

ECONOMIC
RESEARCH
FORUM



منتدى
البحوث
الاقتصادية

2011

working paper series

SUSTAINABLE DEVELOPMENT AND
ENVIRONMENTAL CHALLENGES
IN THE MENA REGION: ACCOUNTING
FOR THE ENVIRONMENT IN THE 21ST CENTURY

Susan L. Sakmar, Mathis Wackernagel,
Alessandro Galli, David Moore

Working Paper No. 592

**SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL
CHALLENGES IN THE MENA REGION: ACCOUNTING FOR
THE ENVIRONMENT IN THE 21ST CENTURY**

Susan L. Sakmar, Mathis Wackernagel, Alessandro Galli, David Moore

Working Paper 592

June 2011

Send correspondence to:

Prof. Susan L. Sakmar, JD, LL.M.
University of San Francisco School of Law
sakmar@usfca.edu

First published in 2011 by
The Economic Research Forum (ERF)
21 Al-Sad Al-Aaly Street
Dokki, Giza
Egypt
www.erf.org.eg

Copyright © The Economic Research Forum, 2011

All rights reserved. No part of this publication may be reproduced in any form or by any electronic or mechanical means, including information storage and retrieval systems, without permission in writing from the publisher.

The findings, interpretations and conclusions expressed in this publication are entirely those of the author(s) and should not be attributed to the Economic Research Forum, members of its Board of Trustees, or its donors.

Abstract

The MENA Region faces a range of challenges to its long-term security and prosperity in the 21st century. Although many of the Region's economic challenges have been widely analyzed, environmental challenges are rarely taken into consideration in the process of formulating economic policies in the MENA Region. This paper begins to address the major gaps in knowledge about the economics of the environment in the MENA Region and will analyze the most current literature and trends regarding sustainable resource management for the 21st century. This paper proposes a framework for the discussion of the economic ramification of various environmental issues facing the MENA Region. It also presents various environmental accounting systems and indicators that may be useful for the MENA Region to implement in order to manage these issues more effectively. Of particular relevance is the establishment of environmental accounts as set forth under the System of Environmental Economic Accounting (SEEA), which is expected to become an international statistical standard for integrated economic and environmental accounting using concepts, definitions and classifications of the System of National Accounts (SNA). The paper then proposes the Ecological Footprint as an additional tool for resource and ecosystem service accounting. The Ecological Footprint is a resource accounting tool that measures how much productive area it takes to produce what a population consumes and absorb its waste, using prevailing technology. It compares this to the available biocapacity of the world or each country. The paper concludes by recognizing that given the complexity of the concept of sustainable development and measuring what counts for the well-being of both present and future generations, it is evident that robust accounting tools and indicators are needed for the 21st century. While many of these tools already exist and can be found in the SEEA and Ecological Footprint, more analysis is needed on the areas of overlap and potential integration of these two systems.

ملخص

تواجه منطقة الشرق الأوسط مجموعة من التحديات للأمن على المدى الطويل والازدهار في القرن 21. على الرغم من أن العديد من التحديات الاقتصادية في المنطقة تم تحليلها على نطاق واسع، إلا أنه نادراً ما تؤخذ في الاعتبار التحديات البيئية في عملية صياغة السياسات الاقتصادية في منطقة الشرق الأوسط. تبدأ هذه الورقة بمعالجة الفجوات الرئيسية في المعرفة حول اقتصاديات البيئة في منطقة الشرق الأوسط وستقوم بتحليل معظم الأدبيات الراهنة والاتجاهات المتعلقة بإدارة الموارد المستدامة للقرن 21. هذه الورقة تقترح إطاراً لمناقشة التشعبات الاقتصادية لمختلف القضايا البيئية التي تواجه منطقة الشرق الأوسط. كما أنها تقدم مختلف نظم المحاسبة البيئية والمؤشرات التي قد تكون مفيدة لمنطقة الشرق الأوسط لتنفيذها من أجل إدارة هذه القضايا على نحو أكثر فعالية. إنشاء الحسابات البيئية على النحو المبين له أهمية خاصة في إطار نظام المحاسبة الاقتصادية البيئية المتكاملة، والتي يتوقع أن تصبح معياراً دولياً للإحصائية المتكاملة المحاسبة الاقتصادية والبيئية باستخدام المفاهيم والتعاريف والتصنيفات لنظام الحسابات القومية. ثم تقترح الورقة البصمة البيئية كأداة إضافية لتنمية الموارد والنظم الإيكولوجية المحاسبة الخدمة. البصمة البيئية هي أداة محاسبة الموارد والتي يقاس بها كم يستغرق منطقة منتجة لإنتاج ما يستهلك السكان واستيعاب نفاياتها، وذلك باستخدام التكنولوجيا السائدة. فإنها تقارن هذا إلى القدرات الحيوية المتوفرة في العالم أو بلد كل منهما. وتخلص الورقة إلى الاعتراف بأنه نظراً لتعقيد مفهوم التنمية المستدامة وقياس ما يهم لرفاه الأجيال الحاضرة والمقبلة على حد سواء، فمن الواضح أن هناك حاجة إلى أدوات ومؤشرات قوية المحاسبة للقرن 21. في حين أن العديد من هذه الأدوات موجودة بالفعل ويمكن العثور عليها في نظام المحاسبة والبصمة البيئية، هناك حاجة إلى مزيد من التحليل على مجالات التداخل والتكامل المحتملة لهذين النظامين.

1. Introduction and Overview

The MENA Region faces a range of challenges to its continued security and prosperity in the 21st century. Although many of the Region's economic challenges have been widely analyzed, environmental challenges are rarely taken into consideration in the process of formulating economic policies in the MENA Region. Moreover, there is a dearth of research assessing existing environmental policies throughout the region. This paper will begin to address the major gaps in knowledge about the economics of the environment in the MENA Region and will analyze the most current literature and trends regarding sustainable resource management for the 21st century.

Since this project was initiated, two significant reports have been published: (1) the "Report by the Commission on the Measurement of Economic Performance and Social Progress," commonly referred to as the "Stiglitz Commission Report"; and (2) the "Framework for Environmental Economic Accounting in the ESCWA Region" by the Economic and Social Commission for Western Asia (ESCWA). Both of these reports will be discussed in detail in this paper.

This paper proposes a framework for the discussion of the economic ramification of various environmental issues facing the MENA Region. It also presents various environmental accounting systems and indicators that may be useful for the MENA Region to implement in order to manage these issues more effectively.

This paper approaches these issues by addressing the following questions relevant to the pursuit of sustainable development in the MENA Region:

- Considering the environmental trends in the MENA region, what information and accounting tools are needed for shaping successful development policy in the MENA region?
- What kind of information is most critical and useful for governments in the region in order to manage their environmental resources most effectively?
- What is environmental accounting and what is the status of environmental accounting in the MENA Region?
- What types of environmental accounts would be most useful for the MENA Region?
- Considering the increasing resource demands and limited biocapacity of the region, how could a tool like Ecological Footprint accounting be used in MENA Region to secure human well-being and economic stability?

A critical first step in addressing the MENA Region's environmental challenges is to ensure that sufficient and reliable information exists to provide a baseline of current conditions, set goals, and measure progress. In simple terms, countries need to know how much nature they have and how much they use. This is particularly important now because "[e]ven in the midst of a global economic slowdown, the human footprint on the Earth has never been so heavy." (National Geographic, Earth Pulse: State of the Earth 2010). Thus, understanding resource constraints is clearly one of the most critical challenges for governments and policy makers in the 21st century.

In the face of climate change, freshwater scarcity, food crises, and increasing competition for agricultural land, environmental issues are becoming more defining for the economic success of countries. This is apparent not only in the MENA Region, but also elsewhere. Therefore, these trends deserve greater attention in political and economic decision-making and should be seen on par with other microeconomic issues. Specifically, the issue of environmental sustainability is still not sufficiently linked to all aspects of development and macroeconomic policies and the failure to do so could be a significant risk for economies.

The need for a greater understanding of resource constraints has led to the need for more sophisticated accounting tools and metrics. At the same time, there is a growing need to integrate different methods for measuring and tracking environmental sustainability. While there are many options, this paper will focus on the promotion of environmental and sustainability management through the use of environmental accounting. It will be informed by the emerging System of Integrated Environmental and Economic Accounts (SEEA) as well as by sustainable development indicators such as the Ecological Footprint.

The United Nations Economic and Social Commission for Western Asia (ESCWA) through the funded project “*Strengthening National Capacities in Environment Statistics, Indicators and Accounts in support of progress toward achieving the internationally agreed development goals in the ESCWA and ECLACI Region 2007-2009*”, has planned activities to assist in enhancing the national capacities of ESCWA Member States in environment statistics, indicator and accounts in order to integrate environmental concerns into economic development, thus supporting progress towards achieving environmental sustainability and related international agreed development goals member countries.

It is widely accepted that water scarcity is one of the major environmental challenges facing the ESCWA/MENA Region. The ESCWA has recognized that the development of reliable, high quality, timely and comparable statistics on water and environment is very important to strengthen decision-making processes on the sustainable management of water resources and the economic analysis of water use. In this context, water accounting provides a robust framework for producing integrated hydrological and economic information on water for managers and decision-makers. The United Nations Statistics Division, having developed the SEEA are currently developing additional materials to assist ESCWA Member countries in implementing the new international standard and are providing expertise to assist in the training of the SEEA.

The ESCWA environmental accounting project that is already underway is an important first step in the region’s efforts to better account for their environmental assets and promote the principles of sustainable development. Nonetheless, environmental accounting is a long-term investment and developing accounts requires a sustained effort over an extended period with the accompanying financial and personnel resources necessary to undertake such an effort.

Environmental accounting, however, is not the only tool that exists to promote sustainable development and indeed there are many other environmental accounting tools and indicators that might be useful for the MENA Region. While a detailed discussion of all options is beyond the scope of this project, the Ecological Footprint is particularly useful and relevant for the MENA Region. The Ecological Footprint is a resource accounting tool that measures how much productive area it takes to produce what a population consumes and absorb its waste, using prevailing technology.

The Ecological Footprint is particularly useful for the MENA Region since it allows analysts to summarize overall resource trends and is a cost-effective policy tool for weighing policy options. It is particularly relevant for the region since at least one country in the region, the United Arab Emirates (UAE), has already launched a major environmental initiative based on the Ecological Footprint.

In 2006, it was reported that the UAE had the highest per capita footprint in the world; more than five times higher than the biocapacity globally available per person. In simple terms, if every person on the planet lived as a person in the UAE, humanity would require nearly seven planets to cover its needs.

In order to better understand their Ecological Footprint, in October 2007, the UAE launched the Al Basama al Beeiya (Ecological Footprint) Initiative as a “national effort to ensure a sustainable future by measuring and understanding the impact of our ways of living on planet earth.” The Initiative involves multiple stakeholders across the nation to work towards developing important guidelines for a more resource-conscious and resource-efficient government and society (Al Basama Al Beeiya Initiative). This paper discusses the Ecological Footprint for each country in the MENA Region below in Section 7.

In terms of organization, Section 2 of this paper discusses the historical background and principles of sustainable development and how these principles are relevant to development policy and environmental accounting.

Section 3 discusses the recently released Stiglitz Commission Report that has become a platform for further debate on the limitations of GDP as true measure of well-being and provides useful guidance on sustainable resource management for the 21st century. This section also discusses the accounting methods and sustainable development indicators that may be useful for the MENA Region, including environmental accounting under the SEEA and the Ecological Footprint.

Section 4 provides an overview of the key environmental challenges facing the MENA region with a primary focus on water scarcity, which has been deemed a priority area of focus by international development organizations such as the United Nations and World Bank as well as regional environmental organizations.

Section 5 discusses the main concepts and applications of the System of Environmental Economic Accounting (SEEA), the soon-to-be adopted international statistical standard integrating economic and environmental information in a common system using concepts, definitions and classifications of the System of National Accounts (SNA). To promote the principle of sustainable development, several institutions have recommended that countries develop environmental accounts.

Section 6 discusses the recently released “Framework for Environmental Economic Accounting in the ESCWA Region.” While there are many environmental accounts that could be constructed in the MENA Region, the Economic and Social Commission for Western Asia (ESCWA) is currently focused on the construction of water accounts for the ESCWA Region. This section discusses the work of the ESCWA in detail as well as some of the challenges and limitations of environmental accounting in the region.

Section 7 discusses the Ecological Footprint as another relevant sustainable development policy tool the MENA Region should consider. This section provides an overview of what the Ecological Footprint measures as well as country-by-country analysis of the Ecological Footprint for each country in the MENA Region.

Lastly, Section 8 concludes by recognizing that given the complexity of the concept of sustainable development and measuring what counts for the well-being of both present and future generations, it is clear that robust accounting tools and indicators are needed for the 21st century. While many of these tools already exist and can be found in the SEEA and Ecological Footprint, more analysis is needed on the areas of overlap and potential integration of these two systems.

2. Sustainable Development – Historical Background

2.1. Introduction and Overview

In the past, many people in the world, including in the MENA Region, took their natural heritage for granted and viewed the environment as an almost limitless source of raw material

to be exploited and fed to a growing economy. This perception has changed in recent years and people in most countries now understand that the capacities of the environment to supply materials and absorb wastes are finite. This growing environmental awareness has led to demands for new kinds of information that highlight the relationship between the economy and the environment.

In response to the demand for more information, in the 1980s and 1990s, there was tremendous growth in the attention paid to integrating environmental and economic concerns in decision-making. The influential World Commission on Environment and Development (commonly referred to as the Brundtland Commission) recognized the need for integrated environmental and economic accounting in 1987 when it called for “an annual report and audit on changes in environmental quality and in the stock of the nation’s environmental resource assets.” The Commission noted that such a report was “essential to obtain an accurate picture of the true health and wealth of the national economy, and to assess progress towards sustainable development” (World Commission on Environment and Development, 1987; 314.) A number of other influential studies also called for the need to integrate environmental considerations into the national accounts (Ahmed et al., 1989; Daly and Cobb, 1989; and Repetto et al., 1989).

In response, many countries began to formulate and implement environmental and resource accounting frameworks and as a result, today many industrialized countries have a fairly well established system of environmental and resource accounts that quantify the links between the environment and the economy. A growing number of developing countries are also in the process of establishing environmental accounts. Most, if not all, of the environmental accounting systems are linked to some extent with the national accounts of their respective countries.

2.2 Sustainable Development Defined

The most commonly accepted definition of sustainable development is found in the Brundtland Commission Report, *Our Common Future*, which defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (Brundtland Commission Report).

Although sustainable development serves as the stated objective of many development initiatives, such as the Millennium Development Goals (MDG), ecosystems worldwide are deteriorating. A summary of the report of the Millennium Ecosystem Assessment by its Board entitled, *Living Beyond Our Means: Natural Assets and Human Well-being*, identified the failure to value ecosystem services as a major contributing cause to this problem.

