WWF

REPORT

CHINA

2012

THIS REPORT HAS BEEN PRODUCED IN PARTNERSHIP WITH

Global Footprint Network
Advancing the Science of Sustainability

中国科学院动物研究所
INSTITUTE OF ZOOLOGY
CHINESE ACADEMY OF SCIENCES

ZSL
LIVING CONSERVATION

China Ecological Footprint Report 2012

Consumption, Production and Sustainable Development

WWF

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global Network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

Institute of Geographic Sciences and Natural Resources Research

The Institute of Geographic Sciences and Natural Resources Research (IGSNRR), established within the Chinese Academy of Sciences (CAS), is a national platform for knowledge and innovation. IGSNRR currently gives high priority to research on physical geography and global change, human geography and regional development, natural resources and environmental security, geo-information mechanisms and system simulation, water cycle and related land surface processes, ecosystem network observation and modeling, and agricultural policies.

Global Footprint Network

Global Footprint Network promotes the science of sustainability by advancing the Ecological Footprint, a resource accounting tool that makes sustainability measurable. Together with its partners, the Network works to further improve and implement this science by coordinating research, developing methodological standards, and providing decision-makers with robust resource accounts to help the human economy operate within the Earth's ecological limits.

Institute of Zoology

Institute of Zoology (IOZ), Chinese Academy of Sciences (CAS), is a government-funded research institution in zoological sciences. With its efforts to both address basic scientific questions and meet national and public demands in the fields of biodiversity, ecology, agricultural biology, human health and reproductive biology, IOZ places great emphasis on integrative biology, evolutionary biology and reproductive biology. Other high priorities include invasive biology and technological innovations for sustained control of agricultural pests.

Zoological Society of London

Founded in 1826, the Zoological Society of London (ZSL) is an international scientific, conservation and educational organization. Its mission is to achieve and promote the worldwide conservation of animals and their habitats. ZSL runs ZSL London Zoo and ZSL Whipsnade Zoo, carries out scientific research in the Institute of Zoology and is actively involved in field conservation worldwide.

WWF Beijing Office

Wen Hua Gong
Working People's Culture Palace
100006 Beijing, P.R. China
www.wwfchina.org

Institute of Geographic Sciences and Natural Resources Research

A11, Datun Road, Chaoyang District,
100101 Beijing, P.R. China
http://www.igsnrr.ac.cn

Global Footprint Network

312 Clay Street, Suite 300
Oakland, California 94607, USA
www.footprintnetwork.org

Institute of Zoology

1 Beichen West Road, Chaoyang
District, Beijing 100101, P.R.China
http://english.ioz.cas.cn

Zoological Society of London

Regent's Park, London NW1 4RY, UK
www.zsl.org/indicators
www.livingplanetindex.org

Advisers:

Zhu Guangyao, James P. Leape, Peter Beaudoin, Li Lin, Li Zuojun

Authors:

Xie Gaodi, Cao Shuyan, Yang Qisen, Xia Lin, Fan Zhiyong, Chen Boping, Zhou Shuang, Chang Youde, Ge Liqiang, Seth Cook, Sarah Humphrey

CONTENTS

FOREWORD

Three hundred years of industrial civilization has seen, as a major feature, a conquest of nature by humans. However, humans cannot survive or develop without nature and this growth pattern - which has sought economic development at the expense of environmental resources - is not sustainable. Human civilization can achieve its full potential for sustainable development only when we combine economic development with environmental protection and resource conservation.

As a country experiencing rapid industrialization and urbanization, China is facing severe environmental and resource challenges. At the same time, opportunities abound for taking a path towards green development and ecological progress. The Chinese government aims to transform China into a developed society that respects and conserves nature, while promoting environmentally friendly development. This implies supporting the establishment of sustainable industrial structure, sustainable production patterns and sustainable lifestyles. Moreover, the Chinese government places high priority on making ecological progress and incorporating it into all aspects of economic, political, cultural, and social progress.

The Ecological Footprint is an effective tool for measuring human demand on natural resources. It can provide support to environmental and economic policymaking through quantifying the supply and demand of resources, and provide guidance in the overall development of an ecological civilization.

Following the publication of the 2008 and 2010 China Ecological Footprint Reports, WWF is once again collaborating with its technical partners to issue the third China Ecological Footprint Report. This report continues to explore the relationship between China's Ecological Footprint and biocapacity, and analyses the forces driving environmental challenges. This iteration of the report introduces for the first time the Living Planet Index, which explores the changes in China's biodiversity, and reflects the concept of leaving space for nature in the development process.

The sustainable management of natural resources and the building of a beautiful China are part of a long-term strategy for the Chinese government and the Chinese people. It is hoped that this report can inspire transformation of economic development mode in China, as well as supporting ecological progress.

祝光耀

Zhu Guangyao
Executive Vice President
China Ecological Civilization Research and Promotion Association

Planet Earth is our common home and the nature and natural resources that support us all are under more pressure than ever before. As one of the fastest growing economies, China is now facing the acute challenges of how to bring environmental and social perspectives into economic development as a whole.

Increasing consumption associated with economic growth and urbanisation place significant pressure on China's vulnerable ecosystems. The per-capita ecological footprint of China has crossed the threshold that is considered sustainable. The patterns of production, consumption and development that China chooses today will deeply influence the future of the country and the wider world.

We need to make choices that facilitate the creation of a prosperous future, allowing people and nature to thrive within one planet. The Chinese government has already raised the concept of "Ecological Progress" which fits into the globally evolving concept of a "green economy" where wise consumption choices are made, resource efficiency is improved and natural capital is conserved. Governments, businesses and other stakeholders must work together to translate these concepts into concrete and achievable solutions.

As one of the world's leading conservation organizations that has served in this country for over 30 years, WWF is well placed and committed to support China in transitioning towards ecological progress and green development. With this report, we explore the opportunities and challenges for China to enhance its sustainable development capacity in an increasingly resource-constrained world – to help build a future where people live in harmony with nature.

James P. Leape
Director General
WWF International

Executive Summary

No matter how advanced our science and technology becomes, humans continue to depend on natural systems for food, water, energy, waste disposal, raw materials and many other functions. Unfortunately, since the 1970s, humans have been exploiting the Earth's renewable resources at a faster rate than they can be regenerated. At present, we require one and a half Earths to sustain our demands and if we maintain our current lifestyle and consumption patterns, by 2030 we will need more than two Earths. Over-extraction of resources and poorly planned development have already resulted in stark ecological crises: shrinking areas of productive land, ecosystem degradation, decreased biological diversity, serious river pollution and fragmentation, and ocean acidification. We have only one planet and the time has come to transform our present lifestyle and consumption patterns in order to halt the degradation of the Earth's natural capital, and to secure ecosystem services as the foundation for economic and social development.

The Ecological Footprint tracks humanity's demand on the biosphere by comparing human consumption with the Earth's regenerative capacity, or biocapacity. Similarly the Water Footprint can help identify whether water resources utilization in a given country or river basin is sustainable. Complementing these measures, the Living Planet Index, an indicator of global biodiversity, reflects the state of the planet's ecosystems by tracking trends in populations of global vertebrates. Combining these measures provides an overview of the relationship between human activities, pressures exerted on the biosphere and the health of the planet.

This report is the third China Ecological Footprint Report and builds on previous reports to present China's Ecological Footprint in a regional and global context, explore the global flow of biocapacity through trade, and look at changes that have taken place in the past 40 years. The China Ecological Footprint Report 2008 presented the latest developments in China around the study of the Ecological Footprint while the 2010 Report extended these results based on an improved methodology for the calculation of Ecological Footprint, and introduced the water footprint. This third edition has become yet more comprehensive, introducing the China Living Planet Index to explore the challenges faced in biodiversity conservation and further exploring the drivers behind China's Ecological Footprint challenges. Finally, this edition presents a framework of pressures, responses and challenges and discusses the choices faced by China and opportunities presented by development of a green economy.

Chapter 1 Presents the complementary measures of Ecological Footprint, Water Footprint and Living Planet Index, to examine the demands being placed on China's ecosystems in a global context.

- Since 1970s, human demand on the Earth's resources has surpassed the planet's regeneration capacity. In 2008, the global per capita Ecological Footprint was 2.7 global hectares (gha), exceeding the available per capital biocapacity of 1.8 gha by 50%. This means humans were using the equivalent of one and a half Earths to produce the resources needed to support our consumption and absorb associated emissions of CO_2.

- China is supporting a population of unprecedented size which places pressure on vulnerable ecosystems. In 2008, the per capita Ecological Footprint in China was 2.1 gha or 80% of the global average. However, this has already exceeded the global sustainability threshold and is over two times the available per capita biocapacity in China. In view of its huge population, the total Ecological Footprint of China is the largest in the world.

- The Ecological Footprint and biocapacity are unevenly distributed across China. There is a notable difference between the per capita Ecological Footprint in eastern provinces and western provinces. Similarly, per capita biocapacity is higher in the provinces to the west of the Aihui-Tengchong population line and lower in the provinces to the east.

- In an increasingly interconnected global economy, China imports and exports large quantities of the biomass components of footprint as an active player in the global markets in timber, food and fibre products. Figures for imported and exported biomass goods are similar, and net imports represent just 3% of the food, fibre and timber consumed in China.

- In 2009, China's per capita Water Footprint was less than half of the global average. Despite this comparatively low water usage, China’s limited water resources are seriously stressed with particularly acute pressures along the Yellow River and the lower reaches of the Yangtze River basin.
- An exploration of China’s Living Planet Index indicates that the populations of more than 10 flagship and keystone species in China have undergone marked decline that was particularly severe between the 1960s and 1980s. Today, conservation efforts are bearing dividends and species such as the giant panda, which has been protected since early in this period, have seen slow but steady population recovery. Other species such as the Père David’s deer, which was reintroduced after the species was thought to be extinct in the wild, and the crested ibis are seeing rapid population increase following habitat conservation and introduction of strict monitoring techniques.

Chapter 2 looks at the different forces that are driving biocapacity deficit in China.

- The magnitude of biocapacity deficit in a country or a region is measured as the difference between two variables: Ecological Footprint and biocapacity. In China the growth in total Ecological Footprint has outpaced growth in biocapacity. The driving forces of footprint growth have changed over time. Increasing individual consumption has been the dominant driver of footprint growth since 2003, while before 1978 population growth was the major driver. In 2008, nearly 40% of China’s total Ecological Footprint was accounted for by long term investments in infrastructure.
- Changing consumption patterns associated with increased affluence in China’s increasingly urban population have contributed to the increase in total Ecological Footprint. Carbon footprint has become the largest individual component of footprint in China and has seen the greatest increase, particularly in urban areas. At the same time, urbanization provides an opportunity to reduce individual footprints and associated pressures on ecological systems through measures such as public transport systems and large-scale recycling.

Chapter 3 Explores the steps that China could take towards a green economy and proposes a pathway to sustainable development in China based on the following five recommendations:

- Consume wisely: shift consumption patterns towards a sustainable, low footprint model.
- Produce better: promote the efficient use of resources and introduce the concept of low footprint into manufacturing and processing.
- Preserve natural capital: leave space for nature while maintaining and supporting biocapacity and meeting human needs.
- Redirect financial flows: promote green finance and investment, leverage financial resources to support conservation, sustainable resource management and innovation.
- Utilize institutional and market mechanisms to promote ecological progress.

Chapter One:

The Current Situation: Ecological Footprint, Water Footprint and Living Planet Index of China

Fundamentally we all depend on nature, the ecological infrastructure of the planet that provides the flow of goods and services on which our economies and livelihoods are founded. However, China and the world are facing unprecedented environmental degradation as a result of increasing human demands on natural resources which have exceeded the Earth's regenerative capacity. China, with its huge population, is on a path of industrialization and rapid urbanization. However, its demand on resources cannot increase indefinitely given the realities of global resource limitations and ecological degradation.

Chapter 1 opens with a presentation of the global Ecological Footprint and an overview of the Footprint of Nations based on Global Footprint Network's National Footprint Accounts. This is followed by a detailed analysis of China's Ecological Footprint and Water Footprint at national and provincial levels based on cutting edge research undertaken in China. These results are complemented by a presentation of the Living Planet Index and an exploration of population changes of key species in China.

Ecological Footprint

The Ecological Footprint tracks humanity's demand on the biosphere by comparing human consumption with the Earth's regenerative capacity, or biocapacity (Figure 1.1). Every human activity uses biologically productive land (including fishing grounds). The Ecological Footprint is the sum of these areas, adjusted for their productivity, regardless of where they are located in the planet.

