LAND DEGRADATION AND WASTE MANAGEMENT IN EGYPT: AN ECONOMIC ASSESSMENT OF DAMAGES

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ABSTRACT

Egypt has been facing environmental degradation which is not only impacting the quality of life but also the country's ability to achieve its sustainable development plans as delineated in its Vision 2030. Most notably, there is a significant strain on land resources resulting in cropland degradation and losses. Furthermore, there are unsustainable waste management practices as the treatment and disposal of waste remain a problem in Egypt. To this end, this paper attempts to estimate the environmental damage costs for land degradation and waste management for Egypt in 2020. The process and methodology for the rapid Assessment of the Economic Costs of Environmental Degradation (COED) utilized in this paper is based essentially on the methodology developed by the World Bank Mediterranean Environmental Technical Assistance Program (METAP). The results of the rapid COED presented in this paper could be used as an instrument for integrating environmental issues into economic and social development planning in Egypt. Furthermore, it could help improve the process of environmental priority setting to achieve reductions in the overall cost of environmental degradation in Egypt.

Keywords: Cost of environmental degradation, cost of damages from land degradation, cost of environmental damages from waste management, monetary valuation of environmental impacts, damage costs of environmental impacts

INTRODUCTION

For several decades, Egypt has been facing numerous and increasing pressures on the environment. One of these environmental pressures are related to soil degradation which is affecting agricultural yields. Human induced land degradation in the region is primarily a result of agricultural activities. Land degradation may have severe and long-term impacts on the eco-systems, water resources, recreation and tourism, and on agriculture.

Another major environmental issue in Egypt is poor solid waste management especially in urban areas. Uncollected municipal waste accumulating in urban and rural areas is a risk to health and affects the quality of life. Waste attracts rodents, flies, and insects that may be vectors transmitting infectious diseases.

As means of addressing such pressing issues, Egypt has prepared strategies and embarked on a number of programs, projects and actions to reduce and reverse land degradation and soil salinity, and continue to improve waste management.

However, most of the strategies addressing land degradation and waste management in Egypt have prioritized policy interventions and actions that are based on a number of criteria mostly qualitative and not quantitative in nature. Within this context, this paper aims to produce a rapid economic cost assessment of environmental degradation (COED) for Egypt for the year 2020 to provide degradation values for the two categories: land degradation and waste management. The results of the rapid COED for these two environmental categories (that is, land degradation and waste management) would help inform decision-makers in their choices for policy interventions and thus, improve the sustainable development and growth strategies' outcomes in Egypt, overall. In addition, the update of this rapid COED could provide an analytical tool during the implementation of sustainable development strategies in Egypt through: (i) establishing an environmental baseline; (ii) setting coherent priorities; (iii) assessing environmental sustainability and environmental pressures especially those afflicting the poor and low-income segments of society.

This paper is considered the first step in a process to use environmental damage cost assessments as an instrument in environmental management, prioritization, and policy setting. The rapid COED assessment presented in this paper also provides an analytical tool to assess environmental sustainability, as called for within the Sustainable

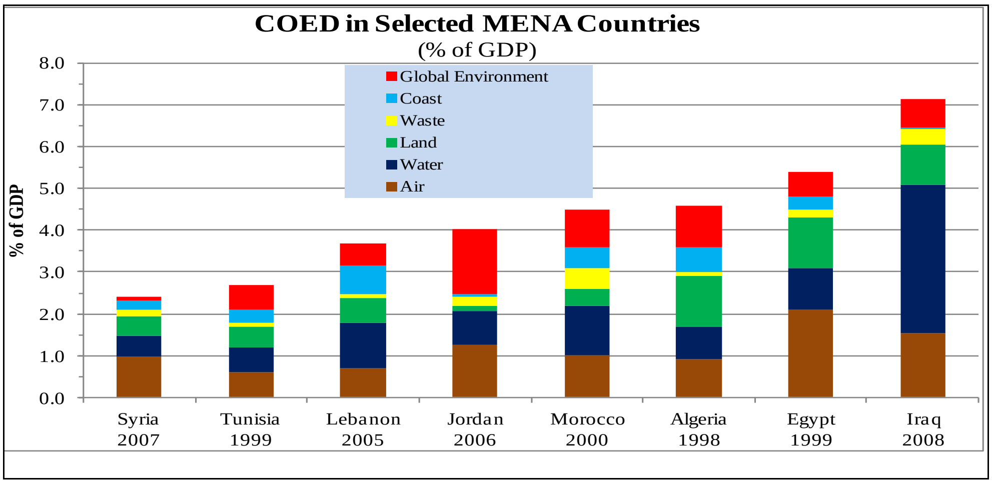
Development Goals (SDGs); most notably, SDG #3 (Good health and well-being), SDG #13 (Climate action), SDG #14 (Life below water) and SDG #15 (Life on land).