As part of the solution, the Assessment proposes that the economic background to decision-making be changed so that policy making and planning take into account the full value of ecosystem services, market and non-market. To achieve this, a framework is needed that is quantitative and comprehensive with respect to the environment, and can be reliably integrated with economic accounts used for decision-making (Sachs et al. 2005).

Integration of sustainability and ecosystem valuation into a more complete economic performance evaluation has increasingly focused on ‘greening’ the national income accounts. The national income accounts are crucial because they constitute the primary source of information about the value-added generated by an economy and are widely used for assessment of economic performance and policy analysis in all countries. The national accounts, however, fail to adequately factor in the treatment of the environment. For example, while income from harvesting timber is recorded in the national accounts, the simultaneous depletion of natural forest assets is not (Sachs et al. 2005).

This can result in misleading economic signals about economic growth and development. Indeed, one of the primary motivations for the early environmental accounting efforts in the mid-1980s was the concerns that rapid economic growth in some countries was achieved through liquidation of natural capital; a temporary strategy that creates no basis for sustained advances in wealth and human well-being (Sachs et al. 2005).

In the years since the Brundtland Report, many natural and social scientists, as well as international institutions, have worked to develop environmental accounts as a tool to promote sustainable development (Sachs et al. 2005). Such accounts provide a framework for collecting and organizing information on the status, use, and value of the nation's natural resources and environmental assets, as well as on expenditures on environmental protection and resource management. An important step forward was the creation of the System of Environmental and Economic Accounting (SEEA), which provides a comprehensive and broadly accepted framework for incorporating the role of the environment and natural capital into the conventional system of national income accounts through a system of satellite accounts for the environment (Sachs et al. 2005).

2.3 Sustainable Development - What to Measure?

Sustainable development strategies (SDS) have their roots in Agenda 21, which was a key policy document describing a program for the achievement of sustainable development adopted at the Rio World Summit in 1992. Agenda 21 called on all countries to develop such a strategy together with a broad variety of stakeholders. As initially stated in chapter 40 of Agenda 21, the role of statistical indicators and the importance of monitoring progress towards sustainable development on the basis of indicators is recognized.

One of the fundamental issues is to define the scope and purpose of the set of indicators. What should be measured: sustainable development per se or sustainable development policies? If it were to be the former, how should sustainable development be defined? The Brundtland definition of sustainable development as “meeting the needs of the present without compromising the needs of future generations” is notoriously difficult to turn into an operational definition. Indeed, the Brundtland report elaborated a complex concept of sustainable development that went far beyond that single resonant phrase.

Another, more analytical, attempt in the Brundtland report at defining sustainable development was as “a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are all in harmony and enhance both current and future potential to meet human needs and aspirations”. There are clearly a number of principles involved, including inter- and intra-generational equity and justice, sustained economic growth that does not damage the environment or impoverish the local natural resource base, the eradication of poverty, and participation in decision-making.

3. The Stiglitz Commission Report – How to Measure Sustainability in the 21st Century?

In 2008, French President Nicholas Sarkozy created The Commission on the Measurement of Economic Performance and Social Progress. Commonly referred to as the “Stiglitz Commission” or the “Stiglitz Commission Report” after the Commission's Chair, Nobel laureate, Joseph Stiglitz,

the Commission's aim was “to identify the limits of GDP as an indicator of economic performance and social progress, including the problems with its measurement; to consider what additional information might be required for the production of more relevant indicators

of social progress; to assess the feasibility of alternative measurement tools, and to discuss how to present the statistical information in an appropriate way” (Stiglitz Commission Report, Exec. Summary, p. 8).

To many, the Commission’s findings and report came at important time; the height of the worst financial crises in post-war history. Some on the Commission believed that the economic crisis heightened the urgency and importance of the reforms suggested in the Report since “one of the reasons why the crisis took many by surprise is that our measurement system failed us and/or market participants and government officials were not focusing on the right set of statistical indicators.” (Stiglitz Commission Report, Exec. Summary, p. 8-9.) While not every member on the Commission agreed with this analysis, the entire Commission was nonetheless in agreement that the decisions governments and individuals make “depend on what we measure, how good our measurements are and how well our measures are understood.” (Stiglitz Commission Report, Exec. Summary, p. 9).

3.1. Moving Beyond GDP to Measure Environmental Sustainability

The Stiglitz Commission Report is a milestone in the history of public indicators and has become a significant platform for further debate on the limitations of Gross Domestic Product (GDP) as a true measure of wealth and well-being and whether there are more useful indicators of social progress and sustainable development. The Stiglitz Commission Report attempted to answer some of these questions in a comprehensive report that was divided into three main chapters. Chapter 1 primarily addressed familiar criticisms of GDP as a measure of well-being. Chapter 2 addressed measures of the “quality of life” that attempt to capture well-being beyond a mere command of economic resources. Chapter 3 pertains to sustainable development and environment and is the most relevant for purposes of this research project.

Under what literature calls a “wealth” or “stock-based” approach to sustainability, future well-being will depend upon the magnitude of the stocks of exhaustible resources that we leave to the next generations. It will depend also on how well we maintain the quantity and quality of all the other renewable natural resources that are necessary” (Stiglitz Commission Report, p. 61) Thus, the key question posed by the Stiglitz Commission is: *How can we measure whether enough of these assets will be left or accumulated for future generations?*

In seeking to answer this question, the Stiglitz Commission separated the various approaches into four general categories: (1) dashboards or sets of indicators; (2) composite indices; (3) adjusted GDPs; and (4) indicators focusing on overconsumption or underinvestment. (Stiglitz Commission Report, pp. 62-71). Of these, the focus for this research project is on adjusted GDPs and indicators of overconsumption or underinvestment.

3.2. Adjusted GDPs and Environmental Accounting Under the SEEA

Adjusted GDPs attempt to measure sustainability by starting with the conventional notion of GDP but systematically adjusting it using elements that standard GDP does not take into account relevant for sustainability. Two strands of approach have developed with one strand being more firmly integrated into the realm of the System of Environmental Economic Accounting (SEEA) (Stiglitz Commission Report, p. 65-66).

The SEEA brings together economic and environmental information in a common framework to measure the contribution of the environment to the economy and the impact of the economy on the environment. The UN Committee of Experts on Environmental-Economic Accounting (UNCEEAA) was created in 2005 to mainstream environmental-economic accounting, elevate the SEEA to an international statistical standard, and advance SEEA implementation in countries (Stiglitz Commission Report, p. 66).

The Stiglitz Commission Report noted that the SEEA comprises four categories of accounts. The first pertains to physical data related to flows of materials and energy and marshals them as far as possible according to the SNA accounting structure. The second takes those elements of the existing SNA that are relevant to the management of the environment and makes the environment-related transactions more explicit. The third category comprises accounts for environmental assets measured in physical and monetary terms. The fourth category of SEEA accounts deals with how the existing SNA might be adjusted to account (in monetary terms) for the impact of the economy on the environment (Stiglitz Commission Report, p. 66).

The Commission recognized that the first three categories of the SEEA are “vital building blocks for any form of sustainability indicator.” The last category, however, requires more analysis. In this last category, a number of adjustments are considered to account for the impact of the economy on the environment: (1) those relating to resource depletion, (2) those concerning so-called defensive expenditures, and (3) those relating to environmental degradation. These environmental adjustments to existing SNA are commonly known as “Green GDP.” Since GDP can be turned into NDP (net) by accounting for the consumption of fixed capital (depreciation of produced capital), it has been suggested that it might be meaningful to compute an “ea-NDP” (environmentally-adjusted) that takes into account the consumption of natural capital. The ea-NDP would comprise resource depletion (the over-use of environmental assets as inputs to the production process) and environmental degradation (the value of the decline in the quality of a resource) (Stiglitz Commission Report, p. 66).

The Commission noted that Green GDP and ea-NDP remain the most controversial outcomes of the SEEA and are implemented less by statistical offices since “translating valuations of degradation into adjustments to macro-economic aggregates” is “hypothetical” and the “very speculative” nature of this type of accounting has led to resistance among many accountants. The Commission also noted that another fundamental problem with green GDP is that it does not provide an assessment of “how far we are from sustainability targets” and what is really needed are measures of overconsumption or underinvestment” (Stiglitz Commission Report, p. 66-67).

3.3. Indicators of Sustainability and The Ecological Footprint

The last category includes all kinds of indicators that address the issue of sustainability in terms of overconsumption, underinvestment or excessive pressure on resources. These indicators tend to be presented in flow terms but are built upon the assumption that some stocks that are relevant for sustainability correspond to the measured flows, i.e. stocks that are being transmitted to future generations and determine their opportunity sets (Stiglitz Commission Report, p. 67). Examples of such indicators include adjusted net savings (also known as genuine savings or genuine investment) and various “footprints.”

The Stiglitz Commission emphasized the importance of complementing GDP with physical indicators for monitoring environmental sustainability and highlighted the Ecological Footprint (“EF”) and the Carbon Footprint. The Ecological Footprint is the main focus of this Research Project since a number of international agencies and countries have tested the Ecological Footprint and several, including Switzerland, Finland, Japan, United Arab Emirates, Ecuador and Luxembourg, are using the tool in varying capacities. Of particular relevance to the MENA Region is the United Arab Emirates, which is using the Ecological Footprint to facilitate sustainable planning through a robust and science-based decision making process (Abdullatif et al., 2009). The experience of the UAE can possibly be extended throughout the Region.

The Commission recognized that the results of the Ecological Footprint are “well-known and rather striking: since the mid-1980s, humanity’s footprint has been larger than the planet’s carrying capacity” (Stiglitz Commission Report, p. 71). As discussed in detail below in Section 7 all of the countries in the MENA Region are “ecological debtors”; they demand more biocapacity than they have within their borders.

Despite this recognition, the Stiglitz Commission favored the Carbon Footprint over the Ecological Footprint due to some perceived weaknesses in the Ecological Footprint and the belief that a “less-encompassing but more-rigorously-defined footprint, such as the ‘Carbon Footprint’ (CF) would seem better-suited, insofar as they are more clearly physical measures of stocks that do not rely on specific assumptions about productivity or an equivalence factor.” (Stiglitz Commission Report, p. 71, para. 166).

While the Stiglitz Commission favored the Carbon Footprint due to current carbon interest, and the already established carbon accounting practices, Global Footprint Network argues that a “carbon plus” view is necessary in order to understand the significance of current environmental trends¹. The Ecological Footprint fully and wholly contains the carbon footprint, and takes a comprehensive, more effective approach by tracking a full palette of human demands on the biosphere’s regenerative capacity. It can also compare this demand against availability of biocapacity (See Section 7 below).

3.4. Al Basama al Beehive (Ecological Footprint) Initiative – UAE

The Ecological Footprint is currently being used by a number of governments around the world, including the United Arab Emirates (UAE), which launched a major environmental initiative based on the Ecological Footprint in 2007.

In 2006, The Living Planet Report 2006² reported that the UAE had the highest per capita footprint in the world -- more than five times higher than the globally available biocapacity per person. In simple terms, if every person on the planet lived as a person in the UAE, humanity would require nearly seven planets to cover its needs.

In order to better understand their Ecological Footprint, in October 2007, the UAE launched the Al Basama al Beeiya (Ecological Footprint) Initiative as a “national effort to ensure a sustainable future by measuring and understanding the impact of our ways of living on planet earth.” The Initiative involves multiple stakeholders across the nation to work towards developing important guidelines for a more resource-conscious and resource-efficient government and society (Al Basama Al Beeiya Initiative).

The four core partners in the Al Basama Al Beeiya initiative are the UAE Ministry of Environment and Water, the Abu Dhabi Global Environmental Data Initiative (AGEDI), the Emirates Wildlife Society - World Wide Fund for Nature (EWS-WWF) and the Global Footprint Network (GFN), an international non-profit organization that promotes Ecological Footprint as a sustainability metric worldwide.

The key aims of the Initiative are to better understand the Footprint methodology, review data for the Living Planet Report 2008 and beyond and look at the possible institutionalization of the Footprint in the UAE. In its first year, the Initiative contributed to a more robust

¹ The Global Footprint Network’s full response to the issues raised in the Stiglitz Commission Report can be found at http://www.footprintnetwork.org/en/index.php/newsletter/bv/_commission_urges_gdp_rethink_new_footprint_standards_released.

² Global Footprint Network compiles the Ecological Footprint data of over 150 nations for the Living Planet Report published biennially in cooperation with the World Wide Fund for Nature (WWF). The Living Planet Report 2006 can be accessed at http://www.footprintnetwork.org/newsletters/gfn_blast_0610.html.

representation of the UAE Footprint by verifying data on population and carbon Footprint. In the second year, an environmentally extended Input-Output approach to Ecological Footprinting was performed to break down the UAE Footprint value by industrial sectors, final demand, and household consumption categories. This helped disaggregate the country's overall demand by key activities, identify areas for potential environmental policy intervention and facilitate sustainable planning through a science-based decision making process (Abdullatif et al., 2009). The initiative has also successfully raised awareness of the Footprint concept among key UAE stakeholders (Al Basama Al Beeiya Initiative).

4. Overview of Key Environmental Challenges Facing the MENA Region

The MENA region is an economically diverse region that includes both the oil-rich economies in the Gulf and countries that are resource-scarce in relation to population, such as Egypt, Morocco, and Yemen.³ The Region is disproportionately endowed with natural resources, being the world's richest in oil and gas reserves and one of the poorest in renewable water resources. All MENA countries share the following environmental challenges, which only differ by magnitude and severity between the countries:

1. Water scarcity and quality;
2. Land degradation and desertification;
3. Urban and industrial pollution;
4. Inadequate capacities for waste management;
5. Coastal and marine environmental degradation;
6. Air pollution;
7. Climate change; and
8. Weak environmental institutions and legal frameworks.

While all of the environmental challenges deserve attention, this paper will focus primarily on issues related to water scarcity and quality since most international development efforts in the Region have been focused on water. The vital importance of water can hardly be overstated; especially for an arid region such as the MENA Region. Water in the MENA Region largely determines the pattern and terms of settlement and plays a crucial role in human and economic development.

4.1. Water Development in ESCWA Countries

There is a growing concern among the international community that a pending water crisis is threatening the entire global population, not only those living in arid to semi-arid areas. There is also a consensus on the need to periodically update the information on water resources across the world because of the rapidly changing situation. In this context, the United Nations established the World Water Assessment Programme (WWAP), with the primary objective of producing a comprehensive analysis on the global water situation in the form of a report published every three years. The first World Water Development Report (WWDR) was published in 2003, the second in 2006 and the third in 2009.