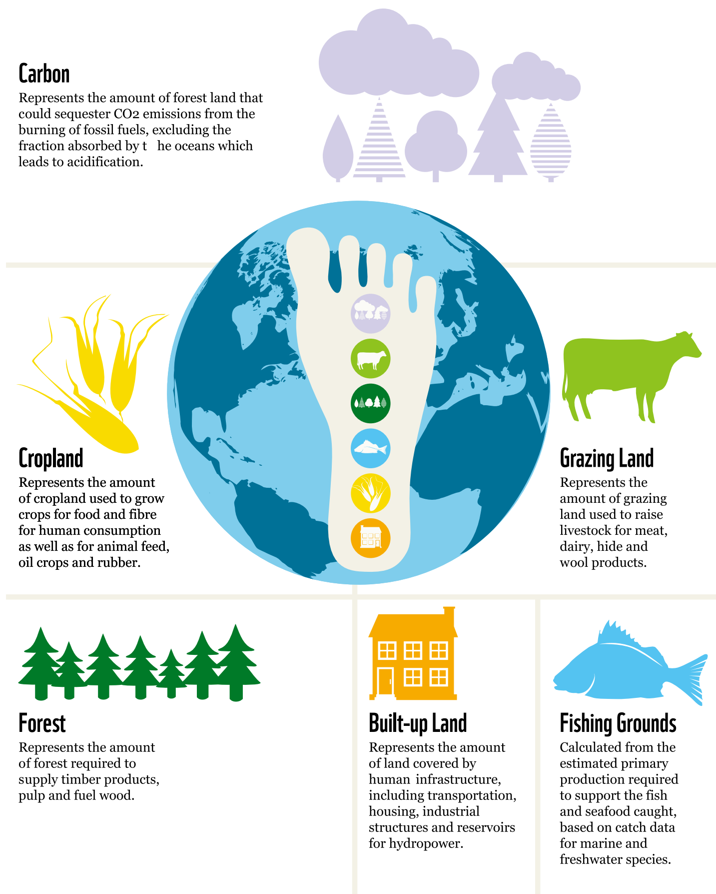


Figure 1.1 Components of the Ecological Footprint

Every human activity uses biologically productive land and/or fishing grounds. The components of the Ecological Footprint are: cropland, grazing land, forest land, built-up land, fishing grounds and carbon.

Data source: Global Footprint Network, 2011

Global Context

Ecological Footprint measures humanity's demand on the biosphere by calculating the area required to produce the renewable resources that people consume, the area occupied by infrastructure, and the area of forest required for sequestering the part of CO_2 emissions from human activities that is not absorbed by the ocean (See Galli et al., 2007; Kitzes et al., 2009; and Wackernagel et al., 2002). This area can be compared to the Earth's biocapacity, which is the amount of productive area available to generate these resources and absorb wastes. Both the Ecological Footprint and biocapacity are measured in units of "global hectares" (gha), where one global hectare represents the productive capacity of one hectare area of utilized land at global average biological productivity levels.

Global Ecological Overshoot

Since around 1970, the world has been in a state of ecological overshoot (Figure 1.2). Humanity's demand on the Earth's ecosystems has exceeded its regenerative capacity. In 2008, the Earth's total biocapacity was 12.0 billion gha, or 1.8 gha per person, while humanity's Ecological Footprint was 18.2 billion gha, or 2.7 gha per person. This discrepancy means it would take 1.5 years for the Earth to fully regenerate the renewable resources that people used in one year, or in other words, we used the equivalent of 1.5 Earths to support our consumption.

Just as it is possible to withdraw money from a bank account more quickly than the interest that accrues, biocapacity can be reused more quickly than it regenerates. Eventually the resources – our natural capital, will be depleted just like running down reserves in a bank account. At present, people are often able to shift their sourcing when faced with local resource limitations. However, if consumption continues to increase as it has in the past decades, the planet as a whole will eventually run out of resources. Some ecosystems will collapse and cease to be productive even before the resource is fully depleted.

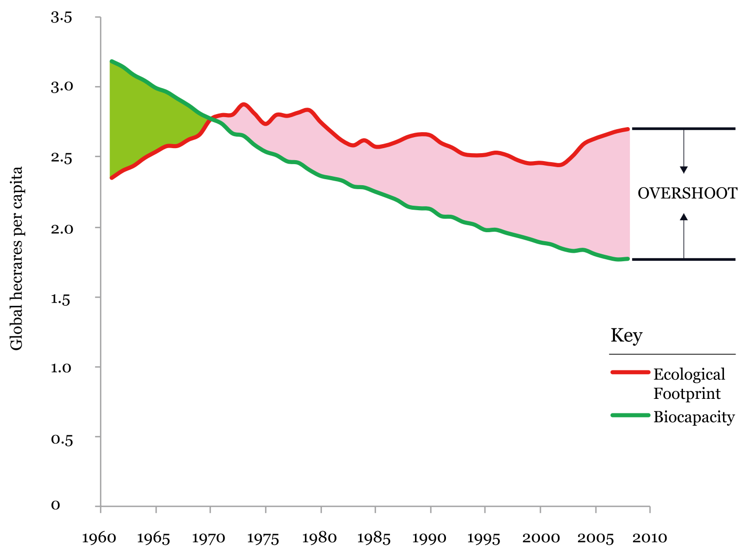


Figure 1.2 Trends in global Ecological Footprint and biocapacity per person between 1961 and 2008

The decline in biocapacity per capita is primarily due to an increase in global population. The Earth's resources have to be shared between more people and the increase in the Earth's productivity has not been sufficient to compensate for the demands of this growing population.

Data source: Global Footprint Network, 2011

Ecological Footprint of Economic Regions

The combination of increasing per capita Ecological Footprint and population growth means that humanity is placing a greater demand on the world's resources than ever before. The factors driving the increase in the total Ecological Footprint vary significantly across different economic groupings. This section examines the Ecological Footprint for groups of countries in four economic regions: members of the Organization for Economic Co-operation and Development (OECD), the group of countries experiencing rapid economic expansion commonly referred to as the BRIC countries (Brazil, Russia, India, and China), all countries on the African continent, and members of the Association of Southeast Asian Nations (ASEAN).

In 1961, the global population was half the size it is today. Population growth has significantly increased the total Ecological Footprint in Africa and in ASEAN member countries. Africa's per capita Ecological Footprint increased by only 0.07 gha between 1961 and 2008, but its total Ecological Footprint more than tripled as a result of the population increase (Figure 1.3).

In contrast, the OECD nations experienced the largest change in per capita Ecological Footprint that increased by 23% from 1961 to 2008. The total Ecological Footprint of the OECD accounts for 33% of the total global Ecological Footprint, while these countries account for only 17% of the world's population. Population growth in the OECD over the same period has been relatively small compared to the BRIC countries and Africa. The OECD's large total Ecological Footprint reflects lifestyles in member countries associated with high individual consumption.

The BRIC countries have together seen the fastest increase in total Ecological Footprint. The combined population of these countries has more than doubled between 1961 and 2008, while their per capita Ecological Footprint has doubled from 0.9 gha to 1.8 during the same period. The result is a fivefold increase in the total Ecological Footprint of these four countries.

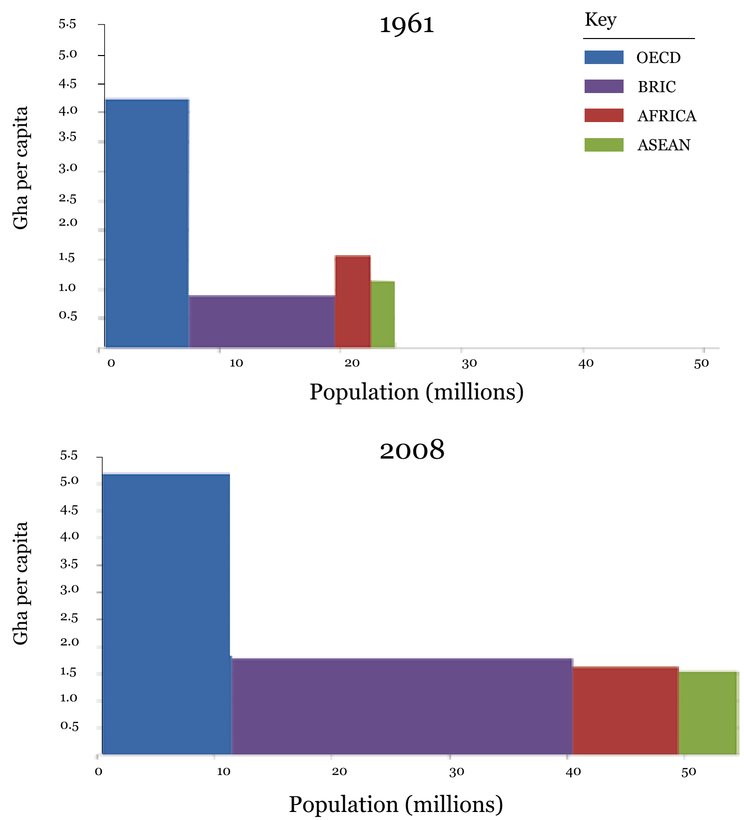


Figure 1.3 The total Ecological Footprint of four economic regions in 1961 and 2008.

The area of the boxes represents the Ecological Footprint per capita multiplied by the population, or the total Ecological Footprint

Data source: Global Footprint Network, 2011

In 2008, these four regions together made up 81% of the world's population and accounted for 75.3% of humanity's Ecological Footprint. They were also the source of 86% of the world's biocapacity. The BRIC countries supplied the largest share of the world's biocapacity, followed by the member countries of the OECD. Together, the countries in these two economic regions contributed two-thirds of the world's biocapacity (Figure 1.4).

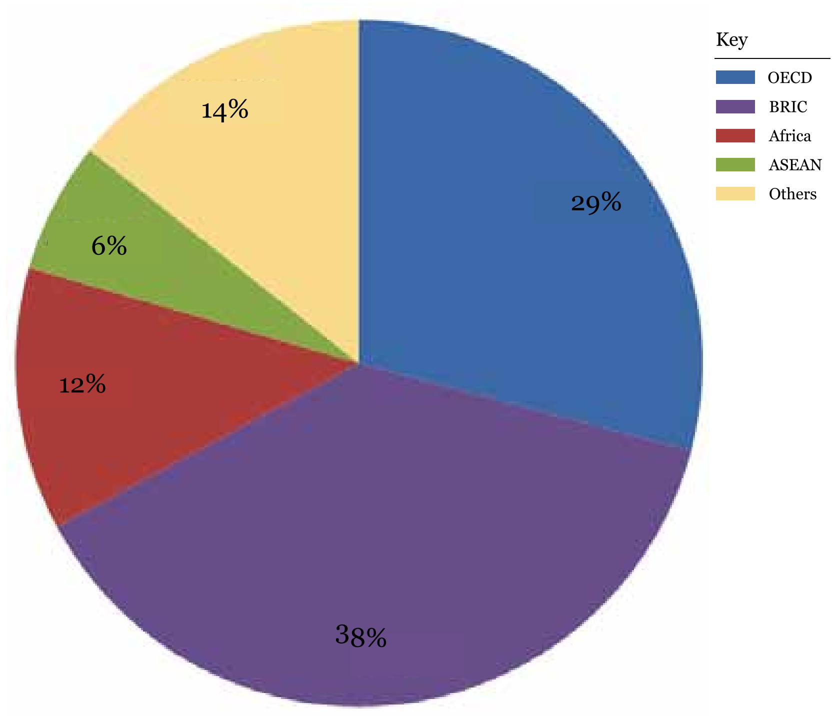


Figure 1.4 Biocapacity of four economic regions, expressed as portion of global total (2008)

In 2008 there were 12 billion gha of biocapacity globally. The countries that are part of OECD, BRIC, Africa, and ASEAN contributed 86% of that total.

Data source: Global Footprint Network, 2011

Ecological Footprint of Different Countries

Per capita Ecological Footprint varies greatly from country to country (Figure 1.5). This is due to the differences in national living standards and consumption patterns. In 2008, Qatar had the largest per capita Ecological Footprint at 11.7 gha, approximately six times that of China. Per capita Ecological Footprints exceed global per capita biocapacity (1.8 gha) in almost three-fifths of the 150 countries included in the National Footprint Accounts. The Carbon component accounts for over half of the Ecological Footprint in around a quarter of these countries, and is the largest component of the Ecological Footprint in nearly half of all countries.

