

## **Green growth and the management of natural capital – options for agriculture**

Grünes Wachstum und das Management von Naturkapital – Optionen für die Landwirtschaft

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### **Summary**

Countries develop green growth strategies, and the management of natural capital is essential. It includes the resources and functions related to ecosystems. Agriculture is a key economic activity that is supported by ecosystems. The value of natural capital might not be fully captured in market prices. Natural capital is a major component of wealth for many developing countries, but has a much smaller share of total wealth in most high-income countries. Securing long-term resource availability is an important component of greening economies. Green growth strategies could benefit from measures targeted at the edge of the energy and food sectors.

**Keywords:** Green growth, natural capital, ecosystems

### **Zusammenfassung**

Länder entwickeln grüne Wachstumsstrategien, und das Management von Naturkapital ist von wesentlicher Bedeutung. Es umfasst die Ressourcen und Funktionen in Bezug auf Ökosysteme. Die Landwirtschaft ist eine wichtige Wirtschaftstätigkeit, die von Ökosystemen unterstützt wird. Der Wert des Naturkapitals wird möglicherweise nicht vollständig in den Marktpreisen erfasst. Naturkapital ist ein wesentlicher Bestandteil des Wohlstands für viele Entwicklungsländer, hat aber in den meisten Ländern mit hohem Einkommen einen viel kleineren Anteil am gesamten Vermögen. Sicherung der Langzeitverfügbarkeit von Ressourcen ist ein wichtiger Bestandteil einer „Grünen Volkswirtschaft“. Grüne Wachstums-

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strategien könnten von Maßnahmen, die auf den Grenzbereich von Landwirtschaft und Energiesektor zielen, profitieren.

**Schlagworte:** grünes Wachstum, Naturkapital, Ökosysteme

## 1. Introduction

The concept of green growth builds on the consideration that greening the economy is an engine of economic growth. It is an economic growth strategy to foster economic growth and development while ensuring that natural assets continue to provide the resources and environmental services on which our well-being and that of our offspring relies. The recent focus on green growth follows global concerns on climate change and degradation of major ecosystem goods and services, as expressed by several countries (e.g. Korea) and international organisations (e.g. UN ESCAP). The UN Economic and Social Commission for Asia and the Pacific (UN ESCAP) pursued 'green growth' since 2005. At the 2005 Ministerial Conference on Environment and Development in Asia and the Pacific, strong support was expressed for environmentally sustainable economic growth – or 'green growth'. 'Green growth aims to decouple economic activities from environmental pressure by reducing their energy and carbon intensities, while also recasting environmental production as an engine of growth' (UN ESCAP, 2010).

As part of a green growth strategy, public and private investments and innovations into green technologies are needed to achieve low-carbon growth in the coming 10–40 years, enhance sustainable growth and offer new opportunities for economic growth. In addition, a reallocation of resources might be necessary (e.g. through payments and taxes) to address property rights and reference levels (defining who pays or is paid for the delivery of environmental outcomes not captured by markets).

A green growth strategy moves from factor-driven growth into a technology-driven growth path. The Republic of Korea, for example, is committed to invest the equivalent of 2% of gross domestic product into green technologies, resource and material efficiency, renewable energy, sustainable transport, green buildings and ecosystem restoration. The European Union (EU) also agreed on their ambitions towards greening the economy. Often, smart and innovative initiatives

to combine technologies with environmental benefits are developed. For example, the 'green security' project in the Netherlands aims to receive residual heat from an artificial fertilizer plant and distribute heat through pipelines of 5 km to nearby greenhouses, which will potentially reduce energy use in glasshouses by 90 per cent. Green deals are set-up as a bottom-up approach to establish green projects. Economically viable initiatives are supported by removing barriers rather than target at public support.

Green growth strategies target at economic growth while natural resources continue to increase our well-being. The paper compares natural capital with other types of capital used in economies. Linkages are established between capital (stocks of the economy) and the flows of goods and services produced. Some examples are presented on the distribution of natural capital and wealth, as well as the composition of natural capital. The global distribution of wealth is also assessed. This understanding is essential to identify options to substitute physical capital for natural capital through technological change. Finally, the paper will highlight the importance of the management of natural capital for resource-intensive activities in the food and energy sectors.

## **2. Green growth and natural capital**

Green growth strategies of a nation could be defined by decoupling physical from economic growth, and air pollutants (mainly greenhouse gas emissions) are widely used, among others in South Korea. This paper, however, explores the value-added adopting green growth strategies from the perspective of the management of natural capital. Such a broader scope considers the availability and management of natural capital (i.e. the resources and functions related to the ecosystems). Since the implementation of a green growth strategy is beyond public investment programs to support renewable energy, the question can be raised whether a green growth program could be similar to earlier transitions in economies like transportation technology (e.g. through railroads) and information technology.