To enhance water resource concepts in the Region, the Economic and Social Commission for Western Asia (ESCWA) has initiated a series of periodic publications on water development in the ESCWA member countries, the aim being to enhance the application of integrated water resources management (IWRM) concepts in the region and provide decision makers

³ According to the World Bank, the MENA Region encompasses the following countries: Algeria; Bahrain; Djibouti; Egypt; Iran; Iraq; Israel; Jordan; Kuwait; Lebanon; Libya; Malta; Morocco; Oman; Qatar; Saudi Arabia; Syria; Tunisia; United Arab Emirates; West Bank and Gaza; and Yemen.

with comprehensive reports on key issues related to the sustainable management of available water resources.⁴

According to the most recent report, “the water supply and demand balance in most ESCWA member countries is in serious deficit” and the countries that are not already in deficit are steadily heading in that direction.⁵ The severe state of water availability in the region is due to growing water demands coupled with the deterioration of surface and groundwater quality.

Table 1 highlights the status of freshwater in the countries of the ESCWA region and indicates that, with the exception of Iraq, all of the countries in the region suffer from water scarcity (ESCWA Framework Report, p. 7)

A combination of both water supply and demand side options are pursued throughout the region, which includes wastewater treatment and reuse, agricultural runoff reuse and desalination. Desalination has become very prevalent in the ESCWA region and many countries rely almost exclusively on desalinated water for their freshwater supply in order to meet growing water demand (ESCWA Water Report 3).

4.2. Overview of Regional Water Issues

Water is a political, environmental and development issue that has dominated the geopolitics of the Region for centuries. Most of the international bodies of water in the region are not regulated by comprehensive international agreements. There are some agreements, which have adapted the principles of international law to water sharing principles of cooperation, inclusive participation and incentives for mutual gain; however, they are seldom signed by all the riparian States (ESCWA Water Dev. Rpt. 2).

Equitable distribution is only one component of the water scarcity challenge. The over-exploitation of water resources and their pollution by industrial effluents and agricultural discharges of waste and by-products further complicate the Region’s cross-national implications of water scarcity. It has been predicted that, in the continued absence of effective agreements on the efficient use and management of water resources in the region, the coming years will witness conflicts over water, rather than oil (ESCWA Water Dev. Rpt. 2).

4.3. Water Scarcity and Quality

Despite the diversity of landscapes and climates in the MENA Region, most of the Region’s countries cannot meet current water demand. Many countries face full-blown crises and the situation is likely to get worse with per capita water availability predicted to fall by half by 2050 (World Bank Scarcity Report).

A recent report about the state of the environment in the Arab world also concluded that fresh water scarcity is one of the top concerns in the MENA Region. The *Arab Environment: Future Challenges* report is the first annual report produced by the Arab Forum for Environment and Development (AFED) and is a policy-oriented report designed to evaluate the progress made towards the realization of sustainable development goals and good environmental quality (Tolba, M. and Saab, N. 2008).

⁴ The first and second development reports, “ESCWA Water Development Report 1: Vulnerability of the region to socio-economic drought” (E/ESCWA/SDPD/2005/9), and “ESCWA Water Development Report 2: State of water resources in the ESCWA region” (E/ESCWA/SDPD/2007/6), are both available at www.escwa.un.org.

⁵ “ESCWA Water Development Report 3: Role of Desalination In Addressing Water Scarcity” (E/ESCWA/SDPD/2009/4) (10 Nov. 2009), available at www.escwa.un.org.

The finding in the *Arab Environment: Future Challenges* report (Tolba, M. and Saab, N. 2008) is that the environmental issues in the MENA Region deserve to be given the same political and economic priority as other major macroeconomic issues. “Specifically, the issue of environmental sustainability needs to permeate into all aspects of development and macroeconomic policies. Currently, this is not the case.” (Tolba, M. and Saab, N. 2008).

According to the Arab Environment Report, the average annual available water per capita in the Arab countries was 977 cubic meters in 2001, which is below the UN definition of water scarcity. Future water predictions are bleak: by the year 2023, the figure is expected to decrease to 460 cubic meters. With the exception of Egypt, Sudan, Iraq, Lebanon, and Syria, all Arab countries are projected to experience severe water stress by 2025.

Even at present, the renewable waters resources for most countries in the MENA Region are far below the levels of other major regions in the world. In fact, for many MENA countries, renewable water resources cannot cover the sustainable human needs as defined by the United Nations (Tolba, M. and Saab, N. 2008).

Policy issues related to water management remain a problem in the MENA Region. Most of the available water in the Region, approximately 80%, is used for irrigation. Water use efficiency levels are relatively low in the region and typically range between 37% and 53%. As per capita water supplies decrease, governments will have to implement strategic planning that can both increase water use efficiency and optimize the allocation of water among the agricultural, industrial, and domestic domains (Tolba, M. and Saab, N. 2008).

It seems clear that water policies in the MENA Region will require improved management of both the supply side and the demand side, together with dedicating more resources for developing technology. In terms of the use of technology to increase water supply, desalination seems to be the best alternative and is heavily used, especially in the Arab Peninsula (Tolba, M. and Saab, N. 2008).

5. Environmental Accounting and the System of National Accounts (SNA) and the System of Integrated Environmental and Economic Accounts (SEEA)

To promote the principle of sustainable development, several international institutions have recommended that countries develop environmental accounts. Such accounts provide a framework for collecting and organizing information on the status, use, and value of the nation’s natural resources and environmental assets, as well as on expenditures on environmental protection and resource management.

The feasibility of constructing environmental accounts for the MENA region has received very little, if any, attention in the literature. However, a major initiative to construct water accounts in the ESCWA is underway and should serve to stimulate critical thinking and research in this area.

5.1. Background of the SNA and SEEA

The internationally accepted set of guidelines for the preparation of national accounts is The System of National Accounts 1993 (SNA93) which represents the work of five international economic organizations to define the scope of the national accounts and provide guidance on the concepts and methods that should be used in their compilation. There are a number of environmental criticisms of the national accounts that have been addressed in the literature (Daly and Cobb (1989) provide an excellent overview) and a detailed discussion is beyond the scope of this paper. In brief, the national accounts have been criticized because they do not measure the contribution of the environment to national wealth; they treat the receipts from the depletion of natural resources as current income rather than capital depletion; they

measure the benefits of the use of the environment but not the costs; and they include expenditures to protect the environment as part of gross production.

The idea of linking environmental and economic data through an accounting framework was recognized as far back as the 1950s. An early advocate was the Canadian economist Anthony Scott (1956) who argued that due to the importance of natural resources to national wealth, national accounts should show annual changes in this total (Statistics Canada, 2006). In the late 1960s and early 1970s, a number of economists began investigating the possibility of integrating environmental data into input-output accounts (Cumberland, 1966; Daly, 1968; Isard, 1969; Ayres and Kneese, 1969; Leontief, 1970; and Victor, 1972).

It was not until later in the 1970s, however, that national statistical offices began the formal development of environmental and resource accounts. Norway (Alfsen et al., 1987) and France (Weber, 1983) were the first to initiate the development of their accounts. In the late 1980s, the United Nations Statistics Division, European Union, OECD, World Bank, and country statistical offices initiated a coordinated effort to address a major part of the problem in analyzing natural wealth, which was the omission of natural capital accounts from the asset accounts. This effort resulted in a standardized framework and methodologies for constructing environmental accounts, called the System of Integrated Environmental and Economic Accounts, or SEEA (United Nations et al. 2003). The SEEA extends the asset boundary of the System of National Accounts to include all natural resources, recording asset value, depletion and improvements in the stock of natural capital (Lange 2004)

Environmental and resource accounts can be defined as any systematic compilation of stock, flow or state statistics relating to the environment or to natural resources. To qualify as accounts, these compilations must adhere to predefined principles that specify:

- What is and what is not, to be measured;
- What units of measure are to be used;
- How often measurement is to be undertaken;
- The geographic scope for measurement; and
- The format in which results are presented.

Taken together, the above elements define an accounting framework. Although environmental and resource accounts can be compiled according to any suitable framework, they most often use that of the national accounts (Statistics Canada, 2006) The benefit of using the national accounts framework is that the statistics of the environmental and resource accounts may be directly linked with those of the national accounts, which enhances the usefulness of both data sets.

The environmental and resource accounts of most countries comprise three major components:

1. The Natural Resource Stock Accounts measure quantities of natural resource stocks and the annual changes in these stocks due to natural and human processes;
2. The Material and Energy Flow Accounts record in physical terms only the flows of materials and energy - in the form of natural resources and wastes – between the economy and the environment;
3. The Environmental Protection Expenditure Accounts identify current and capital expenditures by business, government and households for the purpose of protecting the environment.

5.2. Environmental Accounts and Policy

A strong argument can be made that environmental accounts can contribute to better policy at all levels of governance. “At the macroeconomic level, Ministries of Finance need to know whether their development strategy is laying the basis for long-term economic growth or not. In countries dependent on extraction of high-value natural resources . . . development can only be economically sustainable if revenue from extraction is transformed into alternative assets.” (Sachs et al. 2005) Establishing environmental accounts enables countries to “monitor this process and provides a sound basis for policy interventions consistent with sustainable development at each stage.” (Sachs et al. 2005).

Environmental accounts can also provide the basis for answering the following questions:

- “How much resource rent is being generated, and would different policies increase rent?
- How much resource rent is recovered through taxes and non-tax instruments?
- How much of the recovered rent is invested in other assets, providing the basis for sustainable long-term growth?” (Sachs et al. 2005)

“Ministries of Finance often make budgetary allocations based on information from national accounts that underestimates the true contribution to the economy from the environment and natural resource sectors, resulting in misguided government policies and poor investment decisions. Information about the value of non-market goods and services, particularly environmental services provided to other sectors such as agriculture and tourism, is often missing.” (Sachs et al. 2005). Environmental accounts that include the value of all ecosystem goods and services can provide the information necessary to support the following:

- “Better allocations from the current budget to support management of environment and natural resource sectors;
- Better guidance to business about most efficient private sector investments; and
- Better infrastructure investment decisions that reflect all the potential gains from sustainable management of environment and natural resource sectors.” (Sachs et al. 2005).

Establishing environmental accounts can also lead to better management of resources at all levels. For example, if water accounts are established in the MENA Region, water ministries will be able to quantify the economic gains and losses from a range of water management decisions since the water accounts will be linked to national income accounts. Such decisions might include “the benefits from water infrastructure investment, the economic gains and losses from reallocation of water among end-users, the social and economic impacts of different pricing policies for water and sanitation services, the benefits from treatment of water and pollution abatement and the most efficient combination of methods to meet future water needs.” (Sachs et al, 2005).

5.3 International Comparisons

Many developed countries, such as Australia, Canada, and Norway, have established some components of environmental accounting and continue to refine their accounts. Although the direction followed in each country is generally influenced by resource endowments and environmental and political concerns, there are enough issues in common to point to the need to standardize environmental accounting concepts and practices internationally.

As such, a number of organizations are working to establish international standards for environmental accounts. One such organization is the *London Group on Resource and Environmental Accounting*. The *London Group* is an informal group of approximately 30 statisticians representing 14 countries and 5 international organizations. The *London Group*

meets annually and the papers and proceedings are published by a participating agency on behalf of the group. Global Footprint Network also participates in this group in order to make the Ecological Footprint Consistent with SEEA approaches.

The subject of environmental accounting is well discussed in the literature and a detailed discussion of each countries experience with environmental accounting is beyond the scope of this research project. Rather, this research project will focus on the Water Accounts Pilot Project already underway in the Region and discussed in detail below.

5.4. Overview of SEEA-2003

The United Nations (UN), the Organization for Economic Co-Operation and Development (OECD), and other international institutions have recommended that countries develop environmental accounts. In 2003, the UN issued *The Handbook of National Accounting: Integrated Environmental and Economic Accounting*, commonly referred to as SEEA-2003 (United Nations et al. 2003) that provided certain guidelines for the establishment of environmental accounts.

The Handbook describes the following four components of environmental accounting:

- Natural resource asset accounts, which primarily include information on stocks of natural resources.
- Pollution and material flow accounts, which provide information at the industry level about the use of energy and materials and the generation of pollutants and solid waste.
- Environmental protection and resource management expenditure accounts, which identify expenditures made by industry, government, and households to protect the environment or manage resources.
- Environmentally adjusted macroeconomic aggregates, which include indicators of sustainability, such as an environmentally adjusted net domestic product.

5.5. Natural Resource Accounts

Natural resource accounts present annual monetary and physical estimates for stocks of natural resources including subsoil assets, timber, and land. The Canadian System of Environmental and Resource Accounts (CSERA) provides a model for such accounts and records annual physical and monetary estimates for Canada's "economically recoverable reserves" of:

- Crude oil;
- Natural gas and its by-products (natural gas liquids and sulphur);
- Crude bitumen (or tar sands);
- Lignite, sub bituminous and bituminous coal;
- Metals (copper, nickel, zinc, lead, gold, silver, molybdenum, iron and uranium); and
- Potash.

Economically recoverable reserves are those that can be recovered under current technological and economic conditions. They are known with sufficient certainty to be considered economic assets in the SNA93 and therefore qualify for inclusion in the National Balance Sheet Accounts (Statistics Canada, 2006, p. 6)

Beyond economically recoverable reserves, the CSERA Subsoil Asset Accounts also show supplementary, point-in-time physical estimates for Canada's total resource base. They supplement the estimates of economically recoverable reserves with judgments of reserves thought to be recoverable but not yet proven to exist. This broader physical assessment of

reserves is included because the annual physical and monetary accounts measure only a fraction of total reserves (Statistics Canada, 2006, p. 6)

The Subsoil Asset Accounts take the form of reconciliation accounts that show estimates for opening and closing stocks in each year plus the volume changes that occurred during the year. Volume changes resulting from new discoveries, reserve development, changes in extraction technology, revisions in reserve estimates, and extraction are recorded in both the physical and monetary accounts. The monetary accounts also include estimates of changes in stock volumes resulting from revaluations caused by changes in resource prices (Statistics Canada, 2006, p. 6)

Canada uses two methods of valuation to estimate stock values: (1) net price, and (2) present value. The net price method for subsoil asset valuation is based on the so-called Hotelling model (Hotelling, 1931). This model assumes that in a perfectly competitive market the price of the marginal unit of a non-renewable resource – net of extraction, development and exploration costs (including capital costs) – will rise over time at a rate equal to the rate of interest. This is known as the Hotelling “r-percent” rule (Landefeld and Hines, 1985).

Under such a regime, there is no need to discount future income to account for the devaluing effect of inflation. This leads to the result that the value of the stock of a non-renewable resource can be calculated simply as the net price (or rent) per unit of resource times the size of the resource stocks (Statistics Canada, 2006, at p. 36).

The net price method suffers from a number of shortcomings and empirical analysis shows that this method tends to overestimate the market value of subsoil assets (Statistics Canada, 2006, p. 37). Due to these shortcomings, an alternative method of valuation, based on the formula for calculating the present value of a stream of future income might be the better model for the MENA Region, although additional research is required before a final determination can be made.

In order to apply the present value method to the valuation of subsoil asset stocks, certain assumptions about the future behavior of key variables are required. First, current annual rates of asset extraction are assumed to remain constant for the remaining life of the reserves. Second, current year-end resources prices and extraction costs (in real terms) are assumed to remain constant over the remaining life of the reserves (Statistics Canada, 2006, p. 36-37).