BACKGROUND

Cost of Environmental Degradation: An Overview

Many studies on the COED at the national, regional and sectoral levels or were conducted in Egypt since 2002. The results of the valuations, which cover various base years, shown in Figure 1, are two-fold: (i) regional benchmarking of national COEDs comparing Egypt with other Middle East and North Africa (MENA) countries where Egypt ranks second after Iraq in terms of the highest COED when compared to the GDP; and (ii) various national, local and sectoral COED studies carried out by the World Bank, the United Kingdom Department for International Development (DFID), the METAP Project/World Bank, the Economic Research Forum in Egypt and the European Commission.

Figure 1: Costs of Environmental Degradation and Environmental Benefits in MENA and Egypt



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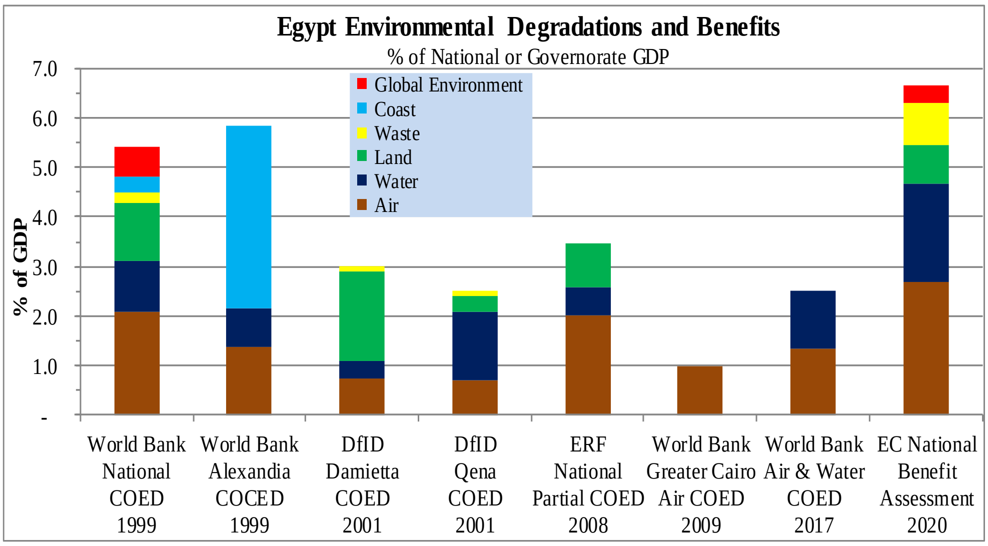

Note: 2017 World Bank Air covers only Greater Cairo whereas Water covers Egypt.
Source: MENA COED compilation by Author; World Bank (2002); UK DFID (2004); METAP/World Bank (2005); Larsen (2011); Bassi et al. (2011); World Bank (2013); and Larsen (2019).

These studies have estimated national, partial national, governorate or sectoral COED, using more-or-less the same methodologies with some variations. The results are as follows:

- In 2002, the World Bank estimated the national COED using data from 1999 covering six categories: air, water, waste, soil and biodiversity; coastal and cultural heritage, and global environment. These costs have been estimated at EGP 16.4 billion in 1999, or 5.4% of GDP including those for the global environment. In comparison with other countries in the region, these costs rank relatively high in terms of percentage of GDP among the other seven MENA countries where the costs of the damage were assessed. However, these costs are significant and indicate that the greatest damage are in two areas: (i) public health, especially with regard to water-borne diseases related to poor sanitation in rural areas, and respiratory diseases related to air pollution and the impact of the lack of disposal and treatment of waste; and (ii) the productivity of natural

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resources, including the loss of agricultural productivity due to soil degradation, and due to lack of disposal and treatment of waste (World Bank 2002).

- In 2004, DFID downscaled the COED for the Governorates of Qena and Damietta. Both studies covered the damage assessments for air, water, land and waste, and provided a COED of 2.5% and 3% of the respective governorate's GDP in 2001 (DFID 2004a, 2004b).

- In 2005, the METAP/World Bank downscaled the COED at the coastal level by targeting the governorate of Alexandria and using 1999 as base year. The damage assessment covered: air, water and coastal zones including, anemities losses, forgone tourism, fisheries catch reduction, beach pollution and wetlands degradation. Land degradation was amalgamated within coastal zone in this case and represented 3.66 % of Alexandria Governorate GDP in 1999 (METAP/World Bank, 2005).

- In 2011, the Economic Research Forum (ERF) has re-estimated a partial national cost of damage covering three categories: air, water (water-borne diseases) and agricultural land degradation. The costs were estimated at about US$ 5.6 billion equivalent to 3.47% of total GDP in 2008, the impact on air, which has the highest COED share, was around 2.02% of GDP or US$ 3.3 billion for respiratory diseases in 2008. Although this estimate was estimated almost 10 years after the World Bank's first study, this assessment has the same order of magnitude for air as that estimated by the World Bank study (around 2%) with a baseline of 1999 (Larsen, 2011).