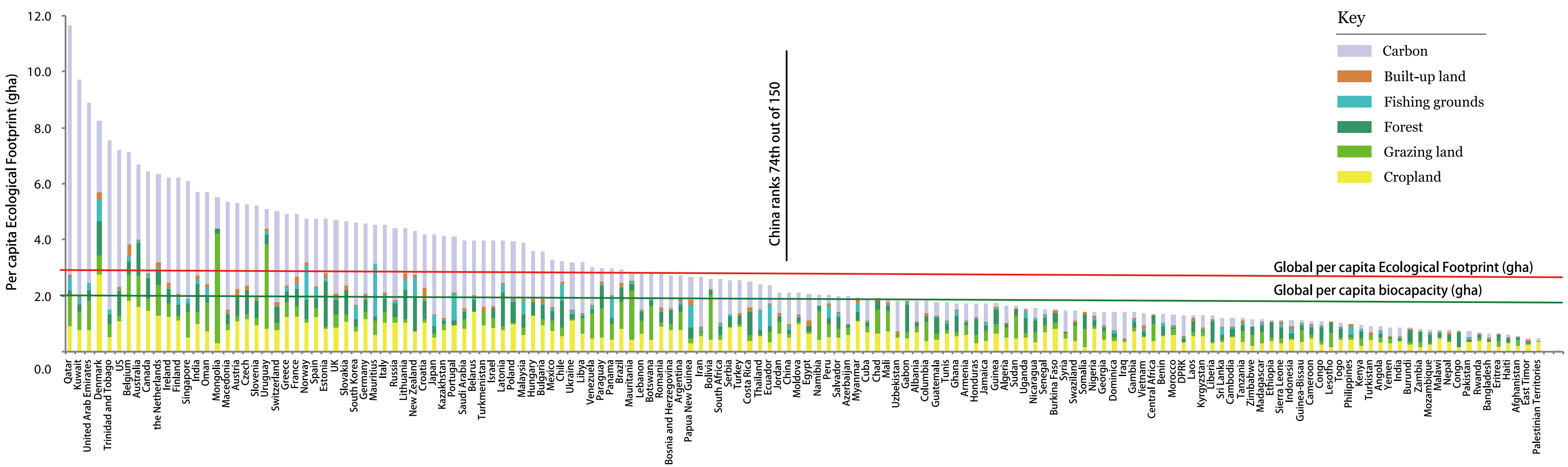


Figure 1.5 Ecological Footprint per country per person (2008)

Data source: Global Footprint Network, 2011

Ecological Footprint in China

In 2008, China's Ecological Footprint per person was 2.1 gha, lower than the global average of 2.7 gha, but higher than global biocapacity per person (1.8 gha).

China's total Ecological Footprint was 2.9 billion gha in 2008, and is a factor of its total population and per capita footprint. Although China's per capita Ecological Footprint of 2.1 gha is just 80% of the global average of 2.7 gha, China's total Ecological Footprint is the largest in the world in view of its large population size. In comparison, the per capita Ecological Footprint of the USA is 7.2 gha, ranking it 6th in the world; but its relatively small population gives the USA a total Ecological Footprint of 2.2 billion gha, lower than that of China.

Since the early 1970s, the China's demand on renewable resources has exceeded its ability to regenerate those resources within its own borders (Figure 1.6). China's per capita Ecological Footprint is 2.5 times its per capita biocapacity of 0.87 gha, meaning that China like many other countries in the world, is in a state of biocapacity deficit.

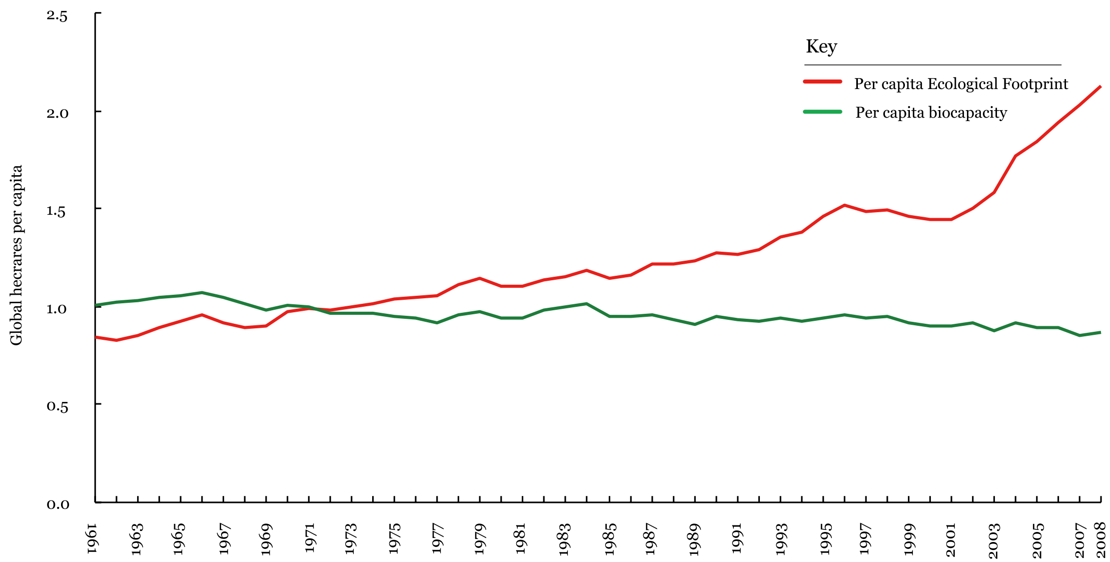


Figure 1.6 Ecological Footprint and biocapacity in China, 1961-2008

Data source: Global Footprint Network, 2011

Growth in China's total Ecological Footprint is being driven by increasing per person consumption multiplied by its large population. China has the world's largest population, but its proportion of the world total population has remained relatively constant over the past 50 years, ranging between 20% and 23% (Figure 1.7). In recent years, China's average per person consumption has significantly increased. Prior to the year 2000, the average rate of increase was 0.02 gha per person per year. This rate increased to 0.07 gha per person per year between 2000 and 2008, leading to an increase in China's share of the total global Ecological Footprint.

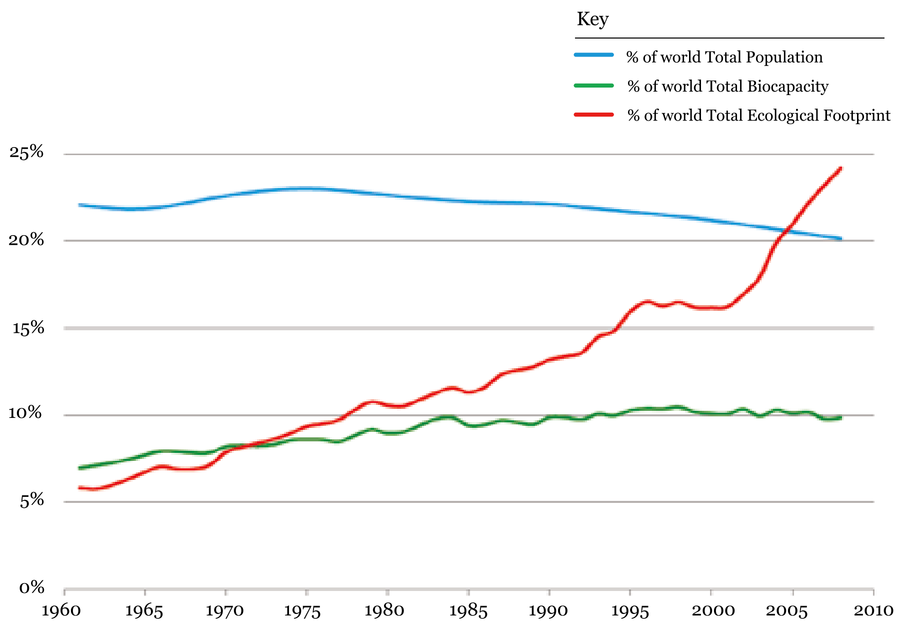


Figure 1.7 China in the World.

Although China has maintained a relatively constant proportion of the world's population and biocapacity, China's share of the total global Ecological Footprint has increased dramatically since 2000.

Data source: Global Footprint Network, 2011

The fastest growing individual component of China's Ecological Footprint is the carbon footprint (Figure 1.8). In 2008, the carbon footprint of China accounted for 54% of the national Ecological Footprint, while it was only 10% of the national Ecological Footprint in 1961. This represents an increase of more than 1.5 billion gha. The situation is similar across most countries. Globally, the carbon Footprint increased by 284% between 1961 and 2008, rising from 36% to 55% of the total Ecological Footprint.

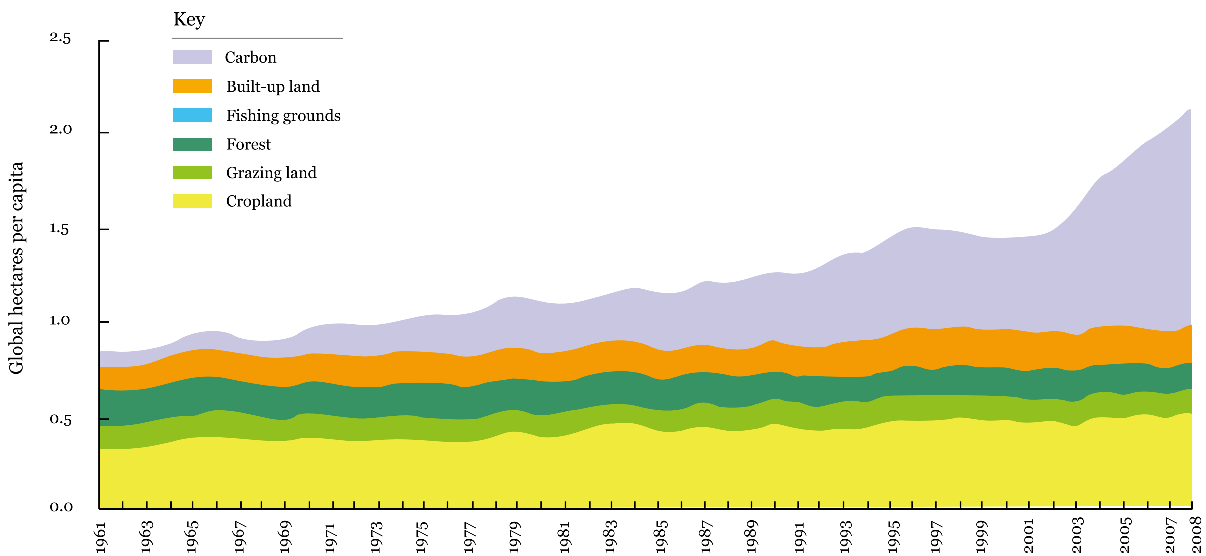


Figure 1.8 Components of China's Ecological Footprint, 1961-2008

The past 50 years have witnessed a steady but moderate growth in the total non-carbon components of China's per capita footprint and a notable growth in the carbon footprint. In terms of composition, carbon accounted for 10% of the Ecological Footprint of China in 1961; 35% in 1998; 41% in 2003; and 54% in 2008. From 2003 to 2008, China's per capita carbon footprint increased by 76%.

Data source: Global Footprint Network, 2011

Ecological Footprint of China's provinces[1]

The demand for and the availability of biocapacity varies significantly among different regions in China. Understanding differences across regions (including provinces, municipalities and autonomous regions) can help to identify the factors influencing supply and demand of ecological services in China and allow efficient measures for limiting the growth of China's Ecological Footprint to be developed.

Chinese provinces show considerable variation in total and per capita biocapacity.

In 2009, the provinces of Shandong, Henan, Sichuan, Inner Mongolia, Yunnan, Heilongjiang, Hebei, Hunan and Jiangsu accounted for approximately half of China's biocapacity. Of these, Shandong, Henan and Jiangsu enjoy particularly productive ecosystems with an average 500 gha of biocapacity produced on every square kilometre of productive land. In contrast, Inner Mongolia Autonomous Region's abundant biocapacity results from its large area of biologically productive land. As a result of either relatively small amount of biologically productive land available or low productivity of the land, the biocapacity of Beijing, Tianjin, Shanghai, Chongqing, Hainan, Shanxi, Ningxia, and Qinghai is among the lowest among China's provinces. Their combined biocpacity is lower than that of Shandong alone (Figure 1.9).