5.6. Overview of the SEEAW

Recognizing the importance of water as an essential element for life, the United Nations, in close cooperation with the London Group on Environmental Accounting, has prepared the handbook *Integrated Environmental and Economic Accounting for Water Resources*, or SEEAW. The SEEAW is part of a series of handbooks in support of implementation of the Handbook of National Accounting Integrated Environmental and Economic Accounting 2003, commonly referred to as SEEA-2003.

The SEEA-2003 provides a conceptual framework for economic and environmental information permitting a consistent analysis of the contribution of the environment to the economy and the impact of the economy on the environment. The scope of the SEEA-2003 is very broad but does not cover in detail all aspects of the environment. The SEEAW was developed in support of the SEEA-2003 by elaborating the concepts of the SEEA-2003 with a special focus on water.

Both the SEEA-2003 and the SEEAW are satellite systems of the 1993 SNA, which is the statistical standard used for the compilation of economic statistics. As such, they have a similar structure to the 1993 SNA and share common definitions and classifications. They

provide a set of aggregate indicators to monitor environmental-economic performance both at the sectoral and macroeconomic level, as well as a detailed set of statistics to guide resource managers toward policy decision-making.

The SEEA and SEEAW directly link environmental and, in the case of SEEAW water, data to the economic accounts through a shared structure, set of definitions and classifications. The advantage of this database is that it provides a tool to integrate environmental-economic analysis whereas these two disciplines have typically been carried out independently of one another.

Another key feature of the SEEA and the SEEAW is that they cover all the important environmental-economic interactions which makes it ideal for addressing cross-sectoral issues such as integrated water resource management. As satellite accounts to the SNA, the SEEA and SEEAW are linked to full range of economic activities; with a comprehensive classification of environmental resources, the SEEA includes information about all critical environmental stocks and flows that may affect water resources and that may be affected by water policies.

The SEEAW goes a step further than the SEEA-2003 by providing a set of standard tables that countries are encouraged to compile using harmonized concepts, definitions and classifications. This is in line with the United Nations Statistical Commission decision, upon recommendation of the United Nations Committee of experts on Environmental–Economic Accounting¹, of elevating the SEEA-2003 to the level of a statistical standard by 2010 (UN, 2006c and 2006d).

As part of its standard presentation, the SEEAW includes the following:

- Stocks and flows of water resources within the environment;
- Pressures of the economy on the environment in terms of water abstraction and emissions added to wastewater and released to the environment or removed from wastewater;
- The supply of water and the use of water as input in the production process and by households;
- The reuse of water within the economy;
- The costs of collection, purification, distribution and treatment of water as well as the service charges paid by the users;
- The financing of these costs (who is paying for the water supply and sanitation services);
- The payments of permits for access for abstraction or use it as sink for discharge of wastewater; and
- The hydraulic stock in place as well as investments in hydraulic infrastructure during the accounting period.

The SEEAW emphasizes the importance of deriving indicators from the accounting system and provides policy makers with 1) indicators and descriptive statistics to monitor the interaction between the environment and the economy, and progress toward meeting environmental goals, and 2) a database for strategic planning and policy analysis to identify more sustainable development paths and the appropriate policy instruments for achieving these paths.

6. Establishing a Framework for Environmental Economic Accounting in the MENA/ESCWA Region

While there are many environmental accounts that could be constructed for the MENA Region, this paper focuses on the construction of Water Accounts currently being developed by the Economic and Social Commission for Western Asia (ESCWA).⁶

6.1. Overview of the ESCWA Environmental Accounting Project

At its thirty-seventh session in March 2006, the United Nations Statistical Commission requested the Committee of Experts on Environmental Economic Accounting to focus on the development and promotion of environmental accounting and refine its working relationship with the various groups responsible for the development of environmental, energy and related statistics. The output is expected to result in a revised edition of the *Handbook of National Accounting: Integrated Environmental-Economic Accounting 2003* and to become an international standard in 2012 (Framework Report ESCWA, p. 3-4).

As a regional commission of the United Nations, the Economic and Social Commission for Western Asia (ESCWA), has undertaken “to develop a regional agenda for environmental accounting in its member countries and to build their capacities in the implementation of environmental accounting according to regional priorities and specificities.” (Framework Report ESCWA, p. 4). Allocated a budget of \$602,000, the ESCWA project is “aimed at enhancing the national capacities of ESCWA member countries in environment statistics, indicators and accounts; and at integrating environmental concerns into economic development by taking advantage of an integrated environmental statistical system approach (IESS) in support of progress towards achieving national and internationally agreed development goals (IADGs).” (ESCWA Framework)

6.2. Establishing Water Accounts in the ESCWA Region

The ESCWA region is “characterized by scarcity and uneven availability of freshwater resources, increasing gap between freshwater supply and demand, deteriorating water quality and dominating water use in agriculture.” (ESCWA Framework p. 15) In addition, “existing wastewater treatment facilities in the region face difficulties in handling increasing volumes of wastewater generated by increased water consumption and urbanization.” (ESCWA Framework at p. 15-16). In light of this, establishing water accounts was considered “vital and critical” for the ESCWA region. According to the ESCWA, the SEEAW can be used to support Integrated Water Resources Management (IWRM) and serves to inform decision makers on numerous water issues (ESCWA Framework, p. 16).

The Global Assessment of Water Statistics and Accounts was undertaken by UNSD with the aim of: (a) obtaining an in-depth understanding of country practices in compiling water statistics and accounts; (b) assessing compliance with SEEAW; (c) contributing towards the development of the International Recommendations of Water Statistics; and (d) assisting with the development of targeted technical cooperation activities in these areas (ESCWA Framework, p. 17).

All ESCWA member countries have requested the assistance of UNSD in implementing their SEEAW. Currently, Bahrain, Jordan and Oman have undertaken practical steps to develop

⁶ The countries of the ESCWA region differ slightly from the countries comprising the MENA region. The ESCWA countries (as defined by the UN) are: Bahrain, Egypt, Iraq, Jordan, Kuwait, Lebanon, Oman, Palestine, Qatar, Saudi Arabia, The Sudan, Syrian Arab Republic, United Arab Emirates, and Yemen. (Framework Report ESCWA, p. 4). The MENA countries (as defined by the World Bank) are: Algeria, Bahrain, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malta, Morocco, Oman, Qatar, Saudi Arabia Syria, Tunisia, United Arab Emirates, West Bank and Gaza, and Yemen. (www.worldbank.org)

water accounts and Egypt and Lebanon anticipated starting pilot water accounts in 2009 (ESCWA Framework, p. 17-18).

6.3. Pilot Water Accounts in ESCWA Member Countries – Jordan and Bahrain

The ESCWA Framework Report focused on two countries that have established pilot water accounts – Jordan and Bahrain (ESCWA Framework, p. 18-19). According to the Framework Report, “Jordan represents one of the world’s poorest countries in terms of water availability. In the face of water scarcity and the few and expensive opportunities to increase supply, the Government is trying to solve part of the problem by redistributing the available water resources to different uses. The Government’s planning and future projects take into consideration alternative sources for water supply, including building dams and the use of such non-traditional sources as the reuse of treated water and desalinization.”

“The Department of Statistics (DOS) in Jordan detains a program of environment statistics and publishes regular statistical reports on environment. In 2008, the section of environment statistics in DOS undertook a pilot study on water statistics and accounts aimed at responding to the issue of water scarcity and its economic implications. This pilot study, which is still under revision, was prepared in coordination among the different stakeholders in Jordan and with the technical assistance from UNSD, ESCWA and MEDSTAT. The study included water sector challenges, data sources, and water supply and demand analysis; and presented standard tables of SEEAW on supply, use and emission accounts. Hybrid accounts were not compiled owing to a lack or dispersion of data.” Bahrain has also launched a pilot study aimed at studying water usage in the country for the year 2005 and more detail on Bahrain is provided in the ESCWA Framework Report, including the complete SEEAW tables for Jordan and Bahrain that are in Annex II (ESCWA Framework, p. 19).

6.4. Energy Accounts in the ESCWA Region

While the primary focus has been on water accounts, the ESCWA pilot project also briefly addressed other possible accounts that may be relevant for the Region to consider establishing at some point in the future. Of these, the most relevant account for future consideration is energy. Energy accounts have not been developed in any ESCWA member country with a major limitation being the quality of energy statistical information in most ESCWA countries (ESCWA Framework, p. 22). With some capacity building in national statistical offices and ministries, the development of energy accounts could be achieved in one or two years in Egypt, Jordan and Oman. Egypt and Jordan are preparing energy balances and Oman has developed a comprehensive set of data on national accounts (ESCWA Framework, p. 27).

6.5. Challenges and Limitations of Environmental Accounting

One of the primary challenges in establishing environmental accounts in the MENA Region is the availability of statistical data necessary to establish the accounts. Sufficient, compatible, and reliable data must be available to develop and populate environmental accounts and sufficient capacity must exist within the relevant statistical offices and ministries.

The ESCWA environmental project has focused on water accounting for the region and has proposed a regional agenda aimed at developing environmental accounts for water. This information provides useful guidance in assessing the Region’s capacity to undertake and implement environmental accounting.

- a) Group 1 – Countries where environmental statistics are available – Bahrain, Egypt, Jordan, Lebanon, Oman and Palestine. These countries are capable of producing water accounting in one year according to ESCWA’s work plan.
- b) Group 2 – Establishment of environmental statistics is a need and financial and human resources are available – Kuwait, Qatar, Saudi Arabia and United Arab Emirates. These countries are capable of compiling water accounts in two years.
- c) Group 3 – Establishment of environmental statistics is a need but financial and human resources are NOT available – Iraq, Sudan, Syrian Arab Republic and Yemen. These countries are expected to be able to compile water accounts in three years.

7. Comparing Human Demand to Nature’s Supply: The Example of the Ecological Footprint

In spite of growing ever more efficient at using nature’s bounty, humanity has also increased its demand for ecological services and resources. As a consequence, human use of nature’s ecological assets now significantly exceeds what nature can renew. Even if we continue on a moderate trajectory projected by the UN, it would take twice the capacity of the biosphere to meet our demands by the early 2030s (Moore et al., in press). This level of overshoot may be physically impossible, and lead to a rapid erosion of Earth’s natural capital.

Without robust accounting measures, decision-makers do not have information about how much nature we have, how much we use, and who uses what. With the aid of these navigational tools, it becomes possible to manage human pressure on the planet and take steps towards moving humanity away from liquidating its ecological resource base. The Ecological Footprint is one of such resource accounting tools. The Ecological Footprint measures the biologically productive land and sea required to produce all the resources a population consumes, and to absorb its waste, using prevailing technology. This is then compared against the bioproductive area available (Wackernagel et al., 2002).

7.1. What does the footprint show

The Ecological Footprint (Wackernagel et al., 1999a, b) answers one particular research question: how much of the planet’s regenerative capacity is demanded by human activities, such as eating, moving, the provision of shelter, and using goods and services? Footprint results are expressed in the unit of global hectares (gha) - hectares of land or sea area with world average bioproductivity in a given year⁷.

While the Ecological Footprint quantifies ‘human demand’, the biocapacity acts as an ecological benchmark and quantifies ‘nature supply’ for resource production and waste disposal services. A population’s Footprint can thus be compared to the biocapacity that is available to support that population, as expenditure is compared against income in financial terms (Monfreda et al., 2004).

How much biocapacity is available to populations? To humanity, the availability is one planet: in 2006 this was equivalent to about 1.8 biologically productive hectares per person. Biocapacity per person in countries varies considerably. For instance the US was endowed with 4.4 gha of biocapacity per resident in 2006; in contrast, in Kuwait there was 0.5 gha of biocapacity per resident. Availability of biocapacity also depends on the population’s purchasing power. If they have high purchasing power, they can access biocapacity from other regions through trade. For instance, they can import biocapacity in the form of food or goods. Alternatively, in the absence of international carbon emissions trading schemes, they

⁷ Such areas are cropland, grazing land, forests, fishing grounds, carbon Footprint, and built-up lands.

can use the biocapacity of other nations freely by emitting carbon dioxide into the global commons.

Countries whose residents use more biocapacity than is available, in net-terms, within the country run an ecological deficit (in contrast, if their residents use less, then they have an ecological remainder). An ecological deficit indicates that a country must rely on biocapacity from outside its own borders (through net-imports or net-emissions of CO₂ to the global atmosphere) or draw down its own natural capital.

The Ecological Footprint monitors the combined demand of anthropogenic pressures that are usually evaluated independently (climate change, fisheries collapse, land degradation / land-use change, etc.) and compresses this large amount of information into a single number (Iha et al., *forthcoming*). However, it does not assign arbitrary weights to individual components, but weights them proportional to their demand on biocapacity.

In 1961, humanity's Ecological Footprint was approximately half of what the biosphere could renew and sequester (biocapacity). According to the most updated National Footprint Accounts (GFN, 2009; Ewing et al., 2009), in the early 1980s human demand for the first time exceeded the planet's biocapacity. This "overshoot"⁸ has continued to increase, reaching 44% in 2006 (see Figure 1). In other words, in 2006 the Earth needed about 17 months to renew all the resources used by humans and absorb the wastes produced. As these annual deficits accrue into an ever larger ecological debt, ecological reserves are depleting, and greenhouse gases such CO₂ are accumulating in the biosphere and atmosphere.

The current state of environmental degradation means that natural ecosystems may lose their ability to provide the same level of life-support systems for mankind they used to. Collapsing fisheries, loss of forest cover, depletion of fresh water systems, build-up of carbon dioxide in the atmosphere and the accumulation of wastes and pollutants are just a few noticeable examples (UNDP, 2007). If continued, overshoot will permanently reduce the Earth's ecological capacity leading to a collapse in ecological and human wellbeing.

7.2 Structure of the National Footprint Accounts (NFA)

Created in 2003 by Global Footprint Network, National Footprint Accounts (NFA) quantifies the flows of regenerative and waste absorptive capacity within the biosphere associated with final consumption activities. NFA cover more than 200 countries, and extend from 1961 through 2006. NFA facilitate the understanding of our collective Ecological Footprint on a national, sub-national or global scale and enable for international comparisons of countries' demand.

NFA monitor the combined impact of anthropogenic pressures that are more typically evaluated independently, such as climate change, fisheries collapse, land degradation/land-use change, food consumption, etc. NFA can be considered an integrated economic and environmental accounting system in that they translate in environmental terms the consequences of the structure and functioning of a country's economy (GFN, 2010).

The National Footprint Accounts utilize approximately 50 million data points, primarily based on international datasets published by the United Nations Food and Agriculture Organization (FAOSTAT), United Nations Commodity Trade Statistics Database (UN

⁸ Global overshoot occurs when humanity's demand on nature exceeds the biosphere's supply, or regenerative capacity. Such overshoot leads to a depletion of Earth's life supporting natural capital and a build up of waste. At the global level, ecological deficit and overshoot are the same, since there is no net-import of resources to the planet. Local overshoot occurs when a local ecosystem is exploited more rapidly than it can renew itself.