- In 2011, the European Commission estimated the increased environmental benefits at the national level covering 5 categories: air, water, nature, waste, and global environment. The benefits were estimated at 6.7% of GDP including the global environment of € 30.5 billion in 2020 in 2008 prices if pollution were to be reduced by ± 50 percent in 2020

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compared to 2008. In other words, in the case where pollution could not be reduced by 50 percent in 2020, the cost of degradation considered could be equivalent to twice the benefit assessment in terms of GDP in 2020 (Bassi, 2011).

- In 2013, the World Bank produced a report on Greater Cairo air pollution where the COED for air reached EGP 10.2 billion equivalent to 1% of national GDP. The major contributors to PM_{10} included soil dust material, mobile source emissions, and open burning, e.g., for the autumn months of 2010, the contribution of open burning exceeded that of soil, likely due to continued agricultural burning. Whereas $PM_{2.5}$ was dominated by mobile source emissions, secondary species (ammonium sulfate and ammonium nitrate), soil dust, and open burning (World Bank, 2013).

- In 2019, the World Bank produced a report valuing the degradation association with air pollution in Greater Cairo and unimproved water and sanitation nationwide where: the air COED reached EGP 47 billion equivalent to 1.4% of national GDP; and the unimproved water and sanitation nationwide COED reached EGP 39 billion equivalent to 1.2% of national GDP (Larsen, 2019).

SCOPE

This paper will provide a first order of estimates of the COED for land degradation and domestic waste management. Also, each of the environmental categories will be divided into two economic categories: (a) impact on health and quality of life; and (b) impact on natural resources.

The scope of this paper is to assess the damage costs resulting from environmental impacts that can be understood as a measure of the lost welfare of a country due to environmental degradation. Such a loss in welfare includes the following (though not limited to):

- Loss of healthy life and well-being of the population (e.g., premature deaths, pain and suffering from illness, absence of a clean environment);

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- Economic losses (e.g., reduced soil productivity, lower production values, lower land/real estate values); and
- Loss of environmental opportunities (e.g., reduced recreational value of lakes, forests, eco-tourism etc.).

PROCESS

The process of estimating the rapid COED involves placing a monetary value on the consequences of such degradation. This often implies a three-step process:

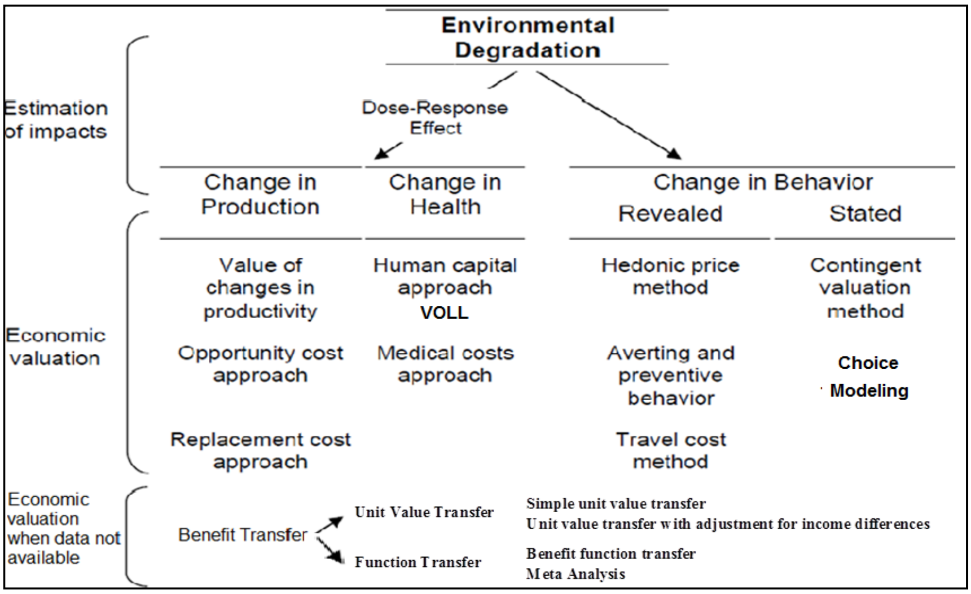
i. Quantification of environmental degradation (e.g., monitoring of soil loss, and soil quality).

ii. Quantification of the consequences of degradation (e.g., changes in soil productivity, changes in forest density/growth, reduced natural resource based recreational activities, reduced tourism demand).

iii. A monetary valuation of the consequences (e.g., soil productivity losses, reduced recreational values).