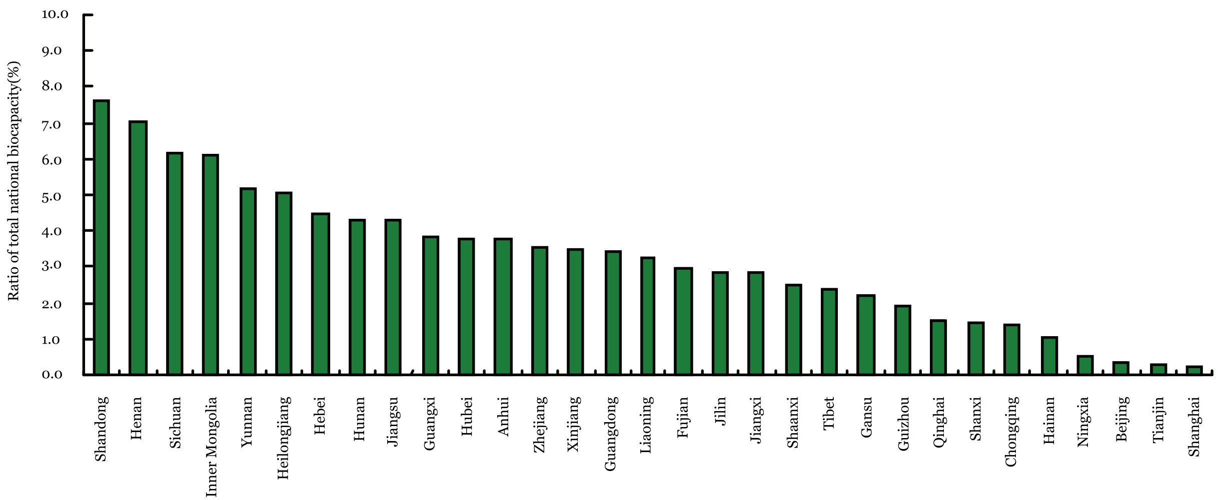


Figure 1.9 Total biocapacity of China's mainland provinces (2009)

Regional biocapacity is a factor of the area of biologically productive land and the productivity of that land. The nine provinces with the highest total biocapacity account for 50% of the China's total biocapacity, while the combined biocapacity of the eight least bioproductive provinces is less than that of Shandong alone.

Data source: IGSNRR, 2012

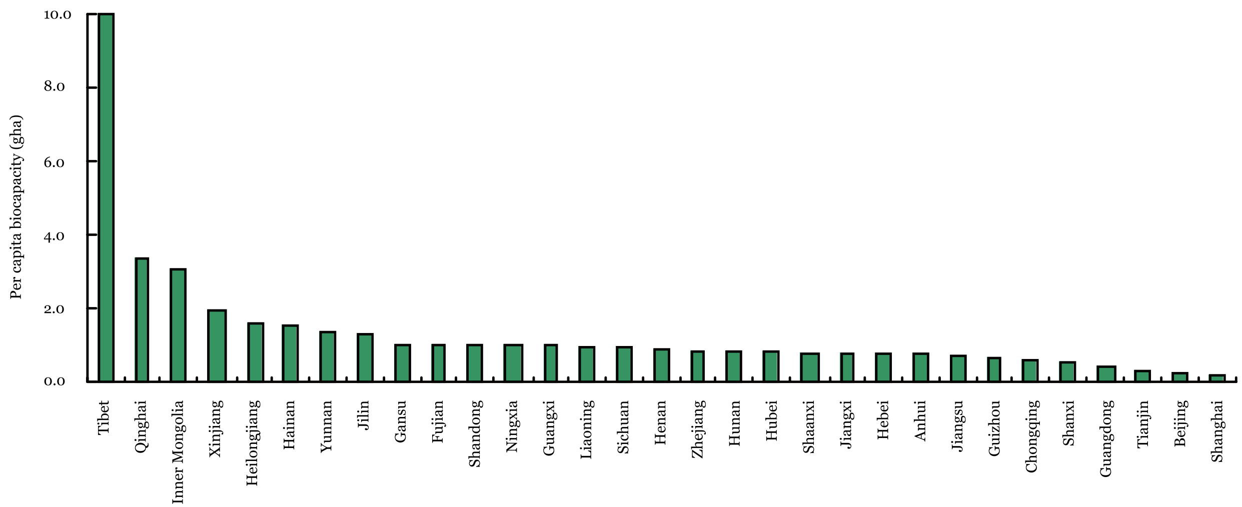
1 The China provincial level analysis in this report only includes 31 provinces, autonomous regions and municipalities in mainland China (hereinafter referred to as "provinces" and does not include Hong Kong, Taiwan or Macao.)

There is a marked difference in availability of per capita biocapacity (Figure 1.10) on either side of the Aihui-Tengchong population dividing line. The provinces to the west of the line such as Tibet, Qinghai, Inner Mongolia, and Xinjiang have relatively high per capita biocapacity as a result of their sparse populations and plentiful ecological resources. In comparison, the provinces east of the line generally have lower per capita biocapacity as a result of dense populations and relatively less abundant ecological resources.

Figure 1.10 Per capita biocapacity in China's mainland provinces (2009)

In general, higher per capita biocapacity is found in the provinces to the west, of the Aihui-Tengchong population line and lower per capita biocapacity to the east.

Data source: IGSNRR, 2012



China's total and per capita Ecological Footprint varies significantly among provinces. Regionally there is a difference in per capita Ecological Footprint between China's eastern and western provinces (Figure 1.11). In general, the per capita Ecological Footprint in the eastern provinces is higher than that of the central and western provinces; and the eastern provinces are also more economically developed with higher population density. In 2009, the regions with the highest per capita Ecological Footprint out of 31 provinces in mainland China were Beijing, Shanghai and Tianjin—three municipalities with both high economic development levels and high urbanization rates.

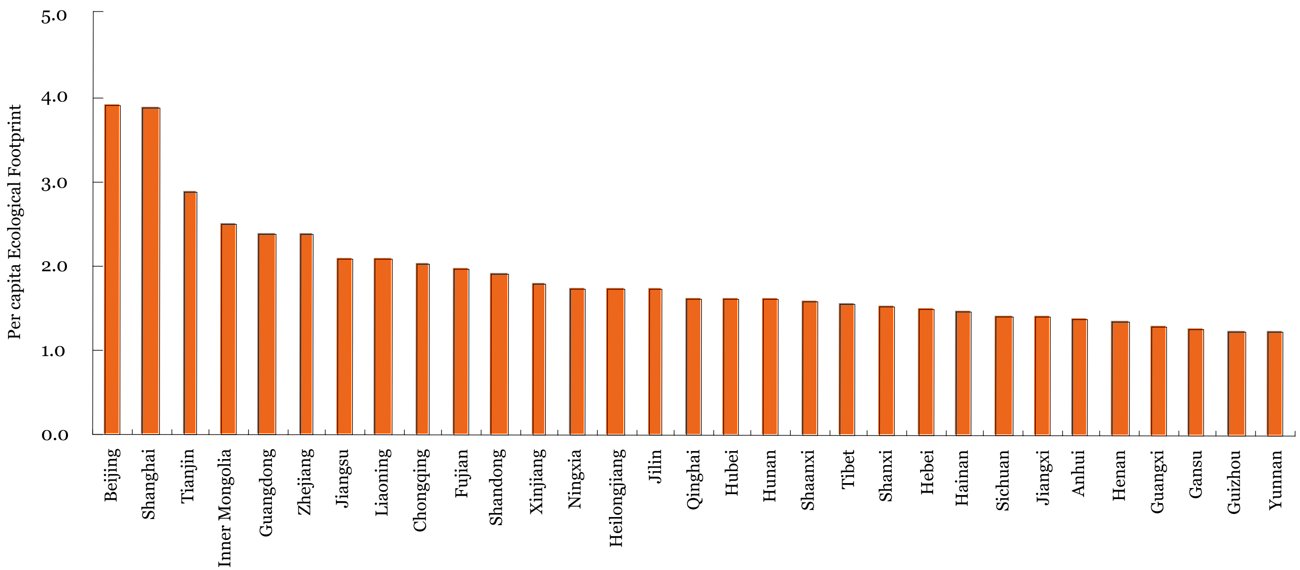


Figure 1.11 Average per capita Ecological Footprint in China's mainland provinces (2009)

The per capita Ecological Footprint in eastern provinces is generally higher than that in the middle and western provinces.

Data source: IGSNRR, 2012

The total provincial Ecological Footprint (Figure 1.12) shows even greatest variability than that of the per capita Ecological Footprint alone since the trends are reinforced by the variation in population distribution. Guangdong has the largest total provincial Ecological Footprint due to its large population and high per capita Ecological Footprint. Henan province in central China also has a high total provincial Ecological Footprint due to its large population, even though its per capita Ecological Footprint is relatively low. This provincial variation demonstrates the need for the adoption of regionally adapted measures for controlling the growth of Ecological Footprint.

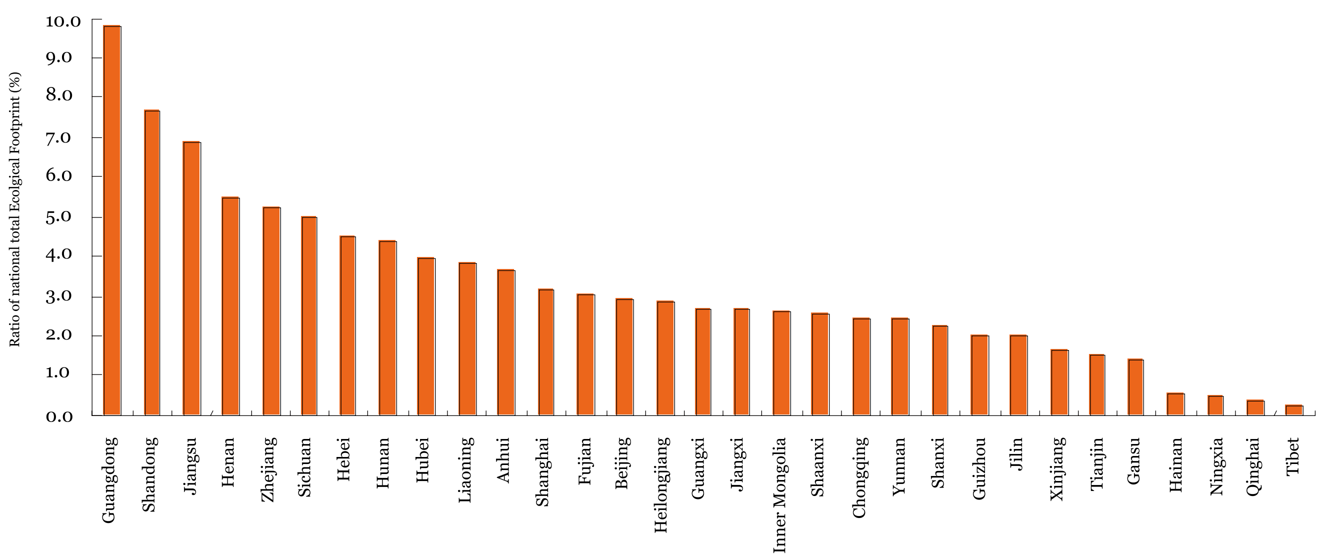


Figure 1.12 Mainland provinces' percentage share of China's Ecological Footprint (2009)

The Ecological Footprint in Guangdong accounts for nearly 10 percent of the national total and is higher than the combined footprints of Guizhou, Jilin, Xinjiang, Tianjin, Gansu, Hainan, Ningxia, Qinghai and Tibet.

Data source: IGSNRR, 2012

Carbon footprint is the largest and most rapidly increasing component of China's Ecological Footprint. It is the largest component of Ecological Footprint in all of China’s provinces and accounts for over 50% of the Ecological Footprint in most provinces (Figure 1.13).