Comtrade), International Energy Agency (IEA) and Global Agro-Ecological Zones 2000 (IIASA and FAO, 2000) (Ewing et al., 2009).

Production statistics for agricultural, forestry and fisheries primary and derived products are obtained from the FAO ProdSTAT, FAO ForesSTAT and FAO FishSTAT Statistical Database and presented in the FAO commodity classifications and HS+ commodity classifications where possible⁹. Production statistics for carbon dioxide emissions are obtained from the International Energy Agency.

This data is used in the NFA framework to then calculate the demand on each of the six considered land types (cropland, grazing land, fishing ground, built-up land, forest area for timber and fuel wood production, and forests for carbon uptake to accommodate the carbon Footprint). This allows for the observation and measurement of the demand humans place on the biosphere and its composing ecosystems. Further details on the NFA' framework can also be found in Kitzes et al. (2008).

For each nation, the aggregate total Ecological Footprint is then calculated by adding up the demand on each land type and used to communicate and inform policy makers. Total National Ecological Footprint values are thus the NFA equivalent to GDP in SNA and the availability of a single calculated figure gives the EFA the status of an objective tool for measurement of phenomena that are difficult to quantify (Schaefer et al., 2006).

7.3 Data Gaps and Limitations

Just as GDP assessments have never given the perfect answer to their particular research question, Footprint accounting also has limitations. The research questions Footprint accounting pursues are: How much biocapacity does a given activity (or population) demand? How much is available within a given region? The results summarize a great number of resource flows and build on vast numbers of UN statistical data sets (Kitzes et al. 2008).

The results continue to be improved with every edition released by Global Footprint Network. Improvements are generated through independent research, but also through research collaborations between national governments and Global Footprint Network. These research collaborations test in their first phase the validity of the results. But even before that, researchers need to determine first whether answering this research question is essential to sustainable development efforts or merely tangential. Then they need to test the validity of the results, checking the UN data input and results against national statistics. While the results will never be perfect, the researchers need to determine whether the results are valid enough for informing policy makers (or whether they would be better off with no estimate at all).

A number of countries have taken up research collaborations. They include Switzerland, Luxembourg, Japan, Ecuador and others. The United Arab Emirates in particular has been keen to address its high Ecological Footprint through an in-depth research collaboration. In 2007, the UAE launched the Al Basama Al Beeiya (Ecological Footprint) Initiative under the patronage of the Ministry of the Environment and Water and with the participation of the Abu Dhabi Global Environment Data Initiative (AGEDI with the Environment Agency - Abu Dhabi), Emirates Wildlife Society (EWS-WWF) and Global Footprint Network. Currently in

⁹ HS+ is an extended version of HS 2002 created by FAO to provide increased resolution and harmonize the FAO and HS commodity classifications.

its third phase, the initiative aims at facilitating in-country sustainable planning through a robust and science-based decision making process.¹⁰

Perfection in an accounting framework is not achievable, especially with a single indicator; indeed, like any accounting framework, the Ecological Footprint only addresses a small set of research questions. However, when used in conjunction with other indicators, the Ecological Footprint is able to concisely assess the state of sustainable welfare within a country.

Research by the French government institute SOeS has demonstrated that the current Footprint method is transparent and reproducible (SOeS 2010). But there are still many aspects that can be significantly improved, as pointed out, for instance, by Global Footprint Network's research agenda (Kitzes et al. 2007, 2009) or national and international reviews. Global Footprint Network has encouraged (Eurostat (2007), DG Environment (2008), European Parliament (2001), Japan, Belgium, Luxembourg, Germany, Ireland, United Arab Emirates, and others).

While the Stiglitz Commission favored the carbon Footprint due to current carbon interest, and the already established carbon accounting practices, Global Footprint Network argues that a "carbon plus" view is necessary in order to understand the significance of current environmental trends¹¹. The Ecological Footprint fully and wholly contains the carbon Footprint, and takes a comprehensive, more effective approach by tracking a full palette of human demands on the biosphere's regenerative capacity. It can also compare this demand against availability of biocapacity.

With a carbon analysis alone, trends as shown in the example of Djibouti (Figure 2) would not be visible to the assessment; the carbon Footprint of Djibouti in 2006, for example, was less than 18 percent of the overall Footprint (or about the thickness of the end of the red line). Djibouti's Footprint represents the biocapacity needed, on average to provide for the average consumption of a Djibouti resident. The biocapacity is the productive area available within Djibouti. The green surface between the lines shows the shrinking ecological remainder of Djibouti. Once the lines cross, the remainder becomes an ecological deficit. Ecological deficits can be compensated by overusing local biocapacity or by using biocapacity from abroad, for instance through net-import.

7.4. How Countries Compare

Humanity as a whole is not living within the means of the planet and countries vary widely in their relative resource demand as natural resource wealth and material consumption are not evenly distributed worldwide. Some countries and regions have a net demand on the planet greater than their respective biocapacity, while others use less than their available capacity.

There is no physical law or principle requiring all countries to live within their own biocapacity. Since trade is possible, countries can access biocapacity from elsewhere. The only constraint is that not all countries can do it over the long run. In the short run, it is possible for all countries combined to run an ecological deficit – but this leads to overshoot and the gradual liquidation of ecological assets, including the saturation of waste sinks.

In a world that is already in global overshoot, running an ecological deficit therefore becomes an increasing risk for that country's economy. It takes financial resources to net import resources from elsewhere, including access to fossil fuels. While CO₂ emissions are still

¹⁰ More information on the UAE Ecological Footprint Initiative can be found at: <http://www.agedi.ae/ecofootprintuae/default.aspx>

¹¹ The Global Footprint Network response is at http://www.footprintnetwork.org/en/index.php/newsletter/bv/commission_urges_gdp_rethink_new_footprint_standards_released.

largely unpaid for, this may change in a future that does have a climate agreement in place. If no climate agreement is in place, then international cooperation may suffer due to the asymmetric impacts of climate change, and international trade may thus become more expensive.

In a state of global overshoot, it therefore becomes important for countries to understand their ecological risk exposure. The size of an ecological deficit is an approximation of that risk. While only a few countries in the world, and in the MENA region, ran an ecological deficit in 1961, by 2006 three quarters of the human population lived in countries that are ecological debtors, demanding more biocapacity than they have within their borders. All countries in the MENA region are in this latter category (see Figures 3 and 4).

Resource demand varies widely across the world. The average Footprint in the United States is 9.0 global hectares per capita (the equivalent of about 10 soccer fields), while in European Union countries it is 4.7 global hectares per capita. Among the countries with populations over one million people, the one with the largest Footprint per capita (10.3 global hectares) is the United Arab Emirates. The average per capita Footprint in the MENA region as a whole is 2.3 global hectares, below the world average Footprint but still above the world available biocapacity of 1.8 global hectares per person.

In contrast, Haiti, the Democratic Republic of Congo, and Pakistan are among the countries with the smallest Footprints, all under 0.8 global hectares and, in most cases, too small to meet basic requirements for food, shelter, infrastructure, and sanitation. In many low-income countries, increasing population is driving an increase in overall resource consumption, even while per capita Footprint is falling. However, per capita Footprints do not represent the whole story: for example, even with the highest per capita Footprint in the world, the United Arab Emirates contributes less than 0.3% of humanity's overall demand on resources. China and the US exert the greatest total pressure on the world's resources, requiring 14% and 16% respectively of all human demand on nature's services, and both have growing ecological deficits and relatively high projected population growth rates.

As of 2006, all countries in the MENA region had an Ecological Footprint greater than their domestic biocapacity, though the individual rates of consumption varied widely. A country-by-country analysis is found in Annex 1.

7.5. Key Questions for the MENA Region

A number of international agencies and countries have tested the Footprint, and some are now using the tool in some form or other (Switzerland, Finland, Japan, United Arab Emirates, Ecuador, Luxembourg). In the development of a regional Environmental Accounting system for the MENA region, the ability to determine whether the region or each individual nation has breached ecological limits or not is a core requirement of the measurement of sustainability. Such a requirement will help to make development efforts succeed more effectively by working with rather than against nature's budget.

In determining whether the Ecological Footprint is a suitable indicator for the MENA region, a number of questions may need to be considered:

- Are biocapacity constraints relevant for MENA countries and their economic success?
- What are potential risks for MENA countries that ecological deficits could entail, if any?
- How accurate are the trend lines depicted here, and what is needed to make these assessments more accurate?
- Are they accurate enough to inform policy makers?

- What kind of blind spots do these assessment have when understanding the resource dependence of countries or cities?
- If indeed it is correct that the MENA region is in a deficit situation, what actions would be in the countries' self-interest?

Ecological Footprint accounts are not sufficient to manage a country's success, but in an ever more resource constrained world, it seems that it is a necessary ingredient. It provides also context for more specific assessments that only highlight one aspect (such as water accounts, or carbon assessments). Since basic Footprint assessments already exist, countries do not need to start from scratch; they only need to verify and improve what already is available.

By definition, a country/region is unable to sustain production above its ability to regenerate the resources used and assimilate the wastes. Consumption above this regenerative and assimilative capacity can be sustained on a local scale, but only through ever greater dependence on foreign resources and its corresponding risks.

8. Conclusions and Recommendations

The introduction of the concept of sustainable development in policy-making has been a major turning point for our societies over the last two decades. Yet, in recent years, it has become clear that no matter how we define sustainability, the hard truth is that “we are a species of unlimited appetites living on a planet with limited resources.” (Earthpulse, 2010). Given the complexity of the concept of sustainable development and the importance of measuring what counts for the well-being of both present and future generations, it is evident that increasingly robust accounting tools and indicators are needed for the 21st Century.

As the Stiglitz Commission Report noted, many of these tools already exist and can be found in the SEEA and Ecological Footprint. For the countries in the MENA Region, including measures of natural capital in natural wealth and implementation of the SEEA could be a significant step forward in improving macroeconomic measures of sustainability. The environmental accounting project currently underway in the ESCWA Region is an important first step in understanding environmental challenges in the region and how to best account for and integrate them into policy decisions. Additional research and analysis is needed to fully understand the difficulties of establishing environmental accounts for the region and to monitor the progress of the establishment of water accounts in the region.

One of the important contributions of the Stiglitz Commission Report was the emphasis on the need to track distinct policy goals separately; economic performance, quality of life and environmental sustainability. The Ecological Footprint has the potential to support this agenda in that is a resource accounting tool and part of a micro-dashboard of economic performance and social progress indicators. The Al Basama al Beeiya Footprint project in the UAE can serve as a model to inform and guide other countries in the Region that seek to learn more about their Ecological Footprint.

In the MENA Region, the subject of environmental sustainability and the appropriate accounting methods and sustainable development indicators is in its infancy and the Region would benefit from much more research and analysis on these topics. This includes assessing the incentives or disincentives embodied in selected regulatory schemes across countries and sectors.

Future research projects that would be beneficial include in-depth analysis on the regional challenges and limitations of both the SEEA and Ecological Footprint. While no fundamental incompatibility exists between the two, much more analysis is needed to understand the issue-coverage and areas of overlap of the two accounting systems.

References

- Abdullatif, L., Alam, T., Galli, A., Iyengar, L., Ledwith, L., 2009. *Al Basama Al Beeiya (Ecological Footprint) Initiative Technical Report – Year 2*. Unpublished document. Executive Summary available on-line at <http://www.agedi.ae/ecofootprintuae/default.aspx>.
- Ahmad, Y.J., El Serafy, S. and Lutz, E. (eds.),1989. *Environmental Accounting for Sustainable Development*, World Bank, Washington, DC.
- Al Basama Al Beeiya (Ecological Footprint) Initiative, available at <http://www.agedi.ae/ecofootprintuae/default.aspx>
- Arrow, K.J., Dasgupta, P. and Maler, K.G., 2003, 'Evaluating Projects and Assessing Sustainable Development in Imperfect Economies'. *Environmental and Resource Economics* 26:647-685.
- Ayres, R.U., and Kneese, A.V., 1969, 'Production Consumption and Externalities,' *American Economic Review*, Vol. 59 (June):282-97.
- Belgium - www.wwf.be/_media/04-lies-janssen-ecologische-voetafdrukrekeningen_236536.pdf
- Brundtland Commission Report, World Commission on Environment and Development, 1987, *Our Common Future*, Oxford University Press, Oxford.
- Cumberland, J.H., 1966, 'A Regional Inter-Industry Model for Analysis of Development Objectives,' *Regional Science Association Papers*, Vol. 17:5-95.
- Daly, H.E., 1968, 'On Economics as a Life Science.' *The Journal of Political Economy*, Vol. 76 (May-June):393-406.
- Daly, H.E., and Cobb, J.B., 1989, *For the Common Good: Redirecting the Economy Toward Community, the Environment and a Sustainable Future*, Beacon Press, Boston.
- Dasgupta, P. and Maler, K., 2000, 'Wealth as a Criterion for Sustainable Development'. Beijer Institute Discussion Paper Series No. 140.
- Dasgupta, P., 2002, 'Economic Development, Environmental Degradation and the Persistence of Deprivation in Poor Countries'. Paper presented at the World Bank.
- DG Environment – June 2008: "Potential of the Ecological Footprint for monitoring environmental impact from natural resource use" available at <http://ec.europa.eu/environment/natres/studies.htm>
- Economist Magazine, "Measuring what Matters," Sept. 17, 2009) available at www.economist.com.
- Economic and Social Commission for Western Asia (ESCWA), "Framework for Environmental Economic Accounting in the ESCWA Region" (E/ESCWA/SD/2009/3).