The main methods for estimating the impacts are grouped around the three pillars with specific techniques under each pillar as illustrated in Figure 2.

Figure 2. Estimation of Impacts and Associated Economic Valuation Techniques



Source: Adapted from Bolt et al. (2005)

METHODOLOGY

This paper will provide a first order of estimates of the COED for land degradation and domestic waste management. The methodology used is presented in the following:

Land

I. Overview

The methodology used by Pagiola and Bendaoud (1995) to study the long run effects of soil erosion on wheat production in a semi-arid region of Morocco is the main guidepost for estimating the monetary value of land degradation. However, the results in this paper are based on the valuation method used by Larsen (2011) to estimate cropland productivity loss in Egypt.

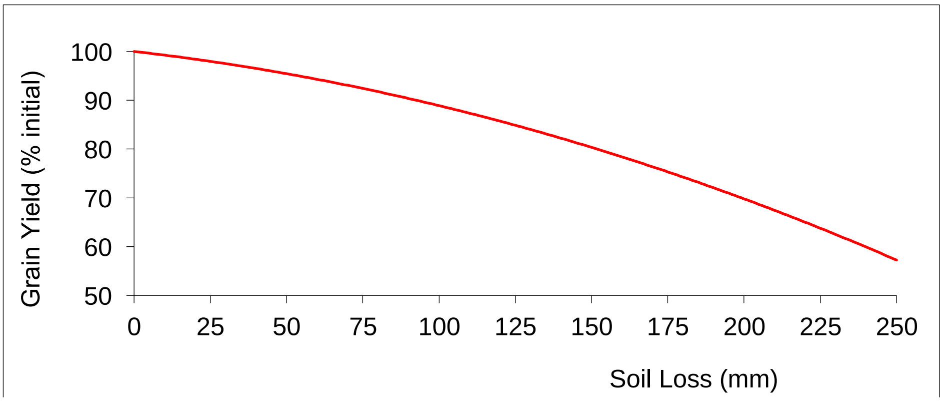
The two main steps that were undertaken and the assumptions made in estimating the cost of soil erosion by Pagiola and Bendaoud (1995) are presented in the following:

i. Determination of Physical Impacts

The first step in this analysis is to estimate the level of soil erosion. As there was no concrete data on erosion rates, a simulation analysis was used. A range of plausible erosion rates was assumed, and the estimates of production trends made for each of these rates.

The analysis then uses a crop growth simulation model, SIMTAG (SIMulation of Triticum Aestivum Genotypes), to simulate the relationship between soil conditions and wheat production. The model requires information on soil characteristics, climatic conditions, and cultural practices. Data on soil characteristics were obtained by collecting and analyzing the soil. Climatic data was taken from daily observations at a nearby market for the period 1983-1992. Information on cultivating practices was obtained from research by the National Agronomic Research Institute (Institut National de Recherche Agronomique, INRA).

Figure 3. Determination of physical impacts: soil loss and grain yield in Morocco



NOTE: while the study area was divided into three basic biophysical regions distinguished by slope and soil types: plateau, slope, and valley, the results from the slope area are presented only for simplification purposes
Source: Pagiola and Bendaoud (1995)

Figure 3 above indicates that as soil loss increases, the grain yield declines. Soil erosion is cumulative given that when soil is lost each year, it is lost forever and will affect production for as long as crops are produced there.

ii. Attaching Market Value to Losses

Once the impacts on production had been estimated from soil erosion, the next step is to attach a market value to these losses. The socioeconomic data required for the analysis of the value of the losses was obtained from a socioeconomic survey of farmers in the area. Prices for most inputs were observed in the area.

The long-run economic effect of a given erosion rate can be calculated by the net present value of losses due to erosion; that is, the sum of the discounted differences between returns in any given year and initial returns over a specified time. In the case of soil erosion, the losses continue over time. The true cost of soil erosion is not just the decline in yields from a single year's erosion, but the value of the decline in yields over the entire time horizon that the soil would have been used for agriculture.

II. Methodology Applied

In this research, cropland productivity loss is estimated to represent the value of the COED for land degradation in Egypt. While the overall valuation method used is drawn primarily from the aforementioned work by Pagiola and Bendaoud (1995), the estimation results presented in Table 1 are those adjusted and adapted from Larsen (2011) which utilized the productivity loss method based on the Economic assessments of land degradation derived from the Global Assessment of Human-induced Soil Degradation (GLASOD) survey data (FAO, 2000).

Table 1. Cropland Opportunity Loss in Egypt in 2020

Yield loss and Degradation	**Low**	**Hi**	**Mid**
Area degraded US$ Billion	2.54	3.99	3.27
Area degraded %	0.7%	1.1%	0.9%

Source: Adjusted from Larsen (2011) by Author.

