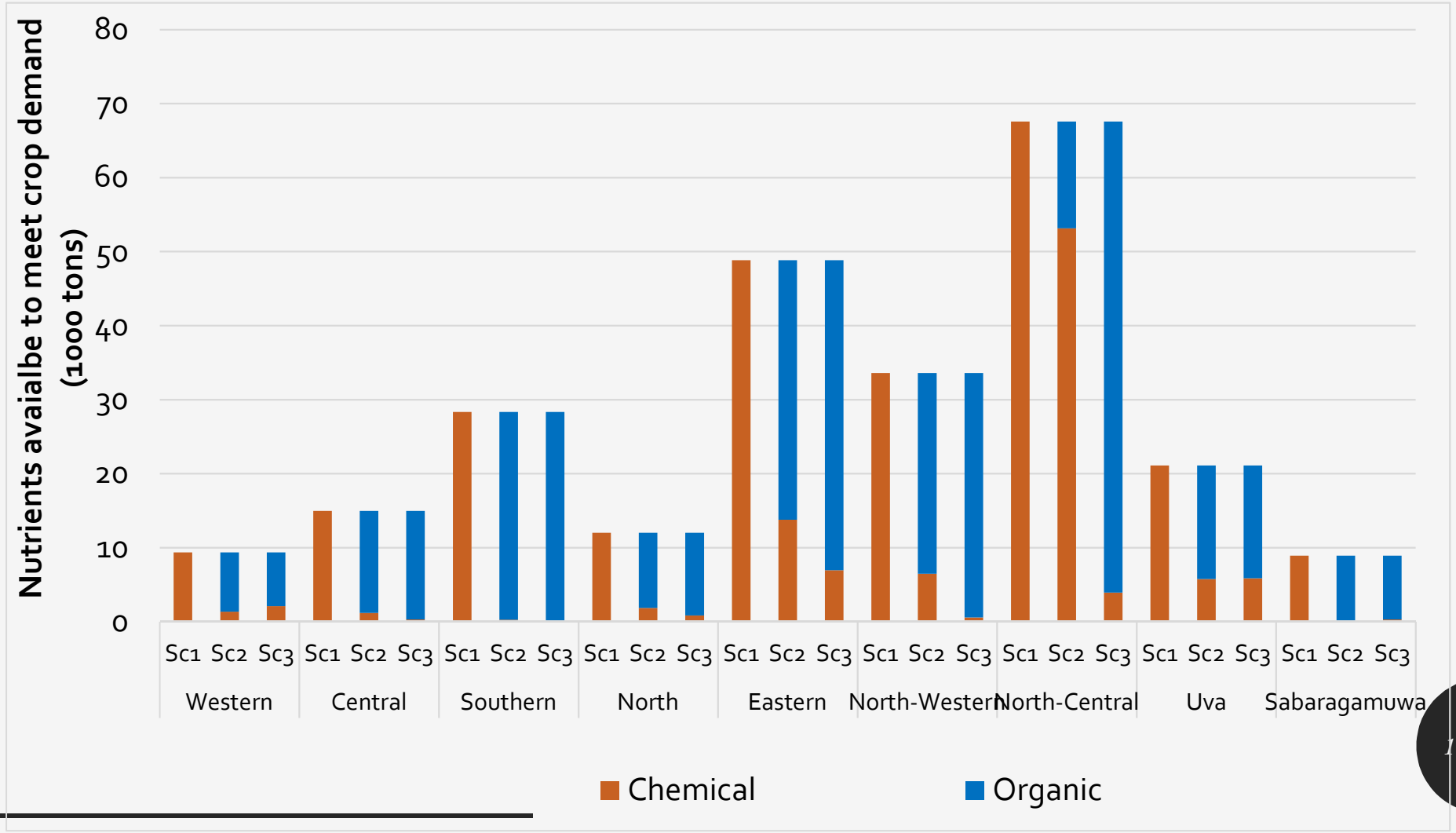
- **Sc1** - No waste recycling (composting);
- **Sc2** – Waste recycling (composting) without the possibility of inter-regional transfer of the compost;
- **Sc3** – Waste recycling (composting) with the possibility of inter-regional transfer of the compost.