Decoupling physical from economic growth is an important feature of a national green growth strategy. The concept of decoupling physical from economic growth relates to the environmental Kuznets curve hypothesis, suggesting that environmental pollution increases during

the early phase of economic development, but measures are taken to reduce pollution when income levels exceed a certain threshold.

Two pathways can be identified to achieve economic growth through greening the economy: first, to decouple physical from economic growth, improve the efficiency of natural resource use and use clean technology to provide jobs, support a low-carbon development path (a low-carbon economy), and second, to transform the economy from a linear towards a circular system through the re-use of material and other natural resources (a circular economy). Resource efficiency, increasing economic output while using less natural resource, is in pursuit of the EU 2020 vision of 'smart, sustainable and inclusive' growth. The initiative of a resource-efficient and low-carbon economy is one of the flagship initiatives for this vision (COM, 2011, 21), as well as resource-related policies for a circular economy. A circular economy would move away from a linear economy taking materials, making products and disposing waste. To the contrary, a circular economy using biological materials would be based on make, consume and enrich and would be using other materials following the principles of make, use and return.

## 2.1 Concept of natural capital

There are several operational definitions of natural capital. The World Bank defined natural capital 'as the sum of cropland, pasture land, timber forest resources, non-timber forest resources, protected areas and sub-soil assets (oil, natural gas, coal and minerals) (WORLD BANK, 2011). The OECD glossary of statistical terms defines natural capital as '... natural assets in their role of providing natural resource inputs and environmental services for economic production'. WTO (2010) adds to this that natural resources are both 'scarce' and 'economically useful in production and consumption'.

Natural capital is the stock of natural resources provided by nature, and includes natural resources (forests, fish, minerals) that can be extracted, as well as the endowments yielding ecosystem services. Natural capital is an endowment of nature ('stock') yielding ecosystem services, which can be presented in physical terms (stock of fish) or monetary terms (e.g. present value of the anticipated revenues of the stocks in the next say 25 years). Ecosystem services are the beneficial 'flows' from natural capital (DOMINATI et al., 2010).

Parts of natural capital can be reproduced by human activities (e.g. fish farms, plantation of forests), and other parts can only be modified by human intervention (e.g. nature for touristic service). It is composed of four types of ecosystem goods and services, including (a) production services from ecosystems (e.g. food, fibre), (b) regulatory services that are delivered from the natural environment (e.g. carbon storage in soils, ability to purify water), (c) life-support services (e.g. wind, waves, sun), and (d) cultural or immaterial services (e.g. landscapes for touristic or recreational use).

National wealth is the stock of capital for a country and a source of future income or other benefits from production and consumption. Total wealth is composed of physical capital, human capital, natural capital and social capital. Some recent literature (e.g. STIGLITZ et al., 2009) recommends the comprehensive picture of wealth as a useful indicator of economic performance. GDP only accounts for economic output, and does not consider wealth that underlies current output and generates future income. In order to understand the sources of future income, a proper accounting of natural capital into the systems of national accounts is important as well. Advancements are made in the System of Integrated Environmental and Economic Accounting (SEEA). Wealth Accounting and Valuation of Ecosystem Services (WAVES) is a partnership, initiated by the World Bank to support countries implementing natural capital accounting based on the SEEA ([www.wavespartnership.org](http://www.wavespartnership.org)).

## 2.2 Distribution of wealth

A more detailed picture on wealth and natural capital will be provided for a range of countries. Table 1 shows the wide variation across countries in their shares of natural capital in national total wealth. World Bank data on natural capital, comprise agricultural land (crops and pastures), protected areas, forests (timber and non-timber forest resources), minerals and energy (oil, natural gas, hard coal, lignite).

Tab. 1: Natural capital in 2005

Country	Total wealth (billion USD)	Natural capital per capita (USD)	Share of natural capital in total wealth (%)
Australia	10,547	39,979	7.7
Brazil	14,752	14,978	18.9
China	25,091	4,013	20.9
Japan	70,116	2,094	0.4
USA	217,623	13,822	1.9
Austria	4,698	9,065	1.6
Denmark	4,024	19,616	2.6
Germany	45,127	5,716	1.0
Netherlands	9,687	13,193	2.2
Global	707,726	7,119	6.2

Source: WORLD BANK

The share of natural capital in total wealth is limited and only around 3% in the EU countries examined, as well as in Japan. The share of natural capital in national wealth is below 5% for several EU-countries (Netherlands, UK, Austria, Belgium, Denmark, France, Greece, Italy, Portugal and Spain). It is between 5% and 10% in Sweden, Finland and Ireland. Agriculture, forestry and energy are the main activities related to natural capital in the countries examined. Biomass production (from agriculture and forestry) has a large share in total natural capital in Brazil and China.