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Waste

I. Overview

The COED for waste management includes the entire chain of domestic solid waste from collection to landfilling and could consider other waste types when these lack proper regulation and handling as they are dumped with domestic waste. As regards uncollected waste, it is calculated by using labor to remove waste disposed haphazardly; the forgone composting and recycling opportunity is considered for lack of treatment; and for disposal, hedonic pricing around dump/landfill as well as forgone both methane capture and energy generation are considered though emissions of CO_2 equiv. were not considered.

The estimates associated with the COED for waste were based on the Cost Assessment of Solid Waste Degradation (CASWD) Model by Doumani, Arif and Abdeljaoued (2015). This Model was used to derive the aggregated urban and rural degradation. However, air pollution, leachate (water) and CO_2 (Global environment) emissions were not considered in this paper as they are usually accounted for in other studies under air, water and global environment respectively. Table 2 presents the following two major categories: COED for waste; and the loss of opportunity valuation. Recycling and composting as well as landfill area avoidable are considered separately to underline the opportunity loss when recycling and composting are not considered whereas the pollution associated with waste mismanagement is considered under the COED for waste. Moreover, the Opportunity Loss in terms of Collection and Landfilling (subsidized services) was not considered in the Model for simplification purposes. Subsidies could however be considered manually to underline the opportunity loss in terms of public fund allocative efficiency (SWEEP-Net: www.sweep-net.org).

Table 2. COED for Waste and Opportunity Loss Valuation Techniques

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Category	Valuation Technique	
	COED for waste	**Opportunity Loss**
Collection	1% of Disposable Income that households could afford (non-collected waste) as a defensive cost reflecting the pollution of the environs, the reduction of clogged drains as well as air (if burnt), sight and odor pollution	
Discharge (for non-collected waste)	Clean up cost	
Recycling and composting		Market price of recycled and composted materials
Landfill area avoidable		Cost of avoided land
Underground water contamination from active landfills and dumps	Water treatment cost	
Loss of land value around waste processing plants	Hedonic (land price decrement)	
Loss of land value around active landfills	Hedonic (land price decrement)	
Loss of land value around active dumps	Hedonic (land price decrement)	
Loss of land value around passive landfills	Hedonic (land price decrement)	
Loss of land value around passive dumps	Hedonic (land price decrement)	
Methane emission avoidable	LandGem or other Models (Stern and Stiglitz for carbon price)	
Forgone energy	LandGem or other	Energy use avoided

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generation	Models (average tariff)	from recycling and composting
Global Environment	Carbon footprint from waste (Stern and Stiglitz for carbon price)	Carbon footprint avoided from recycling and composting (Stern and Stiglitz for carbon price)

Source: Adapted from Doumani et al. (2015).

II. Methodology Applied

With regard to the COED for waste degradation in Egypt, the methodology utilized in this paper, as previously mentioned, is based on the CASWD Model developed by Doumani et al. (2015). The aggregated results are illustrated in Table 3 for degradation from waste management in Egypt in 2020 in both rural and urban areas. The results are divided between environmental degradation and opportunity loss though the total is considered as the overall environmental degradation result of waste management.

Table 3. Waste Treatment Forgone Opportunity in Egypt in 2020

Egypt	US$ million	%/GDP	US$ million	%/GDP
	COED	**COED**	**Opportunity Loss**	**Opportunity Loss**
Collection and Clean Up	15.5	0.004%	-	
Recycling and Composting	-		309.3	0.085%
Marginal differential value: raw vs. recycled materials	-		-	0.000%
Landfill Area Avoidable	-		73.3	0.020%
Underground Water Contamination	-	0.000%	-	
Land Value Loss Due to Active Operations	192.5	0.053%	-	
Passive Dump Clean Up Cost	175.3	0.048%	-	
Forgone Energy Generation	68.7	0.019%	-	
Methane Emission Avoidable	0.9	0.000%	-	

Egypt	US$ million	%/GDP	US$ million	%/GDP
Global Environment	-	0.000%	-	0.000%
Total	**452.9**	**0.125%**	**382.6**	**0.105%**
Lower Bound	385.0	0.106%	325.2	0.090%
Upper Bound	520.9	0.143%	440.0	0.121%

Source: Author, based on Doumani et al. (2015).

RESULTS

Table 4 presents the costs of land and waste degradation in Egypt as estimated by using the aforementioned methodology pertaining to the rapid $COED_{2020}$ both in terms of absolute values as well as relative values as percentage of GDP. Figure 4 depicts the relative costs of degradation as percentage of GDP for land degradation and waste in 2020 compared to those estimated for 1999.