- Emirates News Agency, UAE Interact, "UAE Launches Ecological Footprint", Oct. 20, 2007, at http://www.uaeinteract.com/docs/UAE_launches_Ecological_Footprint/27241.htm.
- "ESCWA Water Development Report 1: Vulnerability of the region to socio-economic drought" (E/ESCWA/SDPD/2005/9), available at www.escwa.un.org.
- "ESCWA Water Development Report 2: State of water resources in the ESCWA region" (E/ESCWA/SDPD/2007/6), available at www.escwa.un.org.
- "ESCWA Water Development Report 3: Role of Desalination In Addressing Water Scarcity" (E/ESCWA/SDPD/2009/4), available at www.escwa.un.org.
- Ewing B.; Goldfinger, S.; Oursler, A.; Reed, A.; Moore, D. and Wackernagel. M., 2009, *The Ecological Footprint Atlas 2009*. Oakland: Global Footprint Network.
- Eurostat – http://epp.eurostat.ec.europa.eu/cache/ITY_OFFPUB/KS-AU-06-001/EN/KS-AU-06-001-EN.PDF
- GFN (Global Footprint Network), 2010. *Harmonizing the National Footprint Accounts with the System of Integrated Environmental and Economic Accounting*. Paper number UNCEEA/5/11 prepared for discussion at the 5th Meeting of the UN Committee of Experts on Environmental-Economic Accounting, 23-25 June 2010, New York. <http://unstats.un.org/unsd/envaccounting/ceea/meetings/UNCEEA-5-11.pdf> [Accessed 10 October 2010].
- Germany - <http://www.umweltdaten.de/publikationen/fpdf-l/3489.pdf>
- Hamilton, K. 2002. "Sustainable per Capita Welfare with Growing Population: Theory and Measurement". Paper presented at the Second World Congress of Environmental and Resource Economists, Monterey, California, 23-27 June.
- Hamilton, K. and Clemmens, M., 1999, "Genuine Savings Rates in Developing Countries". *World Bank Economic Review* 13(2):336-356.
- Hotelling, H., 1931 "The Economics of Exhaustible Resources," *Journal of Political Economy*, Vol. 39(2):137-175.
- Heal, G. and Kristrom, B., 2001. "National Income and the Environment," draft of a chapter forthcoming in T. Tietenberg and H. Folmer, eds., *International Yearbook of Environmental and Resource Economics*. Cheltenham, UK: Edward Elgar.
- Ireland – <http://erc.epa.ie/safer/iso19115/displayISO19115.jsp?isoID=56#files>
- Isard, W., 1969 'Some Notes on the Linkage of the Ecologic and Economic Systems,' paper delivered to the Regional Science and Landscape Analysis Project, Harvard University, June 27.
- Kitzes, J.; Galli, A.; Rizk, S. M.; Reed, A. and Wackernagel, M., 2008., *Guidebook to the National Footprint Accounts: 2008 Edition*. Oakland: Global Footprint Network.
- Kitzes, J.; Galli, A.; Bagliani, M.; Barrett, J.; Dige, G.; Ede, S.; Erb, K.; Giljum, S.; Haberl, H.; Hails, C.; Jungwirth, S.; Lenzen, M.; Lewis, K.; Loh, J.; Marchettini, N.; Messinger,

- H.; Milne, K.; Moles, R.; Monfreda, C.; Moran, D.; Nakano, K.; Pyhälä, A.; Rees, W.; Simmons, C.; Wackernagel, M.; Wada, Y.; Walsh, C. and Wiedmann, T., 2009, A Research Agenda for Improving National Ecological Footprint Accounts. *Ecological Economics*. Vol 68 No 7, p1991 – 2007 (first presented in 2007 - www.brass.cf.ac.uk/uploads/fullpapers/Kitzes_et_al_M65.pdf)
- Kunte, A.; Hamilton, K.; Dixon, J. and Clemens, M., 1998, 'Estimating National Wealth: Methodology and Results'. Environment Department Papers, Environmental Economics Series No. 57, Washington, DC: World Bank.
- Landefeld, J.S. and Hines, J.R., 1985, 'National Accounting for Non-renewable resources in the Mining Industries' *Review of Income and Wealth*, Vol. 31(1):1-20.
- Lange, G., 2004, 'Wealth, Natural Capital, and Sustainable Development: Contrasting Examples from Botswana and Namibia.' *Environmental & Resource Economics* 29:257-283.
- Leontief, W., 1970 'Environmental Repercussions and the Economic Structure: An Input-Output Approach,' *Review of Economics and Statistics*, Vol. 52 (August):262-71.
- Maler, K., 1991, 'National Accounts and Environmental Resources', *Environmental and Resource Economics* 1(1):1-15.
- Moore, D.; Cranston, G.; Reed, A. and Galli, A., *in press*. Projecting future human demand on the Earth's regenerative capacity. *Ecological Indicators*, doi:10.1016/j.ecolind.2011.03.013
- National Geographic, Earth Pulse: State of the Earth 2010, <http://ngm.nationalgeographic.com/earthpulse/straining-resources-text>).
- Pearce, D. and Atkinson, G., 1993, 'Capital Theory and the Measurement of Sustainable Development: An Indicator of Weak Sustainability', *Ecological Economics* 8:103-108.
- Pezzey, J., 1992, 'Sustainable Development Concepts: An Economic Analysis', World Bank Environment Paper No. 2.
- Repetto, R.; Magrath, W.; Wells, M.; Beer, C. and Rossini, F., 1989 *Wasting Assets: Natural Resources in the National Accounts*, World Resources Institute, Washington, DC.
- Report by the Commission on the Measurement of Economic Performance and Social Progress, commonly referred to as the "Stiglitz Commission Report" available at www.stiglitz-sen-fitoussi.fr.
- Sachs, J. and Warner, A., 2001, 'The Curse of Natural Resources', *European Economic Review* 45:827-838.
- Sachs, J.; Lange, G.; Heal, G. and Small, A., 'Global Initiative for Environmental Accounting', *Concept Note*, Department of Economic and Social Affairs, Statistics Division, United Nations, ESA/STATE/AC.108.
- Solow, R., 1974, 'Intergenerational Equity and Exhaustible Resources'. *Review of Economic Studies* 41, 29-45.

- Solow, R., 1986, 'On the Intergenerational Allocation of Natural Resources'. *Scandinavian Journal of Economics* 88:141-149.
- Statistics Canada, 2006, *Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts*, Catalogue No. 16-505-GIE.
- Switzerland - <http://www.bfs.admin.ch/bfs/portal/en/index/themen/21/03/blank/blank/01.html> (technical and descriptive report).
- Tolba, M., Saab, N., (editors) 2008, 'Arab Environment Future Challenges', *2008 Report of the Arab Forum for Environment and Development*, available at <http://www.afedonline.org>.
- United Arab Emirates – Al Basama Al Beeiya Initiative <http://www.agedi.ae/ecofootprintuae/default.aspx>
- UNEP (United Nations Environment Programme), 2007, *GEO₄ Global Environment Outlook: environment for development*. Progress Press Ltd, Malta.
- United Nations, European Commission, International Monetary Fund, Organization for Economic Cooperation and Development, and World Bank, 1993, *System of National Accounts*, New York: UN.
- United Nations, European Commission, International Monetary Fund, Organization for Economic Cooperation and Development, and World Bank (2003) *Integrated Environmental and Economic Accounting 2003*. New York: UN. Available on the UN website: www.un.org
- United Nations Statistical Division – Environmental Accounting – Workshops, available at <http://unstats.un.org/unsd/envaccounting/workshops.asp>.
- UNSD, "Preliminary Report of the Global Assessment of Energy Statistics and Balances," presented to the Statistical Commission at its 39th Session (26-29 February 2008).
- Victor, P.A., 1972, *Pollution: Economy and Environment*, University of Toronto Press, Toronto.
- Wackernagel, M.; Onisto, L.; Bello, P.; Linares, A. C.; Falfán, I. S. L.; García, J. M.; Guerrero, A. I. S. and Guerrero, M. G. S., 1999a, National natural capital accounting with the ecological footprint concept, *Ecological Economics*. 29:375-390.
- Wackernagel, M.; Lewan, L. and Hansson, C.B., 1999b, Evaluating the use of natural capital with the ecological footprint. *Ambio* 28:604–612.
- Wackernagel, M.; Schulz, B.; Deumling, D.; Callejas Linares, A.; Jenkins, M.; Kapos, V.; Monfreda, C.; Loh, J.; Myers, N.; Norgaard R. and Randers. J., 2002, Tracking the ecological overshoot of the human economy, *Proc. Natl. Acad. Sci.* 99(14):9266-9271.
- Wackernagel, Mathis, 2009, *Ecological Creditors and Debtors*, Environment & Poverty Times, UNEP/GRID-Arendal).

Weber J.L., "Implementation of land and ecosystem accounts at the European Environment Agency", *Special Issue on Environmental Accounting*, vol. 61, No. 4 (2007):695-707.

World Bank, 1997, 'Expanding the Measure of Wealth: Indicators of Sustainable Development'. ESD Studies and Monographs Series No. 17, Washington, DC: World Bank.

World Bank, 2002, World Development Report, Washington, DC: World Bank.

World Bank, 2002, Environment in Middle East and North Africa, 'Environment Strategy', available at <http://web.worldbank.org>.

Figure 1: The ratio of humanity’s Ecological Footprint to the biocapacity of the Earth (1961-2006). Source: National Footprint Accounts 2009, Global Footprint Network.

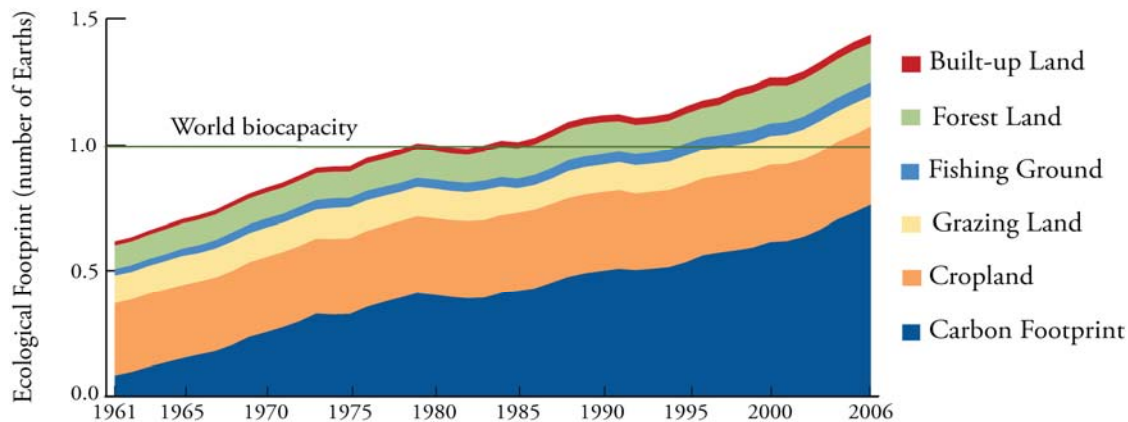
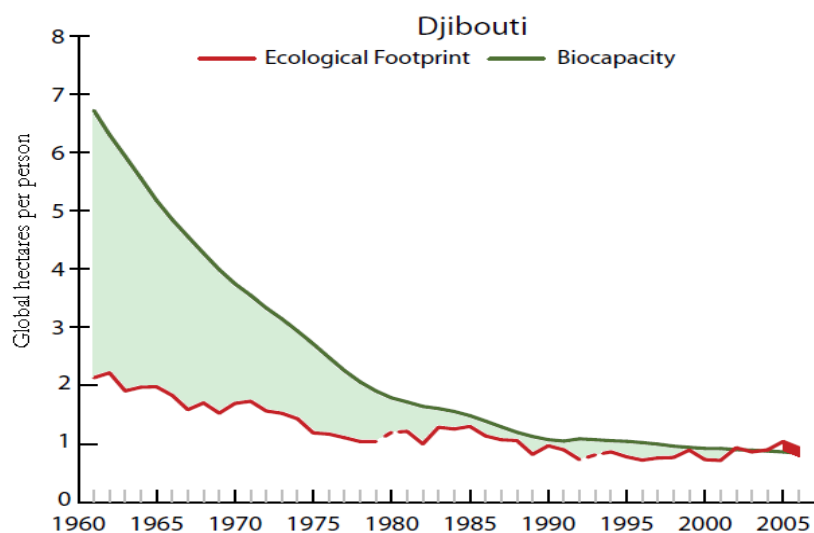


Figure 2: Djibouti’s per-person Footprint¹² and biocapacity since 1961



¹² The dashed line represents interpolations due to inconsistencies in the source data.

Figure 3: Credit/Debtor Status in MENA Region in 1961. Green represents creditor countries, red represents debtor countries.

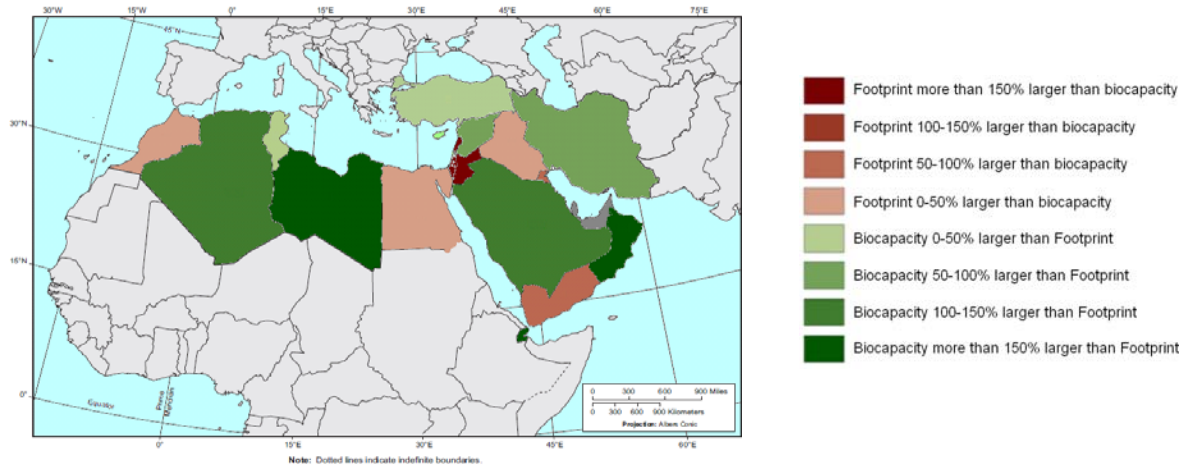


Figure 4: Creditor/Debtor status for countries in the MENA region in 2006. All countries in the MENA region ran ecological deficits in 2006.