Potentials of producing compost are much high in urban areas



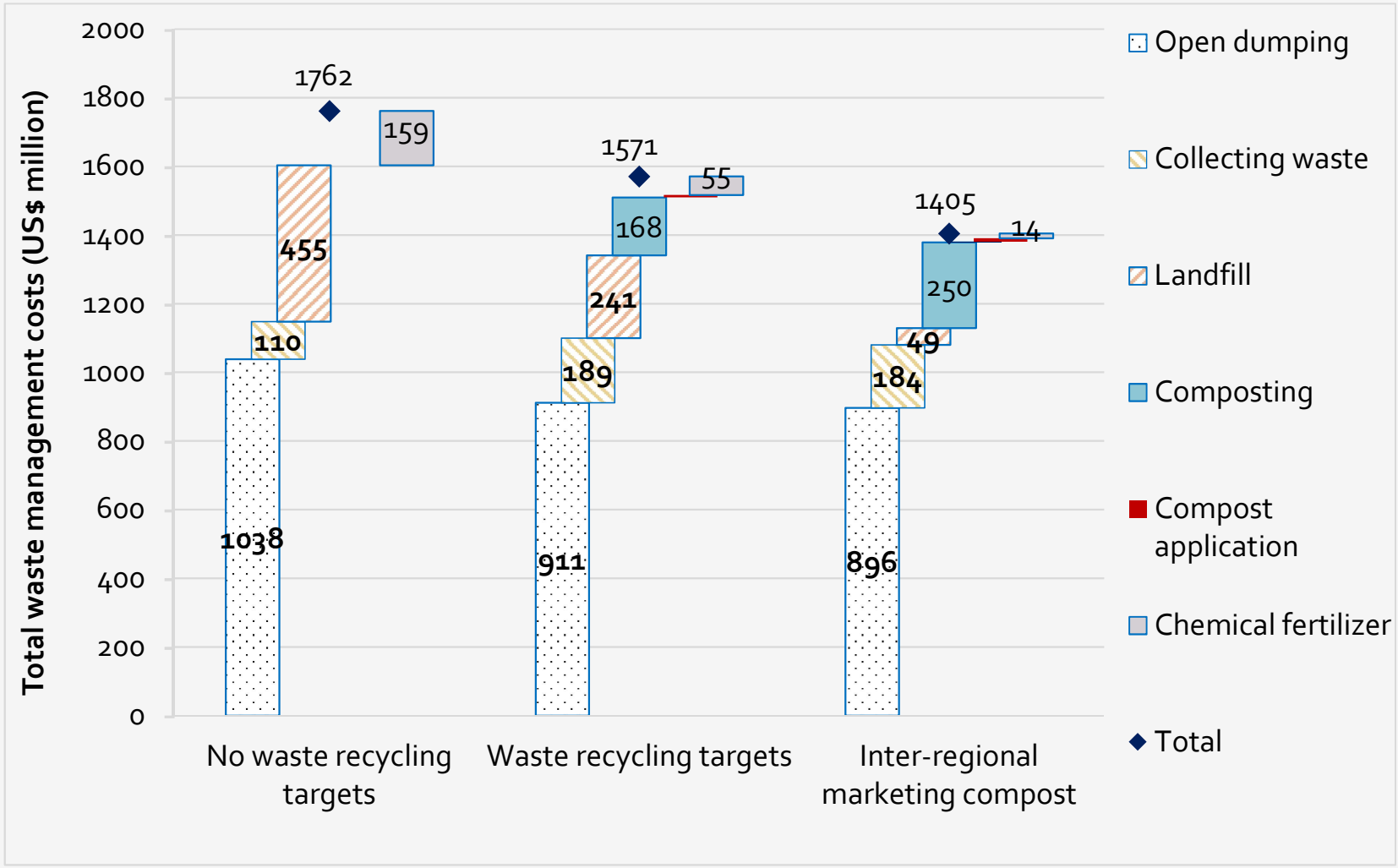
Source: Bekchanov (2018)

Trading in compost is expected to increase the compost uses



Source: Bekchanov (2018)

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

Policy implications

- Sanitation and organic waste and wastewater treatment sectors should gain sufficient attention
- Quality standards in constructing RRR facilities and producing products from waste should be ensured

Reference

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

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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.

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