The results of the rapid $COED_{2020}$ in Egypt for both categories: land and waste degradation, as indicated by Table 5, range between 0.9% and 1.4% of GDP in 2020 with a mean estimate of 1.1% decreasing from 1.4% of GDP in 1999 (World Bank, 2002). However, while the relative cost of land and waste degradation has dropped from 1.4% of GDP in 1999 to 1.1% in 2020, it has increased in absolute value from US$1.3 billion in 1999 (World Bank, 2002) to US$ 4.11 in 2020.

With regard to land degradation, its mean estimate in 2020 amounts to 0.9% of GDP, equivalent to US$ 3.27 billion, decreasing from 1.2% of GDP (about US$ 1.1 billion) in 1999. This clearly indicates that while the relative cost of land degradation in GDP has decreased in 2020 compared to 1999, the absolute value has nonetheless increased within the same period. The damages from land degradation come predominantly from the loss of agricultural productivity while forest areas have been increasing over the decade.

The results presented in Table 4 indicate that the mean estimate for the cost of environmental degradation from waste management has remained more-or-less the same at 0.2% of GDP in both 2020 and 1999. However, in absolute value, the magnitude of degradation for the same category has increased from US$ 0.2 billion in 1999 to US$ 0.84 billion in 2020.

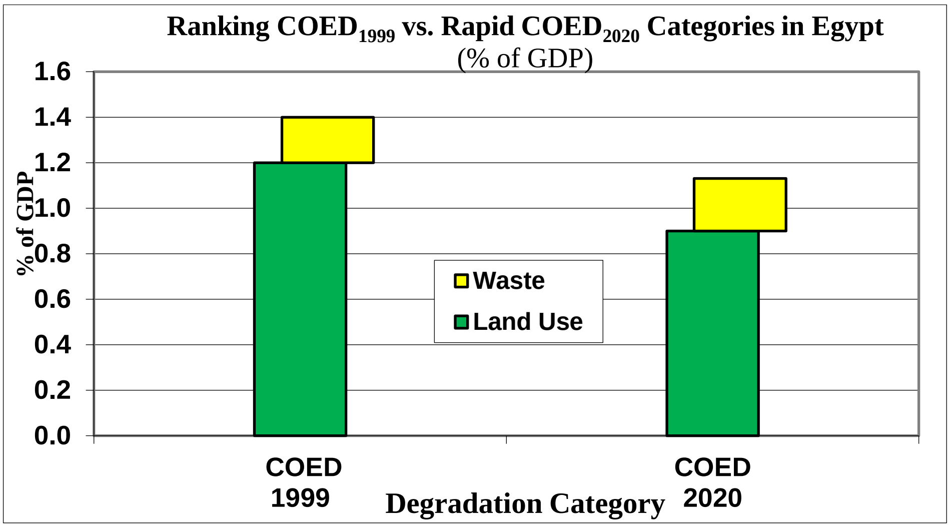
Table 4: Annual Rapid Cost of Environmental Degradation for Land and Waste Degradation - Mean estimate, 2020

Category	COED$_{2020}$			
	Lower Bound	**Upper Bound**	**Middle Bound**	
	US$ billion	US$ billion	US$ billion	% of GDP
Land	**2.54**	**3.99**	**3.27**	**0.9%**
-Cropland Degradation	*2.54*	*3.99*	*3.27*	0.9%
Waste	**0.71**	**0.96**	**0.84**	**0.2%**
-Treatment	*0.28*	*0.37*	*0.32*	0.1%
-Disposal	*0.43*	*0.59*	0.51	0.1%
Total	**3.25**	**4.95**	**4.11**	**1.1%**
GDP$_{2020}$			363.07	

Source: From Tables 1 & 3

- *GDP figures are from World Bank WDI (2021).*

Figure 4: COED$_{1999}$ vs. Rapid COED$_{2020}$ - Mean estimate



Source: World Bank (2002) for COED 1999 and Table 5 for COED 2020

CONCLUSIONS AND RECOMMENDATIONS

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The results of the rapid $COED_{2020}$ for land and waste management in Egypt indicate an increase in absolute terms when compared to the $COED_{1999}$. The differences between the results could be attributed essentially to the marginal degradation of the environment over the period. The results indicate that there is significant strain on land resources in terms of cropland degradation. The results also indicate that the treatment and disposal remain a problem in Egypt. Therefore, there is an urgent need to reduce land degradation and soil salinity, and to continue to improve waste management in Egypt. Within this context, the results and analysis in this paper provide a rationale for continued environmental management and priority setting for environmental action in Egypt in the area of land and waste management. However, the estimates presented in this paper should be viewed as orders of magnitude as the accuracy of all estimates is constrained by data availability and subject to various assumptions and simplifications. To this end, a range of values has been presented to reflect this uncertainty. Despite of such difficulties as well as that encountered in assigning monetary values to environmental degradation, these estimates, nonetheless, can be a used to raise awareness about environmental issues and facilitate the integration of environmental issues into economic and social development planning toward sustainable development in Egypt.