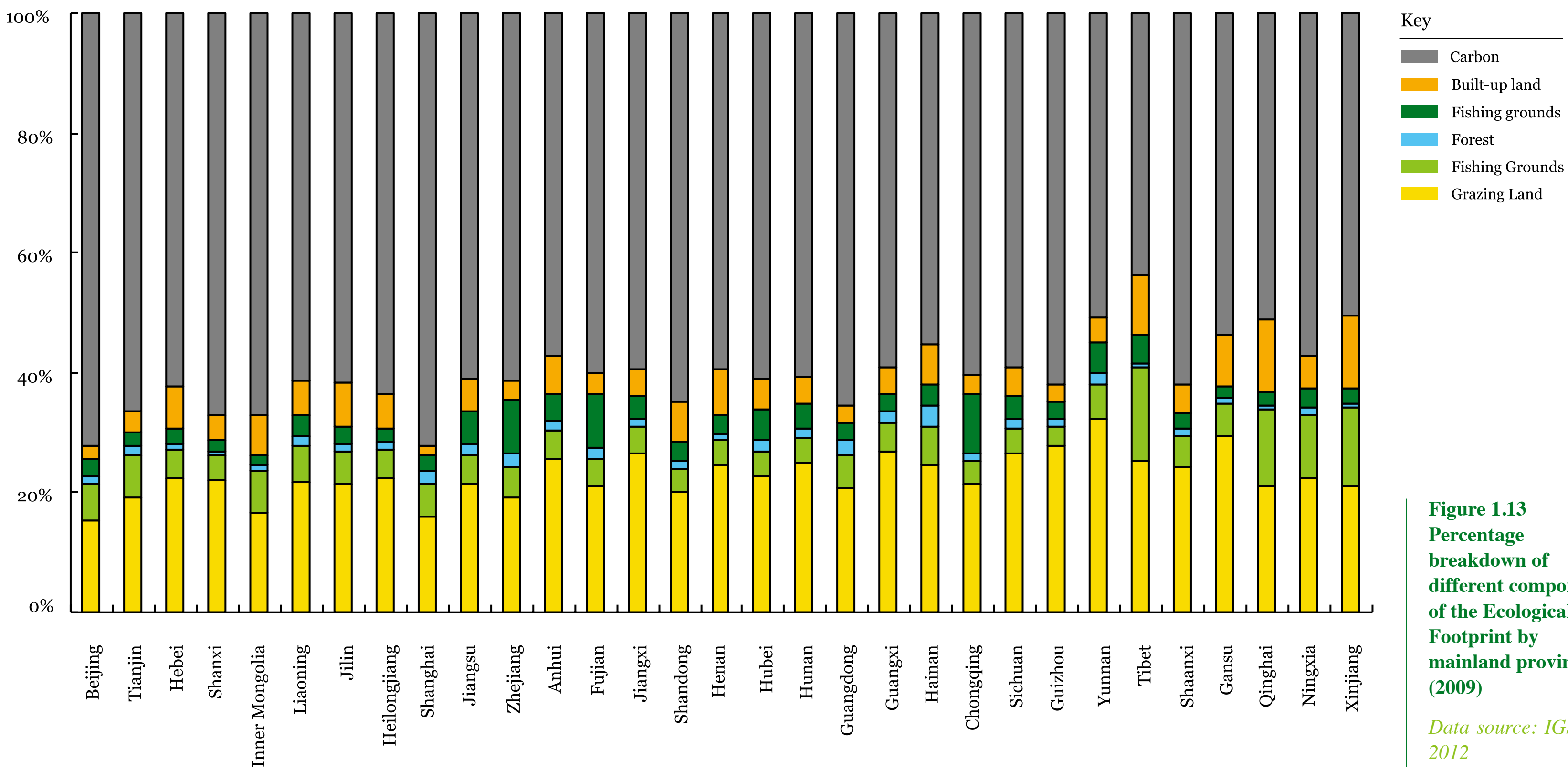


Figure 1.13 Percentage breakdown of different components of the Ecological Footprint by mainland province (2009)

Data source: IGSNRR, 2012

The Carbon Footprint can be described as direct or indirect footprint. The direct carbon footprint represents the consumption of fuel or electricity in households or of gasoline for transport, and is clearly identifiable. In contrast, the indirect carbon footprint represents carbon emissions embodied in consumer goods such as food or in services as a result of the energy used in their production, and is typically less apparent. Figure 1.14 demonstrates that the indirect carbon footprint is the main contributor to carbon footprint in every province of China. In regions along the southeast coast and in the Sichuan basin, the contribution of indirect carbon to the regional carbon footprint is 90% or more.

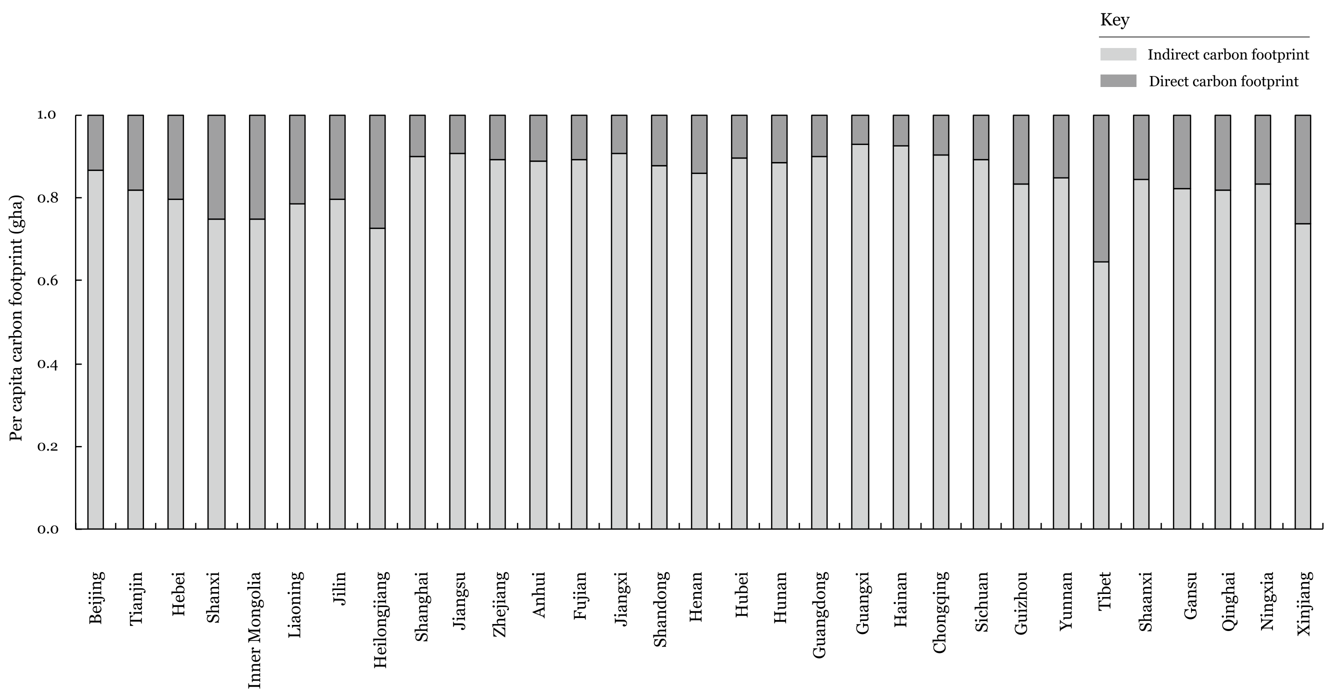


Figure 1.14 Direct and indirect carbon footprint by mainland province (2009)

The indirect or hidden footprint of carbon embodied in goods and services accounts for at least 70% of carbon footprint in China's mainland provinces.

Data source: IGSNRR, 2012

In 2009, six provinces in mainland China had a biocapacity surplus, meaning the biocapacity within their provincial borders exceeded their Ecological Footprint (Figure 1.15 and Figure 1.16) These provinces were Tibet, Qinghai, Inner Mongolia, Xinjiang, Yunnan and Hainan.

The remaining provinces were all in a state of biocapacity deficit where their Footprint exceeded the biocapacity available within their provincial borders. In three quarters of these provinces, biocapacity exceeded the Footprint represented by provincial demands for the four aggregated biomass components of the footprint (cropland, grazing land, forests and fishing grounds). The remaining one quarter do not have sufficient biocapacity to meet their needs for food, fibre and timber.

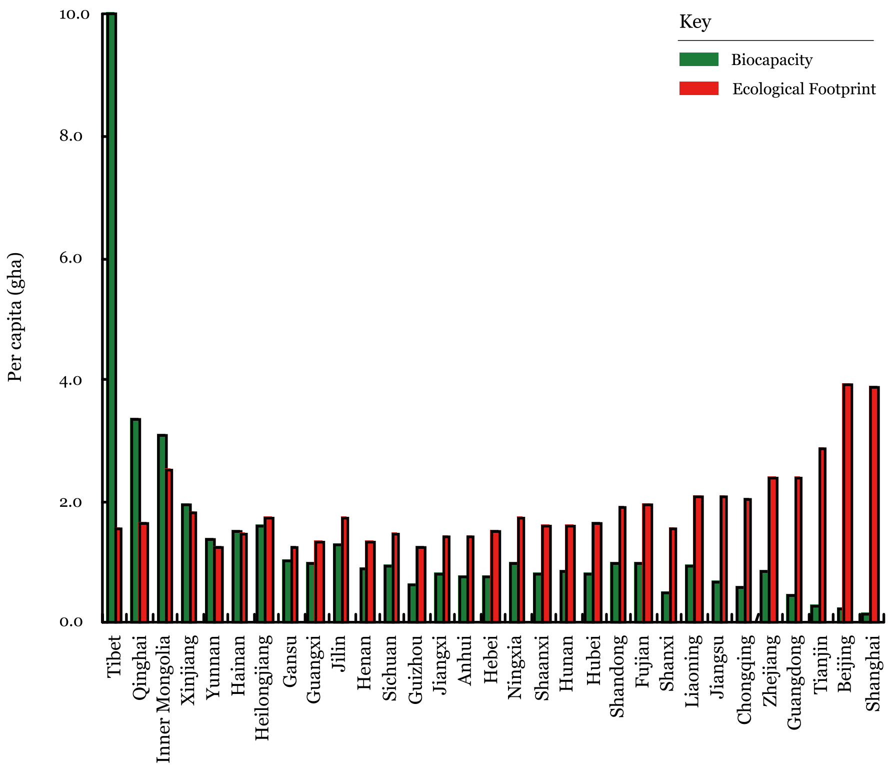


Figure 1.15 Contrast between Chinese provincial Ecological Footprint and biocapacity (2009)

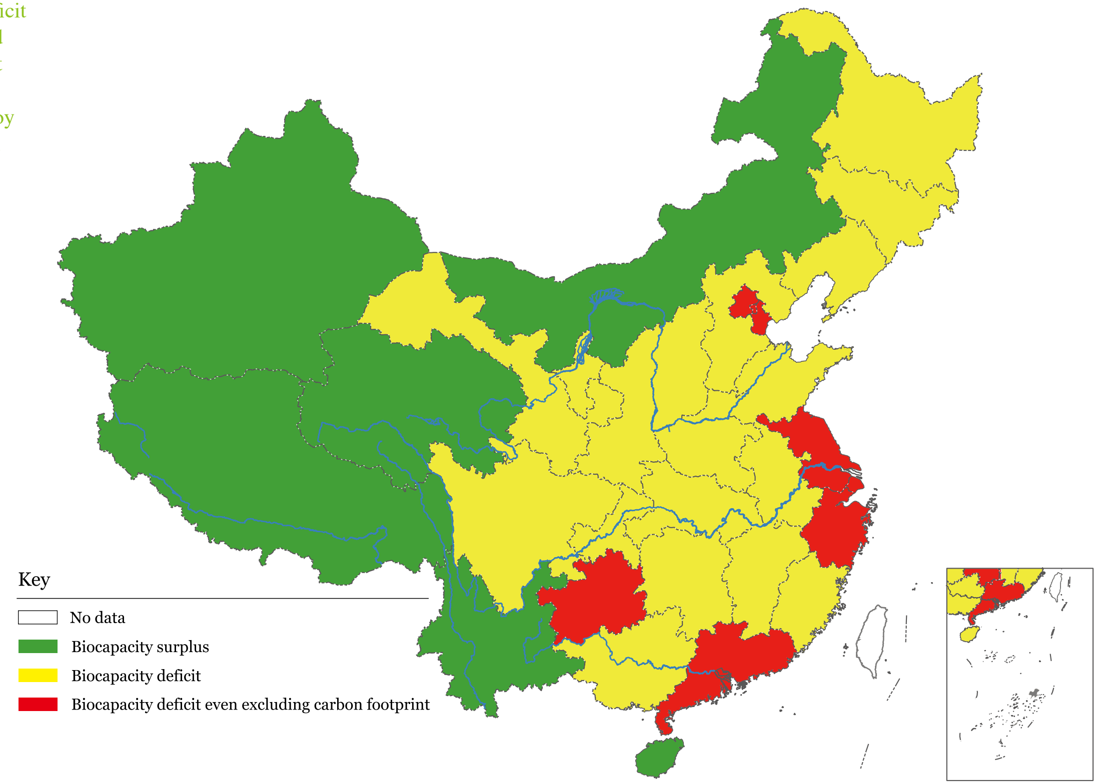
Per capita Ecological Footprint is high in the eastern economically developed areas. At the same time per capita biocapacity is low and the resulting biocapacity deficit is large. In contrast, per capita biocapacity is high in the western areas which have lower Ecological Footprints, and as such these areas are currently more independent in terms of natural resources. These regional differences illustrate how transformation of consumption to control Ecological Footprint and sustainable management of natural resources both have a role to play in minimizing China's biocapacity deficit.