Natural capital is a major component of wealth for many developing countries. It has a share of around a third of total wealth in low income countries, whereas it is less than 2% in high-income OECD countries. Natural capital has a much smaller share of total wealth in most high-income countries, and on average is less than 2% in high-income OECD countries. Proper management strategies for the use of natural capital are important for resource-poor countries, including many high-income OECD countries. Agriculture, forestry and energy are the main activities related to natural capital in the countries examined (table 2). The distribution of natural capital across regions in the world is highly uneven. Energy and crops, pasture land and forests are the main groups in most countries. The management of natural capital could therefore be achieved by taking measures targeted at the energy and food sectors, e.g. the management of land to grow biomass from agriculture and forestry.

Tab. 2: Natural capital composition in 2005 (in billion US\$)

Country	Crops, pasture land, forests	Protected areas	Energy (oil, natural gas, coal)	Minerals	Total
Australia	339.9	59.6	227.4	185.9	812.7
Brazil	2,165.1	194.3	273.4	159.3	2,792.0
China	4,045.7	140.1	937.2	112.2	5,235.2
Japan	245.3	16.3	5.7	0.2	267.6
USA	1,991.4	1,074.5	1,003.7	27.3	4,096.9
Austria	41.3	26.9	4.5	0.2	72.9
Denmark	46.7	13.3	46.2	0.0	106.2
Germany	267.7	159.6	44.0	0.0	471.4
Netherlands	82.4	17.7	115.2	0.0	215.3

Source: WORLD BANK

### 3. Linking the food and energy sectors

Management of natural capital could be achieved through appropriate measures targeted at the energy and food sectors, e.g. the management of land to grow biomass from agriculture and forestry. Green growth strategies could benefit from a bio-based economy, with integrated measures targeted both at the energy and food sectors. Consumer and producer behaviour are critically important for both parts of natural capital and important to maximise the reduction potential of greenhouse gas emissions, also considering international trade. Mutual benefits for the agrofood and energy sectors remain undervalued in green growth strategies.

Nowadays, energy conservation is a widely adopted strategy by countries. The energy sector is key to current green growth strategies, as part of a low-carbon growth strategy. The management of natural capital requires the adoption of measures to increase energy efficiency and resource productivity, and also to design and implement new technologies for renewable energy. Green growth strategies rather focus on new technologies for (non-) renewable energy.

Agriculture has major implications for global biodiversity. With a global share of 70% of total fresh water use, the agrofood sector also is the largest user of water resources, which are foreseen to become increasingly scarce (TASKFORCE BIODIVERSITEIT & NATUURLIJKE HULPBRONNEN, 2011). Changes in consumer behaviour (e.g. reducing food wastes and dietary changes) are strategies for improving resource

efficiency (e.g. BARRETT and SCOTT, 2012) and might be important components of a green growth strategy. Countries often put limited efforts towards agriculture, forestry and fisheries. FOLEY et al. (2011) claim that meeting the growing food demands while reducing environmental pressure is one of greatest challenges of this century. Strategies proposed include enhancing food production and sustainability, stop expanding agriculture, close yield gaps, increase agricultural resource efficiency and increase food delivery by shifting diets and reducing waste. The agrofood sector can support changes in consumer behaviour, enhance greening an economy and be an engine of economic growth. This however requires a green growth strategy to focus at the agrofood chain that considers interactions between agriculture and the rest of the economy. It requires considering interactions between agriculture and the rest of the economy. Cascading is the sequential exploitation of the full potential of a resource during its use, mainly to improve efficiency of resource use. It is an intelligent reuse and recycling strategy adopted in the forest sector to improve resource efficiency and reduce greenhouse gas emissions.

The economic lifetime of the resource would be increased. Different stages would include use for frames, shelves, recycling, compost and burning. It is a type of recycling or circular economy (adopting the 'cradle-to-cradle' concept), moving away from 'take-make-dispose', taking resources, make products and eventually dispose them as waste. The concept 'cradle-to-cradle' builds on the creation of industrial systems that essentially are waste-free (WIJKMAN and SKÅNBERG, 2015).

#### **4. Conclusions**

There is no pre-defined route for the design and implementation of a national green growth strategy. To the contrary, countries currently implementing green growth strategies face different economic and environmental challenges and also have wide ranging development paths. However, decoupling physical from economic growth, as well as improvements in energy efficiency and resource productivity are important components of a green growth strategy. Such objectives might be insufficient to secure long-term availability of natural capital and the volatility of its market prices.

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