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REFERENCES

Abd El-Salam MM and Abu-Zuid G. 2015. “Impact of landfill leachate on the groundwater quality: A case study in Egypt.” J Adv Res. 2015 Jul; 6(4):579-86.

Bassi, Samuela. 2011. *EC Benefit Assessment, Egypt Report*. Brussels. <www.environment-benefits.eu>.

Bolt, Katherine, Gionanni Ruta and Maria Sarraf. 2005. *Estimating the Cost of Environmental Degradation: A Training Manual in English, French and Arabic*. Environment Department Papers. The World Bank. Washington, D.C.

CAPMAS. 2022. *Egypt in Figures 2022*. Central Agency for Public Mobilization and Statistics. Cairo, Egypt. www.sis.gov.eg

DFID, 2004a. *Governorate of Qena, Egypt: Cost of Environmental Degradation, A Socio-Economic and Environmental Health Assessment.* Department for International Development, U.K. SEAM Program, Entec U.K. ltd and ERM. Cairo.

DFID, 2004b. *Governorate of Damietta, Egypt: Cost of Environmental Degradation, A Socio-Economic and Environmental Health Assessment.* Department for International Development, U.K. SEAM Program, Entec U.K. ltd and ERM. Cairo.

Doumani, F., S. Arif and Ilyes Abdeljaoued. 2015. *Cost Assessment of Solid Waste Degradation Model Guidebook*. GIZ SWEEP-Net. Tunis.

Egyptian Environmental Affairs Agency (EEAA). 2009. *Egypt State of Environment Report 2008*. Cairo.

Egyptian Environmental Affairs Agency (EEAA). 2010. *Egypt State of Environment Report 2009*. Cairo.

Egyptian Environmental Affairs Agency (EEAA). 2016. *Egypt State of Environment Report 2014*. Cairo.

Egyptian National Competitiveness Council (ENCC), Competitiveness of Green Construction in Egypt, 7th ENCC report, May 2010.

Egyptian Environmental Affairs Agency, *National Policy Framework on Cleaner Production*, 2004.

FAO (UN Food and Agriculture Organization). 2000 *Global Assessment of Human-induced Soil Degradation (GLASOD)* data, Rome.

Industrial Modernization Center (IMC), *Egypt’s Industrial Development Strategy. Industry: The Engine of Growth*, 2009.

Institute for Health Metrics and Evaluation (IHME): <wwwhealthdata.org>

Larsen, Bjorn. 2011. *Cost of Environmental Degradation in the Middle East and North Africa Region: Selected Issues*. Working Paper 583. Economic Research Forum. Cairo.

Larsen, Bjorn. 2019. Egypt: *Cost of Environmental Degradation: Air and Water Pollution*. The World Bank. Washington, D.C.

Light Pollution Infor website: <www.lightpollutionmap.info>

Mediterranean Environmental Technical Assistance Program (METAP) and World Bank. 2005. *Cost of Environmental Degradation in Coastal Areas of Egypt. Strengthening of the Capacity in Selected*

الترقيم الدولي ISSN 1110-0826
الترقيم الدولي الموحد الاليكتروني 2636-3178

METAP Countries to Assess the Cost of Environmental Degradation in Coastal Areas. Washington, D.C.

Ministry of Planning and Economic Development, Egypt Vision 2030 website: <http://mop.gov.eg/Vision/EgyptVision.aspx>.

Ministry of State for Environmental Affairs and Egyptian Environmental Affairs Agency. 2009 *Egypt State of the Environment (ESOER)*. Cairo.

Ministry of State for Environmental Affairs and Egyptian Environmental Affairs Agency. 2010. Annual Guide for Environmental Data and Indicators. Cairo.

Murray, C. and A. Lopez. 1996. *The Global Burden of Disease.* Global Burden of Disease and Injury Series. WHO and the World Bank. Harvard School of Public Health, Cambridge, Massachusetts.

Navrud, Ståle, 1996. *The Benefits Transfer Approach to Environmental Valuation*. EEPSEA Special Paper.

Navrud, Ståle, 2004. Environmental Valuation, Techniques and Applications Presentation. Department of Economics and Resource Management, University of Life Sciences.

Navrud, Ståle. 2009. Value Transfer Techniques and Expected Uncertainties. New Energy Externalities Developments for Sustainability (NEEDS). Project no: 502687. Deliverable n° 2.1 - RS 3a. SWECO. Stockholm.

Navrud, S. and Lindhjem, H. 2010. Meta-analysis of stated preference VSL studies: Further model sensitivity and benefit transfer issues. Prepared for the Environment Directorate, OECD.