Data source: IGSNRR, 2012

Figure 1.16 Biocapacity surplus / deficit by province (2009)

Twenty five provinces in China are in biocapacity deficit (yellow and red). The six provinces highlighted in red are in biocapacity deficit even before carbon footprint is accounted for: Beijing, Shanghai, Chongqing, Guangdong, Jiangsu and Zhejiang. Six provinces enjoy a biocapacity surplus: Hainan, Inner Mongolia, Tibet, Xinjiang, Yunnan and Qinghai.

Data source: IGSNRR, 2012



The Global Reach of China's Ecological Footprint

This section of the report looks at the global reach of China's Ecological Footprint in terms of the Footprint biomass components embodied in its imports and exports, that is, in traded goods derived from food, fibre and timber products sourced from forests, cropland, grazing land and fishing grounds. The number of categories of traded goods considered in the calculations present here has increased to 455 compared to the 132 categories considered in China's Ecological Footprint Report 2010.

In 2009, China's embodied biocapacity in imports and exports of products sourced from forests, cropland, grazing land and fishing grounds each accounted for around 2% of the total global biocapacity. The net import of these biomass components of footprint amounts to an average of 0.03 gha per person. In other words, just 3% of biomass biocapacity consumed by the average Chinese citizen is dependent on net imports. These figures indicate that China's aggregate demand for renewable resources could largely be met by its domestic ecosystems.

Figure 1.17 summarizes trade flows and net trade flows of the four biomass components of biocapacity between China and 26[2] trading partners. In 2009, trade with these partners accounted for around 80% of China's imports and exports of food, fibre and timber measured in global hectares.

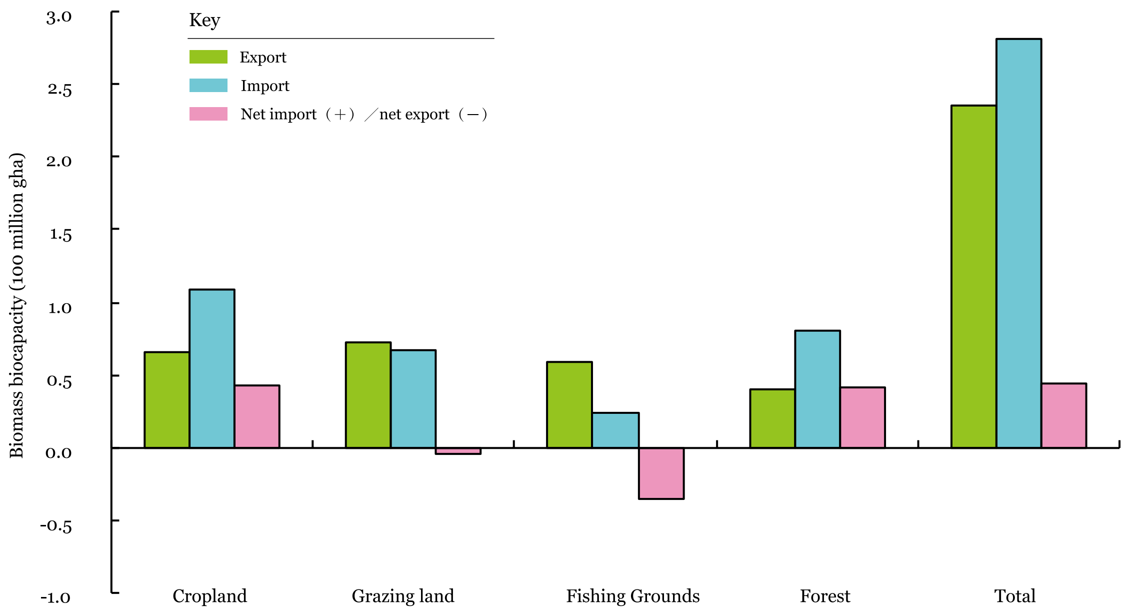


Figure 1.17. Biocapacity flows between China and 26 trading partners

An analysis of trade flows of the biomass components of biocapacity. China is a net importer of biocapacity embodied in cropland and forest products and a net exporter of biocapacity embodied in products from fishing grounds and grazing land. In general, goods exported by China have undergone a higher overall level of processing and transformation than those that are imported.

Data source: IGSNRR, 2012

2 The 26 countries include: Thailand, India, Malaysia, Korea, Indonesia, Saudi Arabia, Japan, Spain, Italy, France, Russia, UK, Netherland, Germany, Mexico, Chile, Brazil, Egypt, Nigeria, South Africa, New Zealand, Australia, US, Canada.

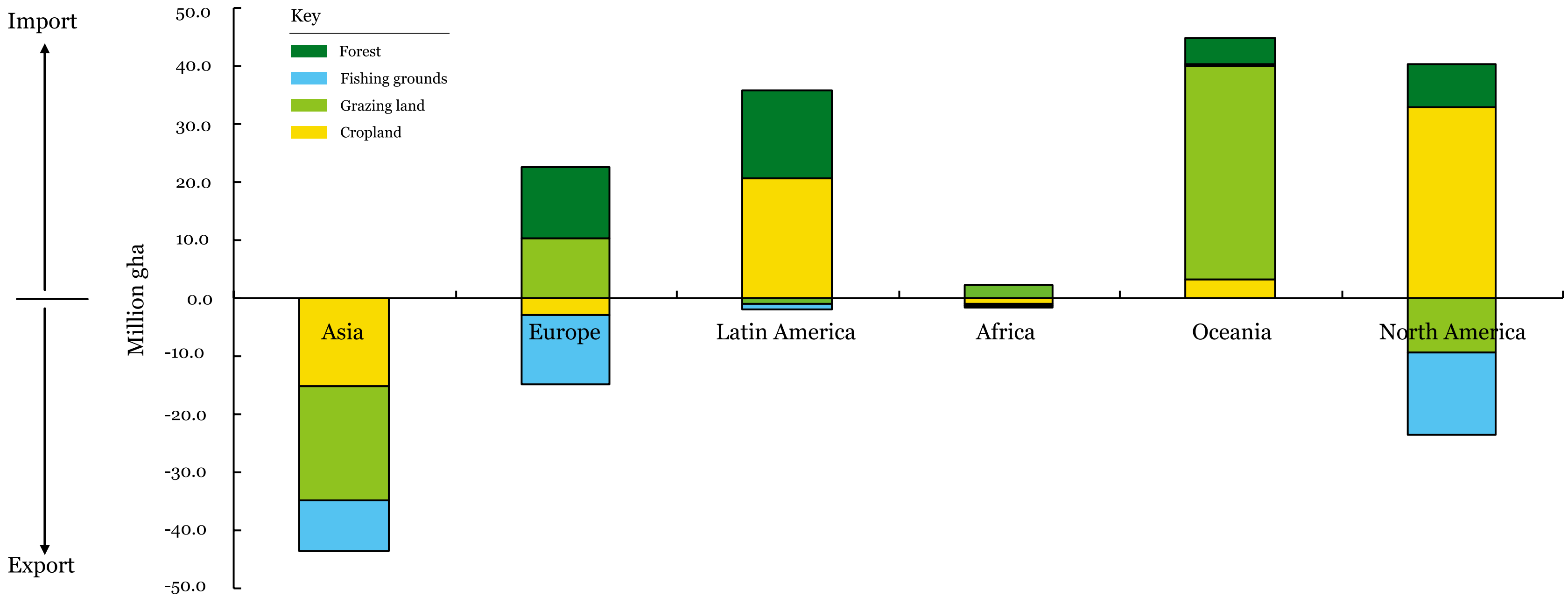


Figure 1.18 Net international flows in biocapacity by trading partner

Summary of the net trade of biomass components of the footprint by major selected trading partners.

Data source: IGSNRR,2012

The breakdown of trade by regions (Figure 1.18) indicates that China's biocapacity exports flow mainly to its neighbours in Asia (specifically Japan and Korea). Products of grazing lands are mainly sourced from Oceania, while cropland and forest products are imported from Latin America. Trade in biocapacity with Europe and America is characterized by both imports and exports. For example, China is a net importer of forest products from Europe and North America but exports fisheries products to both regions.

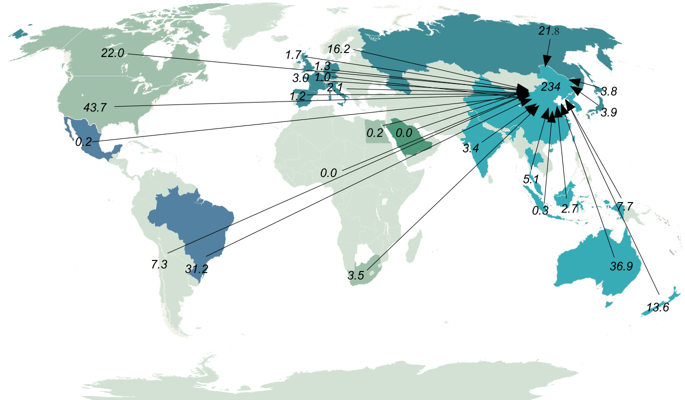


Figure 1.19 Biocapacity (biomass components) imports to China (million gha)

Calculation based on 455 different categories of traded goods

Data source: IGSNRR, 2012

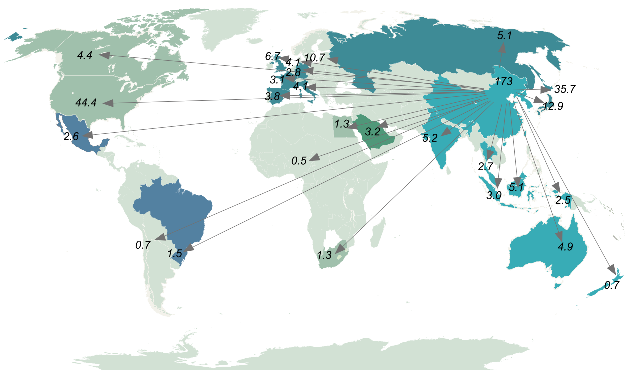


Figure 1.20 Biocapacity (biomass components) exports from China (million gha)

Calculation based on 455 different categories of traded goods

Data source: IGSNRR, 2012

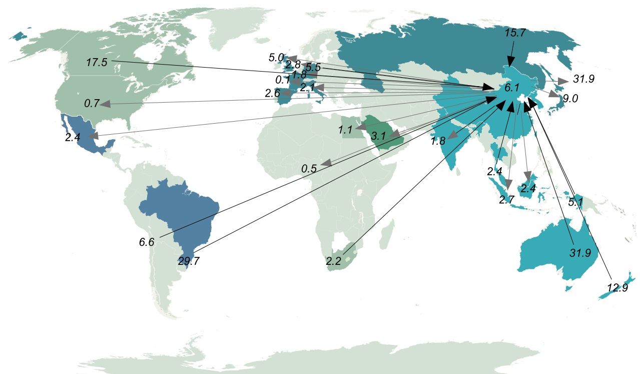


Figure 1.21 Net import or export of biocapacity (biomass components) between China and its major trading partners (million gha)

Calculation based on 455 different categories of traded goods

Data source: IGSNRR, 2012

Trade has the capacity to meet the demand of China and its trading partners for different commodities. China's imports of biocapacity come largely from countries with an overall biocapacity surplus or a surplus in specific components of biocapacity. In contrast, the major destination countries for China's exported biocapacity are countries with a biocapacity deficit. In the face of an increasing global biocapacity deficit, the competition for resources can be expected to intensify and even countries with an ecological surplus are currently facing footprint pressures as a result of global resource demands, thereby highlighting the need for sustainable resource management in those countries. China has the opportunity to play an increasingly active role in conserving global ecosystem services by strengthening its principles and standards related to environmental conservation in all aspects of international trade and investment.