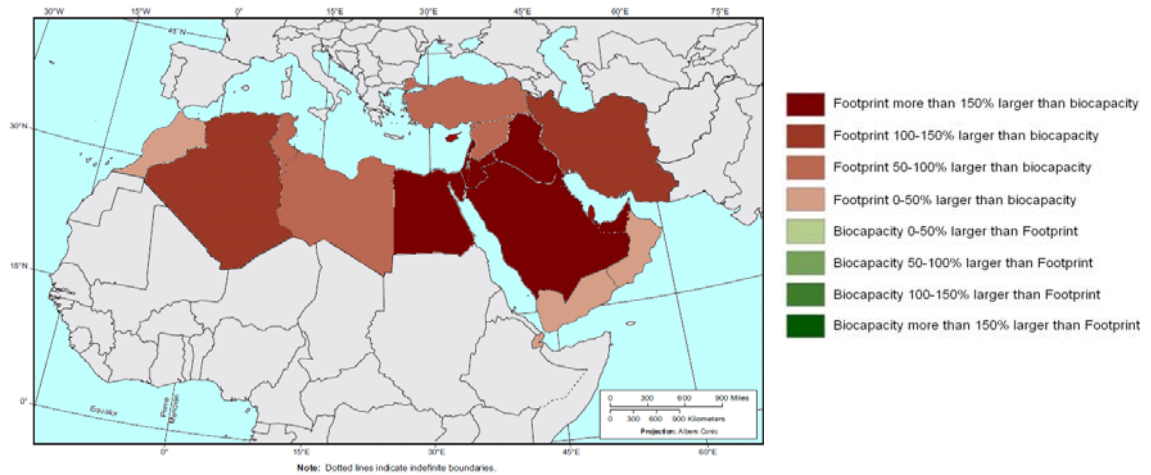


Table 1: Freshwater Status of ESCWA Member Countries, 2007 (Cubic metres per capita per year)

Country or Territory	Freshwater
Kuwait, United Arab Emirates, Qatar, Jordan, Bahrain, Yemen, Palestine, Saudi Arabia, Oman	Acute scarcity: less than 500
Egypt	Scarcity: 500-1000
Lebanon, the Sudan	Stress: 1000-1700
Iraq, Syrian Arab Republic	Abundance: more than 1700

Source: ESCWA Calculations

Annex 1: Ecological Footprint – Individual Countries in MENA Region¹³

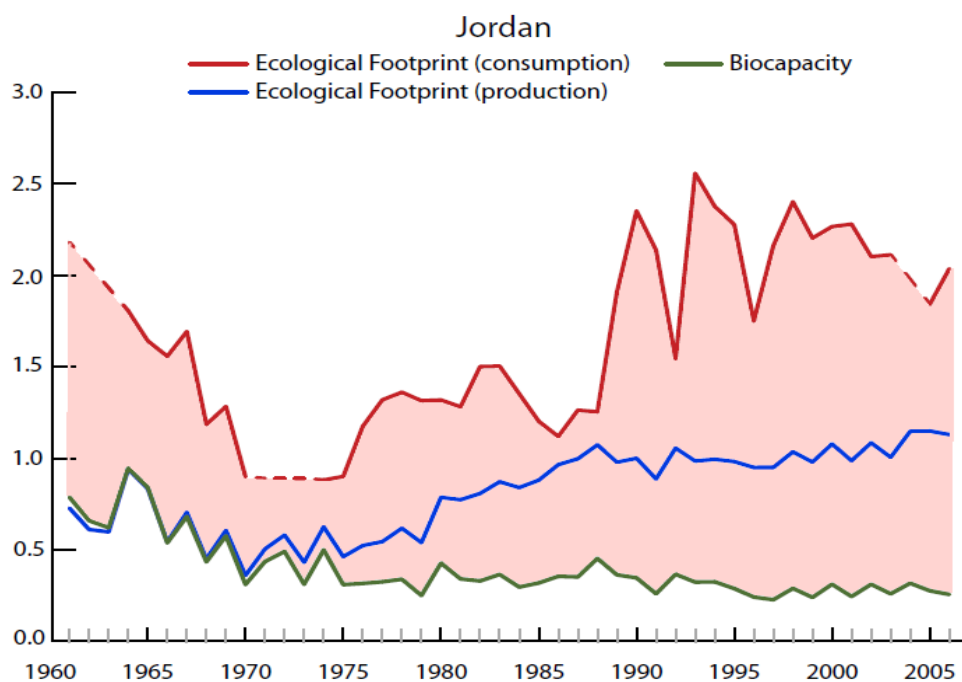
Jordan

In 2006, Jordan occupied 8.8 million hectares. Of this, 83 thousand hectares were forest, 276 thousand hectares cropland, and 742 thousand hectares grazing land. 199 thousand hectares were covered by built infrastructure. Bordering the Gulf of Aqaba, Jordan had 8 thousand hectares of continental shelf.

Jordan's cropland and forest yields were higher than the global average, while the grazing and fishery yields are lower, leading to a total biocapacity of 1.5 million global hectares (gha). This is vastly lower than Jordan's Ecological Footprint of consumption of 11.7 million gha. Jordan has been running an ecological deficit since before 1961. Jordan's Ecological Footprint of production, minus carbon, of 1.4 million gha is less than the local biocapacity value and this indicates that Jordan may not yet be drawing down its stock of natural capital.

Jordan's average Ecological Footprint per capita is 2.0 gha, smaller than the global average Footprint per capita, but larger than the global average available biocapacity per capita, indicating that the consumption of Jordan is not globally replicable in a sustainable manner.

Figure A-1: Jordan Ecological Footprint and biocapacity per capita over time. Dotted lines indicate interpolation due to inconsistencies in the source data.



Egypt

In 2006, Egypt occupied 99.5 million hectares. Of this, 69 thousand hectares were forest, 3.5 million hectares cropland, and 1.3 million hectares grazing land. 1.3 million hectares were covered by built infrastructure. Bordering the Mediterranean and the Red Sea, Egypt had 5

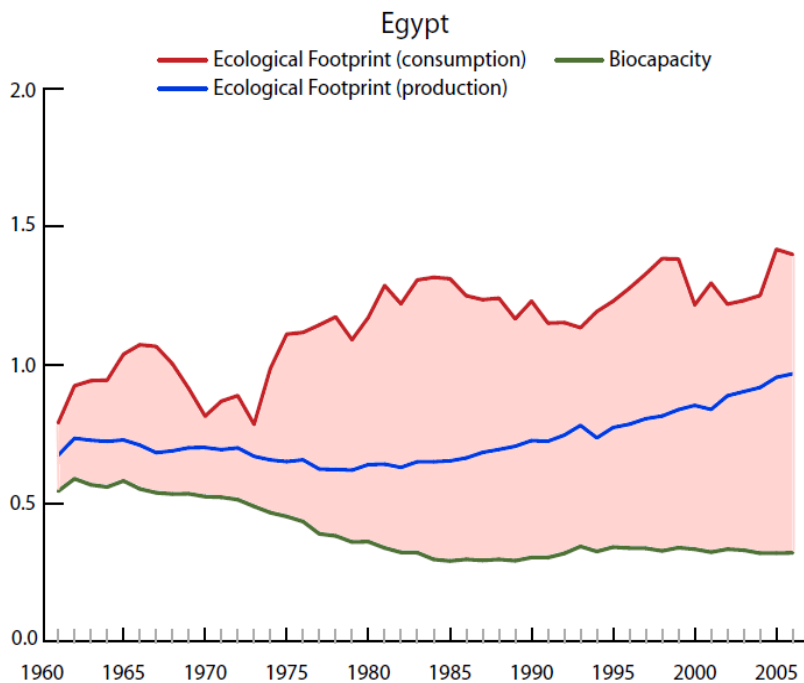
¹³ The Ecological Footprint for select countries is presented here as well as an overview for the entire MENA Region. Individual footprint data for all countries in the MENA Region is available from the authors and Global Footprint Network.

million hectares of continental shelf, and the Nile and its tributaries provided 0.6 million hectares of inland water.

Egypt’s cropland yields were greater than the global average, while grazing land, fishery, and forest yields are lower, leading to a total biocapacity of 23.8 million global hectares (gha). This is significantly less than Egypt’s Ecological Footprint of consumption of 103.8 million gha. Egypt has been running an ecological deficit since before 1961, possible, in part, because of its ability to use oil revenue to import resources. Egypt’s Ecological Footprint of production, minus carbon, of 29.5 million gha is greater than the local biocapacity value and this indicates that Egypt may be drawing down its stock of natural capital.

Egypt’s average Ecological Footprint per capita is 1.4 gha, smaller than the global average Footprint per capita and the global average available biocapacity per capita.

Figure A-2: Egypt Ecological Footprint and biocapacity per capita over time



A country’s production overshoot (where production Footprint exceeds available biocapacity) may be observable in two of the six land types: forest land and fishing grounds. Few nations set aside forests for carbon sequestration, and if they do, it is too little compared to their overall emissions. Therefore, forest area for carbon uptake land is typically in overshoot. Egypt’s production overshoot comes entirely from forest land; fishing grounds are in surplus. Continued overshoot in forestry will result in further deforestation of Egypt’s remaining forests, with severe impacts on soil stability, water storage, and biodiversity.

Figure A-3: Egypt production overshoot (excluding carbon)

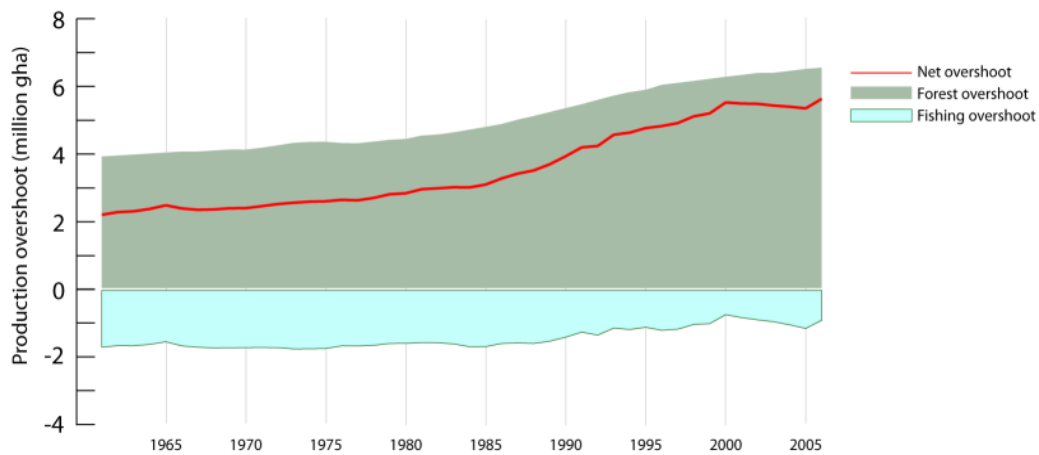
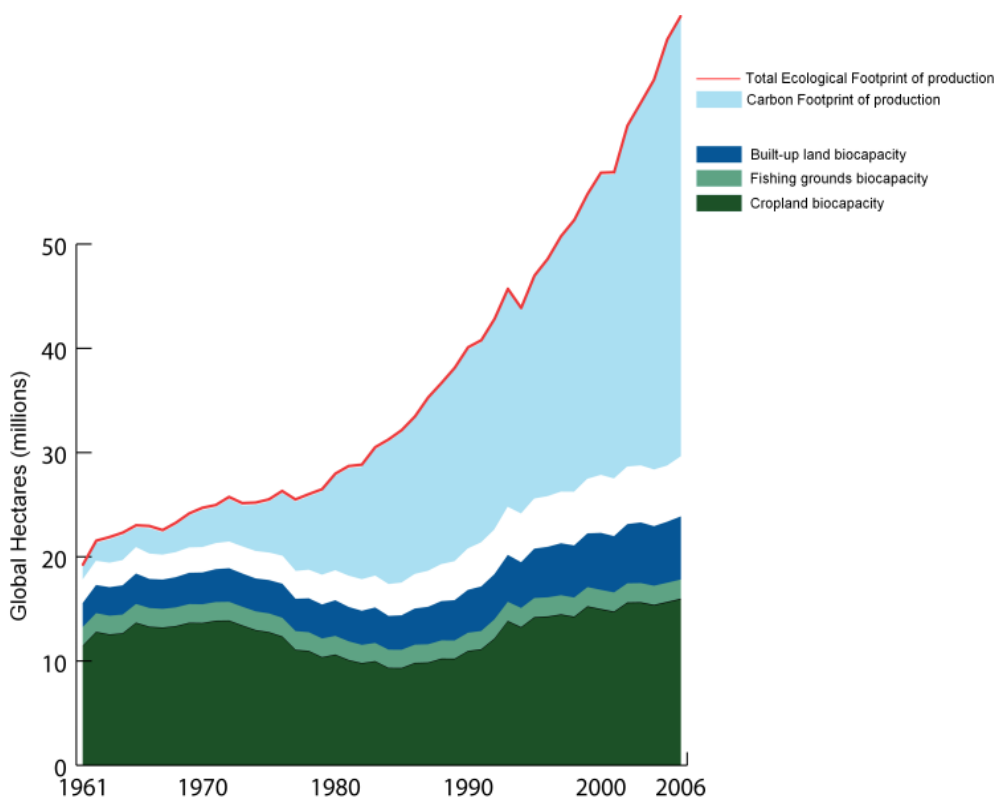


Figure A-4: Evaluating production overshoot with the inclusion of carbon shows the large demand that Egypt's production is placing on global biocapacity



To succeed in an ecologically constrained world, every population, region, or country needs to understand its demand on and availability of biocapacity.

In fact, its policy makers need to proactively determine its own optimal level of resource consumption. A consumption rate that is too low can lead to inadequate food, shelter and health services. Conversely, a consumption rate that is too high can put a population at risk,

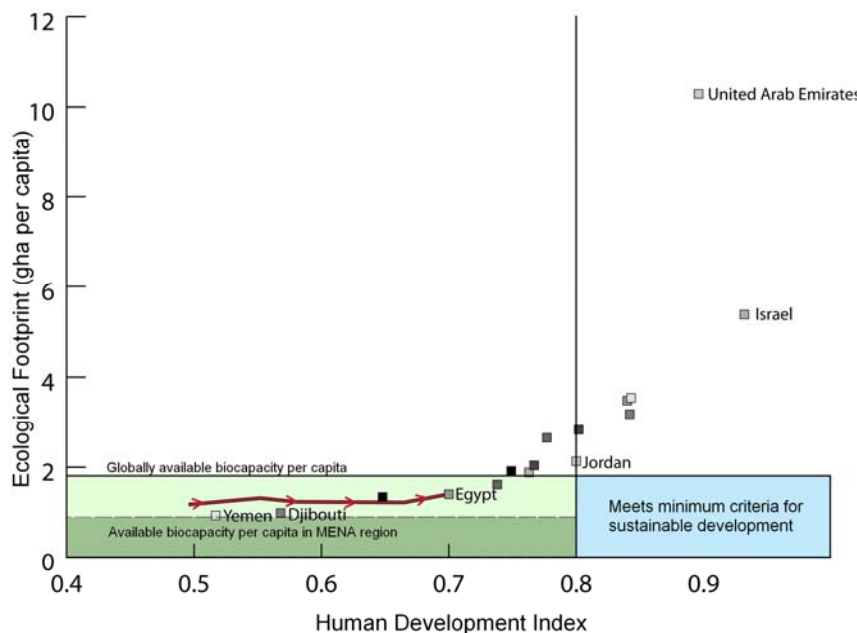
since domestic ecological deficits in a world with significant ecological overshoot globally will become an increasing liability to economies.

Optimal resource consumption for a region or country depends on three factors:

1. the amount of biocapacity in their country,
2. the amount of biocapacity in the world as a whole, and
3. the country's purchasing power compared to world average.

If the country's purchasing power is below the worldwide average, then it is unlikely the region will be able to maintain a positive biocapacity trade balance. Countries with low purchasing power will not be able to access biocapacity from elsewhere. Rather, they may in fact end up sacrificing biocapacity to countries with purchasing power.

One way of determining the optimal resource consumption rate is to explore the level needed to attain a high level of social welfare. The Human Development Index (HDI) is one measure of this, and an HDI of 0.8 or greater is considered high. When comparing the HDI to the Ecological Footprint, no nation achieves both a high level of development and a globally replicable sustainable rate of consumption. In the MENA region, Jordan comes closest. Egypt is currently on a pathway that might meet this criterion for global sustainable development.