Pagiola, S. and *M. Bendaoud.* 1994. *Long-run Economic Effects of Erosion on Wheat Production in a Semi-Arid Region of Morocco: A Simulation Analysis*, Agricultural Economics Staff Paper. The World Bank, Washington D.C.

Sachs, J., Schmidt-Traub, G., Kroll, C., Lafortune, G., Fuller, G. 2019. *Sustainable Development Report 2019*. New York: Bertelsmann Stiftung and Sustainable Development Solutions Network (SDSN).

Safar, Zeinab, Mounir W. Labib and Alan W. Gertler. 2009. Evaluation of CO_2 and Other Pollutant Emissions in the Greater Cairo (GC) Area from Diesel and CNG Buses. AWMA, USA. Paper # 138.

SEPA (2006). 'Environmental Standards', Beijing, China, State Environmental Protection Agency.

United States Department of Interior (USDI). 2010. Egypt 2008 Minerals Yearbook. Washington, D.C.

U.S. Environmental Protection Agency. (USEPA). 1997. *Evaluation of Emissions from the Open Burning of Household Waste in Barrels*. Control Technologies Center, Research Triangle Park. EPA-600/R-97-134a. N.C.

United Nations, World Urbanization Prospects, The 2009 Revision, Highlights, 2009.

Viscusi, W. Kip and Joseph E. Aldy. 2003. "The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World." Journal of Risk and Uncertainty vol. 27, p. 5-76.

Watson J.G., J.A. Cooper, and J.J. Huntzicker (1984) The effective variance weighting for least squares calculations applied to the mass balance receptor model. Atmos. Environ. 18, 1347-1355.

World Bank. 2002. *Arab Republic of Egypt Cost Assessment of Environmental Degradation*. Study, Report No. 25175-EGT. Rural Development, Water and Environment Department, Middle East and North Africa Region. Washington, D.C.

World Bank, 2010. *Tapping a Hidden Resource: Energy Efficiency in the Middle East and North Africa*. Energy Sector Management Assistance Program (ESMAP), Washington, D.C.

World Bank. 2013. The Arab Republic of Egypt: For Better or for Worse: Air Pollution in Greater Cairo. A Study. Report No. 73074-EG. Sustainable Development Department, Middle East and North Africa Region. Washington, D.C.

World Bank. 2015. Egypt: Promoting Poverty reduction and Shared Prosperity, A Systematic Country Diagnostic. P151429. Middle East and North Africa Region. Washington, D.C.

World Bank. 2018. *The Changing Wealth of Nations: Building a Sustainable Future*. Editors: Glenn-Marie Lange, Quentin Wodon and Kevin Carey. Washington, D.C.

World Bank. 2021. *World Development Indicators*. Washington, D.C.

Younes, H., *Renewable Energy and Energy Efficiency: Innovative policies and financing instruments for the EU's Southern and Eastern Neighbors*, Presentation, Berlin, Germany, 2007.

تدهور الأراضي وإدارة النفايات في مصر: تقييم اقتصادي للأضرار

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المستخلص

تواجه مصر تدهوراً بيئياً لا يؤثر فقط على جودة الحياة ولكن ايضاً على قدرة البلاد على تحقيق خطط التنمية المستدامة على النحو المحدد في رؤيتها ٢٠٣٠. وعلى وجه الخصوص ، هناك ضغط كبير على موارد الأراضي مما يؤدي إلى تدهور الأراضي الزراعية وخسائر اقتصادية . علاوة على ذلك ، هناك ممارسات غير مستدامة لإدارة النفايات حيث أن معالجة النفايات والتخلص منها لا تزال مشكلة في مصر. تحقيقا لهذه الغاية ، تحاول هذه الورقة تقدير تكاليف الأضرار البيئية لتدهور الأراضي وإدارة النفايات لمصر في عام ٢٠٢٠. تعتمد عملية ومنهجية التقييم للتكاليف الاقتصادية للتدهور البيئي (COED) المستخدمة في هذه الورقة بشكل أساسي على المنهجية التي وضعها برنامج المساعدة الفنية البيئية لمنطقة البحر الأبيض المتوسط التابع للبنك الدولي (METAP). يمكن استخدام نتائج التكلفة الاقتصادية للتدهور البيئي COED المقدمة في هذه الورقة كأداة لدمج القضايا البيئية في التنمية الاقتصادية والاجتماعية في مصر. علاوة على ذلك ، يمكن أن يساعد في تحسين عملية تحديد الأولويات البيئية لتحقيق خفض في التكلفة الإجمالية للتدهور البيئي في مصر.

الكلمات المفتاحية: تكلفة التدهور البيئي ، تكلفة الأضرار الناجمة عن تدهور الأراضي ، تكلفة الأضرار البيئية من إدارة النفايات ، التقييم النقدي للتأثيرات البيئية ، تكاليف الأضرار الناجمة عن الآثار البيئية