Water Footprint

Water is indispensable for biological productivity as well as for industrial production and household use. The Water Footprint complements Ecological Footprint by measuring the volume of water used to produce the goods and services that we consume.

The Water Footprint measures human demand and impact on water resources resulting from agricultural production, industry and households. It serves as a comprehensive index to measure the distribution and utilization of fresh water resources, provides a tool to support discussion and study of sustainable utilization and fair distribution of water resources, and establishes a baseline for the assessment of local economic, social and environmental conditions and drivers.

Water Footprint of Production

The Water Footprint can be considered from the perspective of production or consumption. The Water Footprint of production of a country or a region is the volume of freshwater used to produce goods and services within a given area, irrespective of where those goods and services are consumed.

The Water Footprint of Production depicts the volume of freshwater used for the production of goods and services in a country or region. In 2009, China's Water Footprint of Production was 1.12 trillion cubic meters, accounting for 12% of the global Water Footprint of Production (Hoekstra & Mekonnen, 2012). Forty five percent was of this total was green water, 29% was blue water and 26% was grey water (Figure 1.23). Approximately 60 percent of China's grey water footprint results from agricultural production, indicating that agricultural production activities are the primary source of water pollution. Better management of fertilizer and pesticide applications in agricultural production would have positive effects on China's water quality.

Figure 1.22 components of water footprint

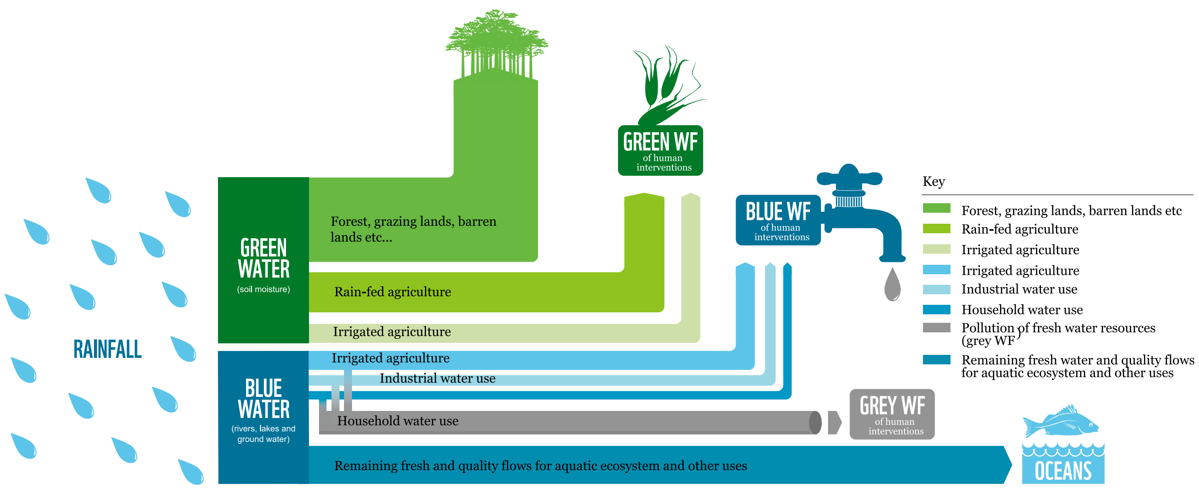
The Water Footprint comprises three components: green water footprint, blue water footprint and grey water footprint.

Green water footprint is the volume of rainwater that is taken up by crops from the soil and subsequently evaporated.

Blue water footprint is the combined volume of surface and underground water used in households, agriculture and during the production of goods.

Grey water footprint is the volume of water required to dilute water pollutants to such an extent that the quality of ambient water remains above designated quality standards.

Data: African Ecological Footprint Report, WWF 2012



There is significant regional variation in the geographic distribution of China's Water Footprint of Production. The Water Footprint of Production is low in large municipality cities such as Beijing, Tianjin and Shanghai and in provinces with limited agricultural development such as Tibet and Qinghai. In contrast, provinces with well-established agricultural economies have much higher Water Footprints of Production (Figure 1.24).

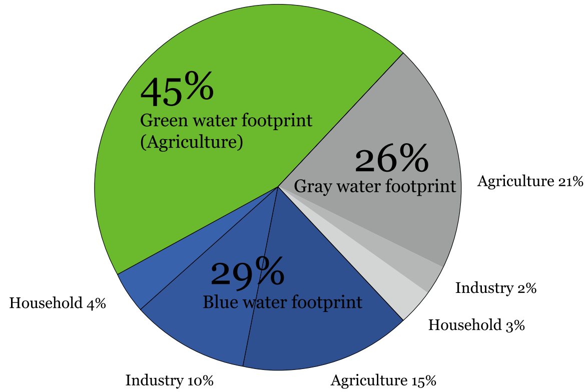


Figure 1.23 Components of China's Water Footprint of Production (2009)

Green water is the main component of China's Water Footprint of Production. With its relatively small negative impact on the environment and low opportunity cost in comparison with blue water, green water plays an essential role in water resource security and food security.

Data source: IGSNRR, 2012

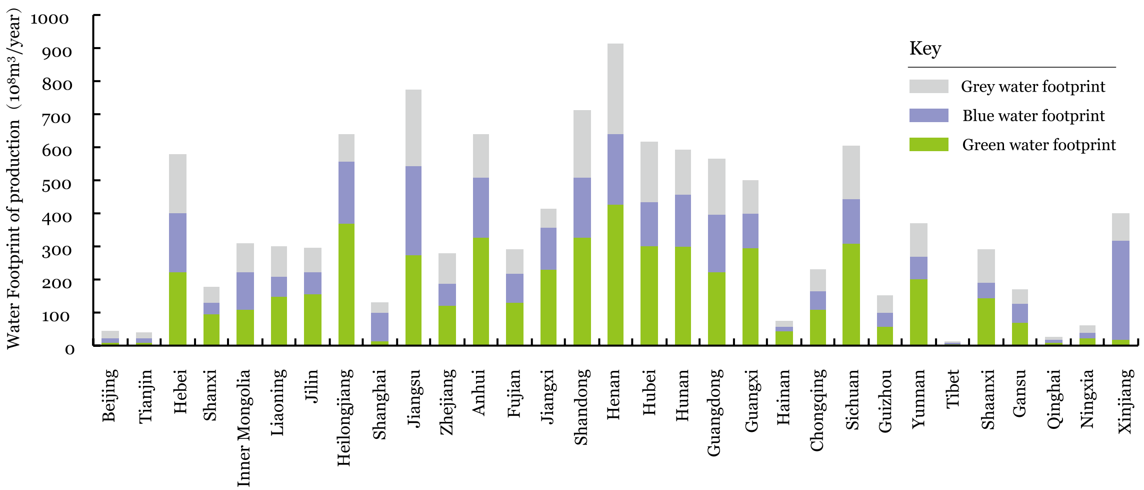


Figure 1.24 Water Footprint of Production in China's mainland provinces (2009)

The composition of the Water Footprint of Production varies among provinces as a result of different climatic conditions and production activities. Green water use is most prominent in provinces in tropical and subtropical regions with abundant rainfall and agriculture such as Guangxi and Hainan. Blue water use is most prominent in Xinjiang where there is very limited rainfall for agriculture. Big cities like Beijing and Tianjin have the highest proportion of grey water footprint.

Data source: IGSNRR, 2012

Water Footprint of Consumption

The Water Footprint of Consumption of a region is the volume of water used in the production of goods and services that are consumed by the residents of that region, irrespective of where the goods and services are produced.

The per capita Water Footprint of Consumption in China is less than half the global average. Water consumption varies significantly between provinces, with more urbanized provinces and the provinces along the south-eastern coast having a higher Water Footprint of Consumption (Figure 1.25). Guangdong, Jiangsu and Shandong have the highest total Water Footprints of Consumption, reaching 70 billion cubic meters for Guangdong. The three provinces with the smallest Water Footprint of Consumption are Ningxia, Qinghai and Tibet. The total Water Footprint of Consumption in Tibet is less than 1.8 billion cubic meters.

China's per capita Water Footprint of Consumption is not high compared to other countries. However, China is still facing large pressures and challenges in water resource supply since the country as a whole is not endowed with abundant water resources and has a huge population.

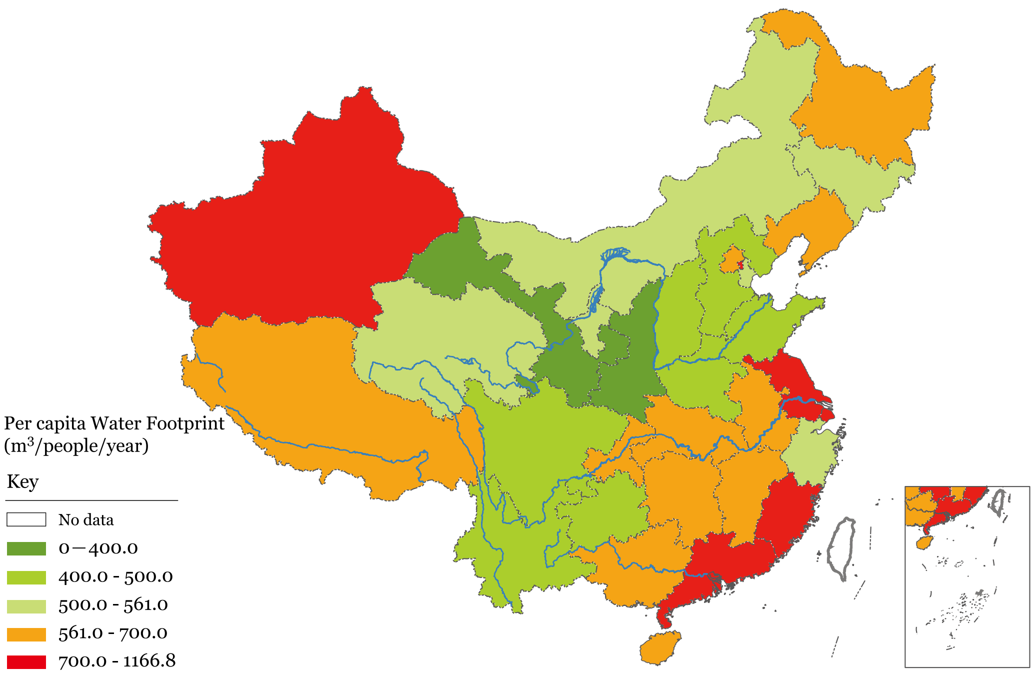


Figure 1.25 Geographic Distribution of China's per capita Water Footprint of Consumption (2009)

Green shows provinces in which the per capita Water Footprint is lower than or equal to the national average; red shows provinces in which the per capita Water Footprint is higher than the national average.

There are 16 provinces in which per capita Water Footprint exceeds the national average level; Xinjiang, Shanghai, Jiangsu, Guangdong and Fujian have the highest levels. The per capita Water Footprint in Xinjiang and Shanghai is more than 1000 cubic meters; in comparison the per capita water footprint in Shannxi, Gansu and Henan is less than 500 cubic meters.

Data source: IGSNRR, 2012

Water stress in China

Water stress can be defined as the proportion of renewable surface water and underground water that is consumed by households, industry and agriculture in a given country or a region on a year round basis. It is calculated as the ratio of Water Footprint of Production minus the green water component to the annual renewable water resources in the country or region. The degree of water stress experienced in China varies among regions, but the overall situation with regard to China's water resources is of general concern. Provinces experiencing the most severe water resource stress (> 100% in 2009) are mainly in the north of the country and are characterized by their large cities and significant agricultural economies. Water stress is also significant in Central China and in the lower reaches of the Yellow and Yangtze Rivers, and the geographic area experiencing water stress is expanding into more southerly provinces (Figure 1.26). Steps that could help alleviate China's water resource stress include further industry restructuring, more efficient irrigation techniques such as drip and spray irrigation, and development of a new water strategy.