Turkey

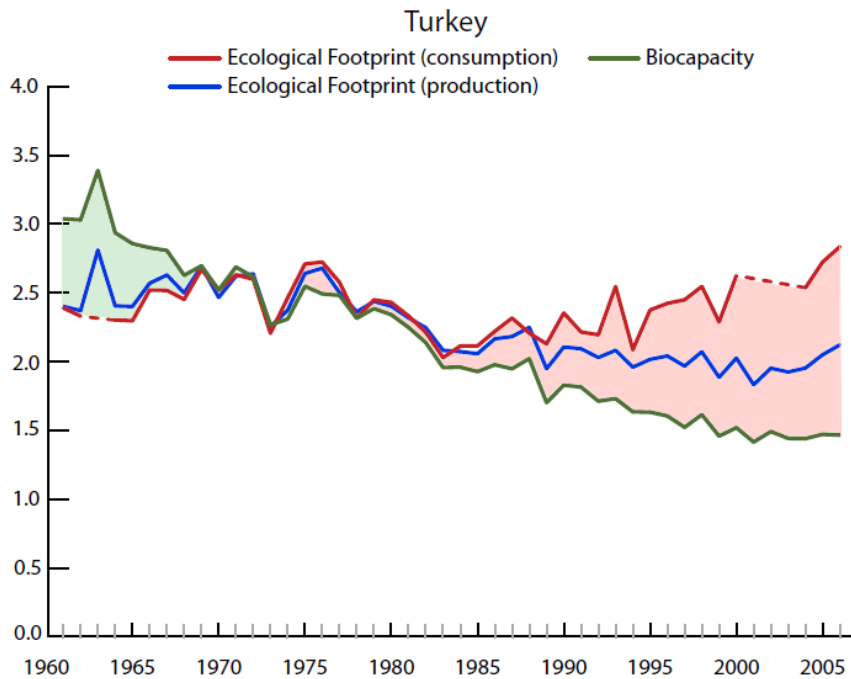
In 2006, Turkey occupied 77.0 million hectares. Of this, 10.2 million hectares were forest, 25.9 million hectares cropland, and 14.6 million hectares grazing land. 2.3 million hectares were covered by built infrastructure. Bordering the Mediterranean and the Black Sea, Turkey has 5.3 million hectares of continental shelf.

Turkey's cropland, grazing, forest, and fishery yields are all higher than the global average, leading to a total biocapacity of 108.4 million global hectares (gha). This is much lower than Turkey's Ecological Footprint of consumption of 209.6 million gha. Turkey has been running

an ecological deficit since 1974. Turkey's Ecological Footprint of production, minus carbon, of 90.5 million gha is less than the local biocapacity value and this indicates that Turkey may not yet be drawing down its stock of natural capital.

Turkey's average Ecological Footprint per capita is 2.8 gha, larger than the global average Footprint per capita and the global average available biocapacity per capita, indicating that the consumption of Turkey is not globally replicable in a sustainable manner.

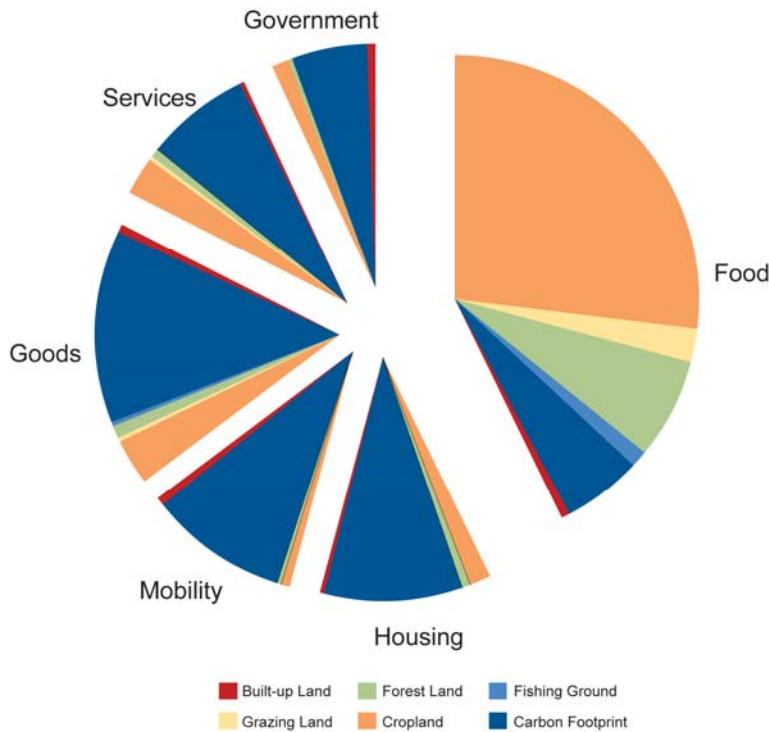
Figure A-5: Turkey Ecological Footprint and biocapacity per capita over time. Dotted lines indicate interpolation due to source data inconsistencies.



Utilizing national macroeconomic data, such as supply-use, or input-output, tables, it is possible to deconstruct a nation's Ecological Footprint to categories of final consumption. This allows policy makers to determine the direct and indirect impacts of a given change in final demand. For example, the impacts of the purchase of food by a consumer can be traced through all the inputs into the agricultural sector. These data therefore also allow the construction of personal consumption calculators, which help individuals determine and modify their demands on resources.

The majority of Turkey's Ecological Footprint is associated with the consumption of food, of which only a relatively small portion results from the carbon Footprint. The housing and mobility Footprints are predominantly carbon, while the goods (the second greatest contributor) and services sectors have significant cropland Footprints associated with them.

Figure A-6: Turkey Ecological Footprint by final consumption category. Gross Fixed Capital formation has been internalized into household consumption and government expenditure.



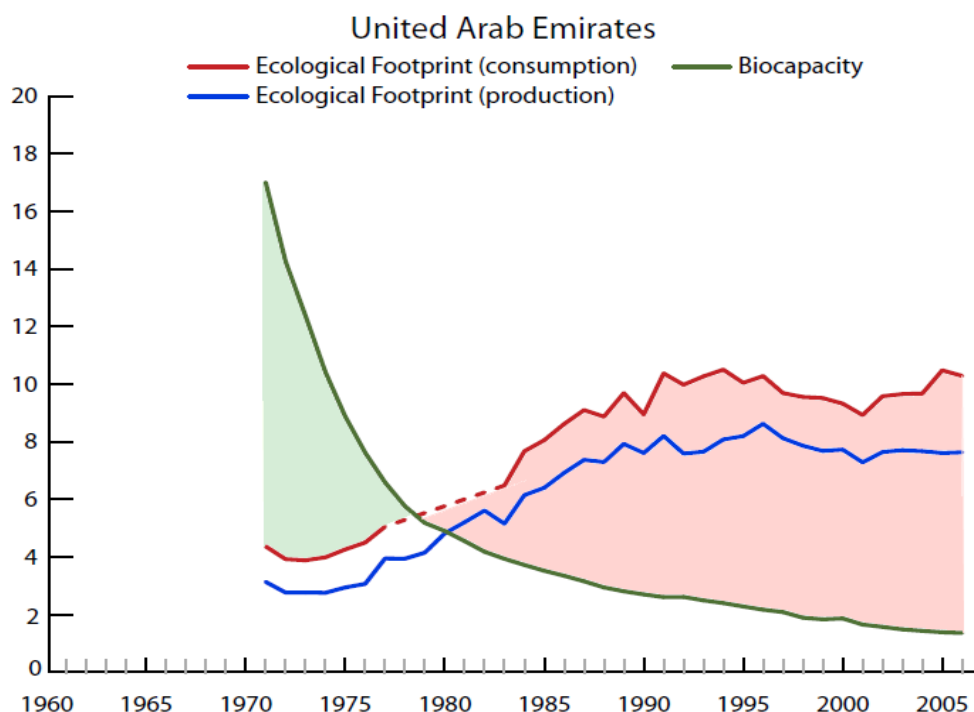
United Arab Emirates

In 2006, the United Arab Emirates occupied 8.4 million hectares. Of this, 312 thousand hectares were forest, 290 thousand hectares cropland, and 305 thousand hectares grazing land. 131 thousand hectares were covered by built infrastructure. Bordering the Persian Gulf, the United Arab Emirates has 5.1 million hectares of continental shelf.

The United Arab Emirates' cropland, and grazing yields are lower than the global average, while the forest and fishery yields are higher, leading to a total biocapacity of 5.8 million global hectares (gha). This is vastly lower than the United Arab Emirates' Ecological Footprint of consumption of 43.7 million gha. The United Arab Emirates has been running an ecological deficit since 1980, possible, in part, because of its ability to use oil revenue to import resources. The United Arab Emirates' Ecological Footprint of production, minus carbon, of 1.9 million gha is less than the local biocapacity value and this indicates that The United Arab Emirates may not yet be drawing down its stock of natural capital.

The United Arab Emirates' average Ecological Footprint per capita is the highest in the world at 10.3 gha, indicating that the consumption of the United Arab Emirates is not globally replicable in a sustainable manner.

Figure A-7: United Arab Emirates Ecological Footprint and biocapacity per capita over time. Dotted lines indicate interpolation due to source data inconsistencies.



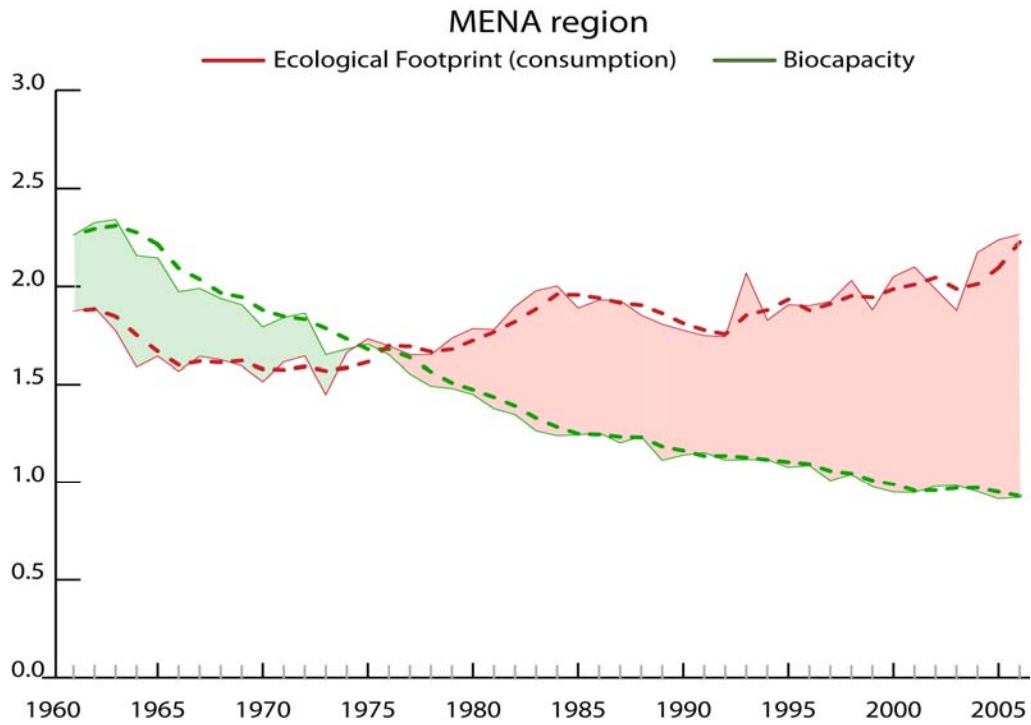
The MENA Region

In 2006, the countries comprising the MENA region occupied 1,199 million hectares. Of this, 35 million hectares were forest, 90 million hectares cropland, and 327 million hectares grazing land. 13 million hectares were covered by built infrastructure. The combined continental shelf area was 75 million hectares.

The combined biocapacity of the region was 385 million global hectares, leading to an implied biocapacity per physical hectare of 0.32 gha (the world average is defined as 1). This number is indicative of the large areas of the region that are non-productive or have very low yields. The MENA region's Ecological Footprint of consumption was 936 million gha in 2006, nearly two and a half times the region's biocapacity, and the region has been in overshoot since 1975. The Ecological Footprint of production, minus carbon, was 303 million gha, suggesting that with current technology the volume of production is not drawing down the MENA regions stock of natural capita. However, with the inclusion of carbon, the Ecological Footprint of production is 804 million gha, and would need to more than halve in order to attain the possibility of sustainability.

The MENA region's Ecological Footprint per capita was 2.2 gha, smaller than the global average Footprint per capita, but larger than the global average available biocapacity per capita, indicating that the consumption of the MENA region is not globally replicable in a sustainable manner.

Figure A-8: The Ecological Footprint and biocapacity of the MENA region since 1961. Dotted lines represent the 3 year moving average, while the solid lines represent raw yearly data.



Country	Population		EF (consumption) per capita		Biocapacity per capita		EF (production) per capita	
	2006 [millions]	Change from 1961 [%]	2006 [gha]	Change from 1961 [%]	2006 [gha]	Change from 1961 [%]	2006 [gha]	Change from 1961 [%]
Algeria	33.4	203%	1.9	92%	0.8	-59%	1.3	29%
Djibouti	0.8	810%	0.9	-56%	0.8	-87%	0.5	-70%
Egypt	74.2	160%	1.4	77%	0.3	-41%	1.0	44%
Iran	70.3	215%	2.7	21%	1.0	-65%	2.6	23%
Iraq	28.5	277%	1.3	-21%	0.2	-85%	1.0	-29%
Israel	6.8	210%	5.4	53%	0.3	-55%	2.8	227%
Jordan	5.7	515%	2.0	-51%	0.3	-67%	1.1	55%
Kuwait	2.8	805%	7.9	29%	0.5	-84%	6.8	51%
Lebanon	4.1	108%	2.1	18%	0.4	-38%	1.2	123%
Libya	6.0	331%	3.2	60%	1.6	-62%	2.6	52%
Morocco	30.9	158%	1.3	-11%	0.9	-37%	1.1	-11%
Oman	2.5	340%	3.5	-	2.5	-74%	4.2	1227%
Saudi Arabia	24.2	476%	3.5	94%	1.3	-70%	4.7	236%
Syria	19.4	307%	1.6	-16%	0.9	-71%	1.5	-34%
Tunisia	10.2	138%	1.9	26%	1.1	-37%	1.5	13.6%
Turkey	73.9	155%	2.8	19%	1.5	-52%	2.1	-12%
U.A.E. ¹⁴	4.2	1497%	10.3	135%	1.4	-92%	7.6	143%
Yemen	21.7	308%	1.0	-82%	0.7	-75%	0.7	-40%
World	6592.9	114%	2.6	13%	1.8	-51%	2.6	-

¹⁴ The U.A.E. union was formally created in December 1971. Therefore, the percent changes for the U.A.E. represent 1971 to 2006.

Figure A-9: Summary of the Ecological Footprint and biocapacity trends of countries in the MENA Region.