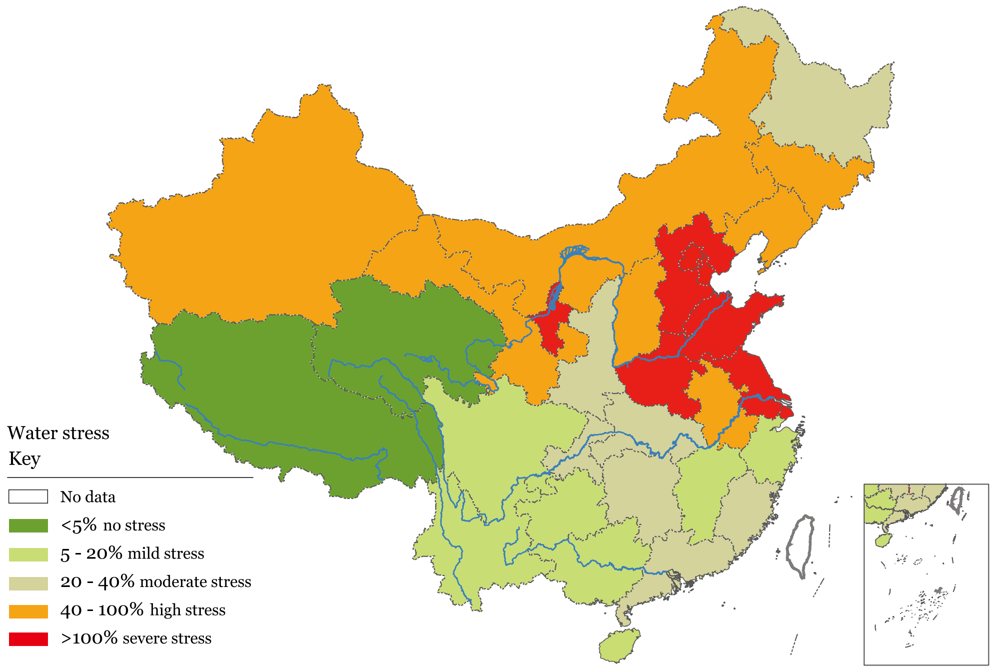


Figure 1.26 Geographic Distribution of China's water resource stress (2009)

In the north, water resource stress is severe, but the per capita Water Footprint of Consumption is relatively low. In contrast, water resources along the southeast coast are plentiful, water resource stress is low and per capita Water Footprint of Consumption is high. Besides the region's large population, the role of the agricultural areas of the North in China's economic development contributes to high water resource stress.

Data source: IGSNRR, 2012

Living Planet Index

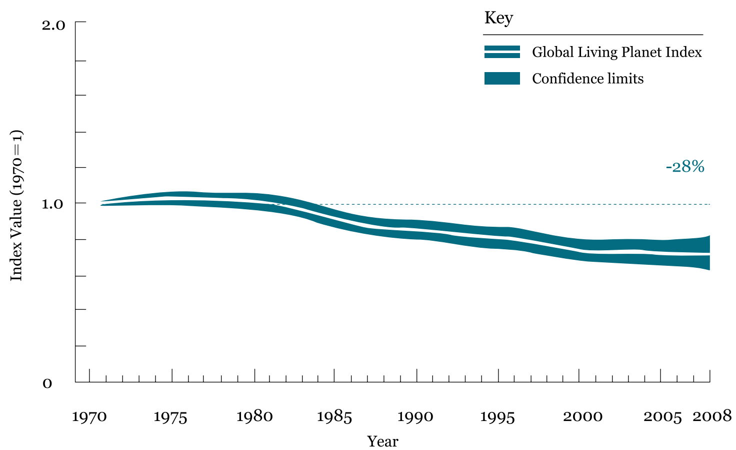


Figure 1.27 The Global Living Planet Index

Data source: Zoological Society of London, 2012

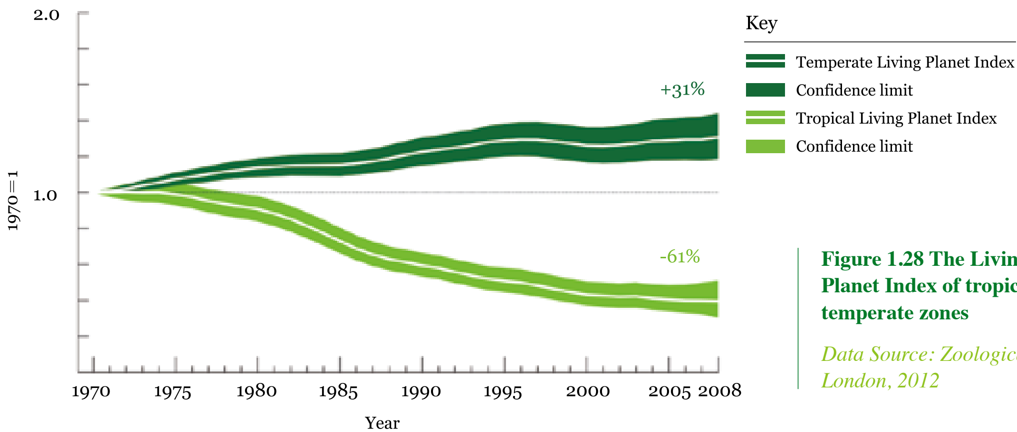


Figure 1.28 The Living Planet Index of tropical and temperate zones

Data Source: Zoological Society of London, 2012

Living Planet Index in global context

The Living Planet Index (LPI) reflects the change in the status of the Earth's biodiversity by tracking trends in populations of vertebrate species over time. It is one of the indicators adopted by the Convention on Biological Diversity to assess the health of the global ecosystem (Collen et al., 2008). The LPI has been updated biennially since 1998 with the publication of the Living Planet Report. In 2012, the LPI tracked the trends of 9,014 populations of 2,688 vertebrate species. The index shows a decline of around 28% between 1970 and 2008 (WWF/ZSL,2012). Among these changes, the LPI of tropical zones decreased by 61% and that of temperate zones increased by 31%.

The global Living Planet Index provides a quantitative reference for establishing policy, strategy and framework agreements on biodiversity protection at the global level. The Living Planet Index complements the measure of Ecological Footprint by tracking changes in the state of the planet's biodiversity, using trends in the size of 9,014 populations of 2,688 mammal, bird, reptile, amphibian and fish species from different biomes and regions. The Living Planet Index database provides reference information for evaluating population pressures and management, assessing the status of species, and controlling harmful and invasive species.

China's Living Planet Index

China is one of the 12 globally recognized "Mega-biodiversity" countries, which together contain the majority of the world's species.[3] China has more than 6,500 species of vertebrates representing 14% of the global total. China is also one of the countries experiencing the severest loss of biodiversity. Until recently, the global LPI database included information on just 0.8% of the vertebrate species found in China. As a result, the global Living Planet Index trends are of limited relevance to the Chinese situation and do not accurately reflect the status and trends of biodiversity and ecosystems in China.

The first step in the development of China's Living Planet Index was to establish a database of historical information concerning the status of populations of Chinese vertebrate. Information on the populations of vertebrate species in the China Living Planet Index database was collected from academic papers published in China and internationally, and from monographs, government reports, investigative reports of conservation zones, and databases and records of species distribution and population numbers issued by authorities. China's Living Planet Index database currently comprises time-series information on 1417 populations of 485 species spanning the period 1952 - 2011, including 125 species of mammals, 210 species of birds, 32 species of amphibians, 27 species of reptiles and 93 species of fishes. Together these records represent nearly 8% of China's vertebrates. The information on populations in the database covers all of China's administrative regions except for Taiwan, Macao and Hong Kong. At the same time the number of records for China in the global LPI database has increased by 30% to 40%, which will increase the accuracy of the Living Planet Index as well as its relevance for China.

The calculation of China Living Planet Index employs the same methodologies as the previously published national and regional Living Planet Index, such as the Canada Living Planet Index, Uganda Living Planet Index and the Arctic Species Trend Index (WWF et al.,2007; Pomeroy et al., 2006; McRae et al., 2010). It takes the characteristics of China's zoogeography and fauna and the complexity of its ecosystems into account through stratified analysis of data and the selection of species.

3 These twelve countries are Brazil, Ecuador, Peru, Mexico, Congo, Madagascar, Australia, China, Columbia, India, Indonesia and Malaysia

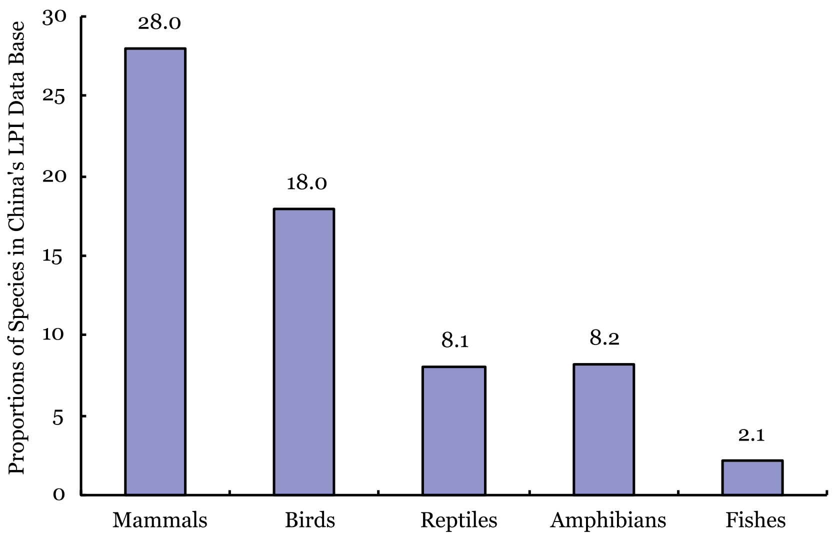


Figure 1.29 Distribution of Vertebrate populations in the China Living Planet Index Database

Data source: Institute of Zoology, Chinese Academy of Sciences, 2012.

Living Planet Index case study - trends of historical change for keystone and flagship species in different ecosystems in China

Keystone and Flagship species serve as indicator species for a given ecosystem. Conservation activities in habitats aimed at protecting these species can also benefit other species in the same habitat. The species in Figure 1.30 are an illustrative subset of the species represented in China's LPI database selected to highlight issues facing species in China. The Amur tiger, giant panda, Asian elephant, and Hainan gibbon are flagship species for forest ecosystems. Further habitats are represented by the desert-dwelling wild Bactrian camel; the Yangtze river dolphin and wild Chinese alligator from the Yangtze freshwater system; and the crested ibis and Père David's deer found in wetland ecosystems. Finally the selection includes the Qianghai Lake naked carp, a keystone species living in the saline ecosystem of Qinghai Lake, and the musk deer, which is a historically exploited species covered by CITES[4]. The aim of this case study was to establish a preliminary understanding of the health of ecosystems by tracking population trends in these species over time, whilst simultaneously analyzing and verifying index trends by considering factors such as habitat conservation, human disturbance, and environmental change.

The graphs in Figure 1.30 show that although these species have been identified as priorities for protection, all except the crested ibis and the Père David's deer have experienced negative trends at some stage in the past decades. The giant panda, as a star species in China, benefitted from early and continued protection and policy support, and has seen a slow recovery as has the Asian elephant. The recovery of the crested ibis and Père David's deer highlight the benefits of in situ conservation and species reintroduction. The number of animals increased rapidly as a result of establishment of conservation areas and strengthening habitat conservation and species management, and the conservation areas became a refuge for other species. The benefits of conservation measures are less evident in the population trends of other flagship and keystone species in this case study. The factors threatening key species, including poaching, human population growth, urbanization, infrastructure construction and global climate change, are faced by Chinese ecosystems to varying extents. China's Wildlife Conservation Law and establishment of a network of conservation areas have contributed to active habitat conservation and control of hunting, and have slowed the downward trend of animal species numbers over the last 20 years. However, species recovery is a long-term process, particularly for species with small populations and for rare and endangered species with low reproduction rates. These species require ongoing and long-term conservation support including strict habitat protection and management.

This case study demonstrates that the Living Planet Index database can accurately track and reflect population trends of China's vertebrate species. These trends vary significantly between species and the database can be used to identify species of conservation concern. The population trends of species associated with different ecosystems can guide conservation policy formulation and implementation in accordance with the status of different ecosystems.

4 CITES is the Convention on International Trade in Endangered Species of Wild Fauna and Flora, signed in 1973. It aims to strictly control and supervise commercial international trading of listed endangered species so as to prevent excessive international trading as well as ensuring they are not threatened in the wild.

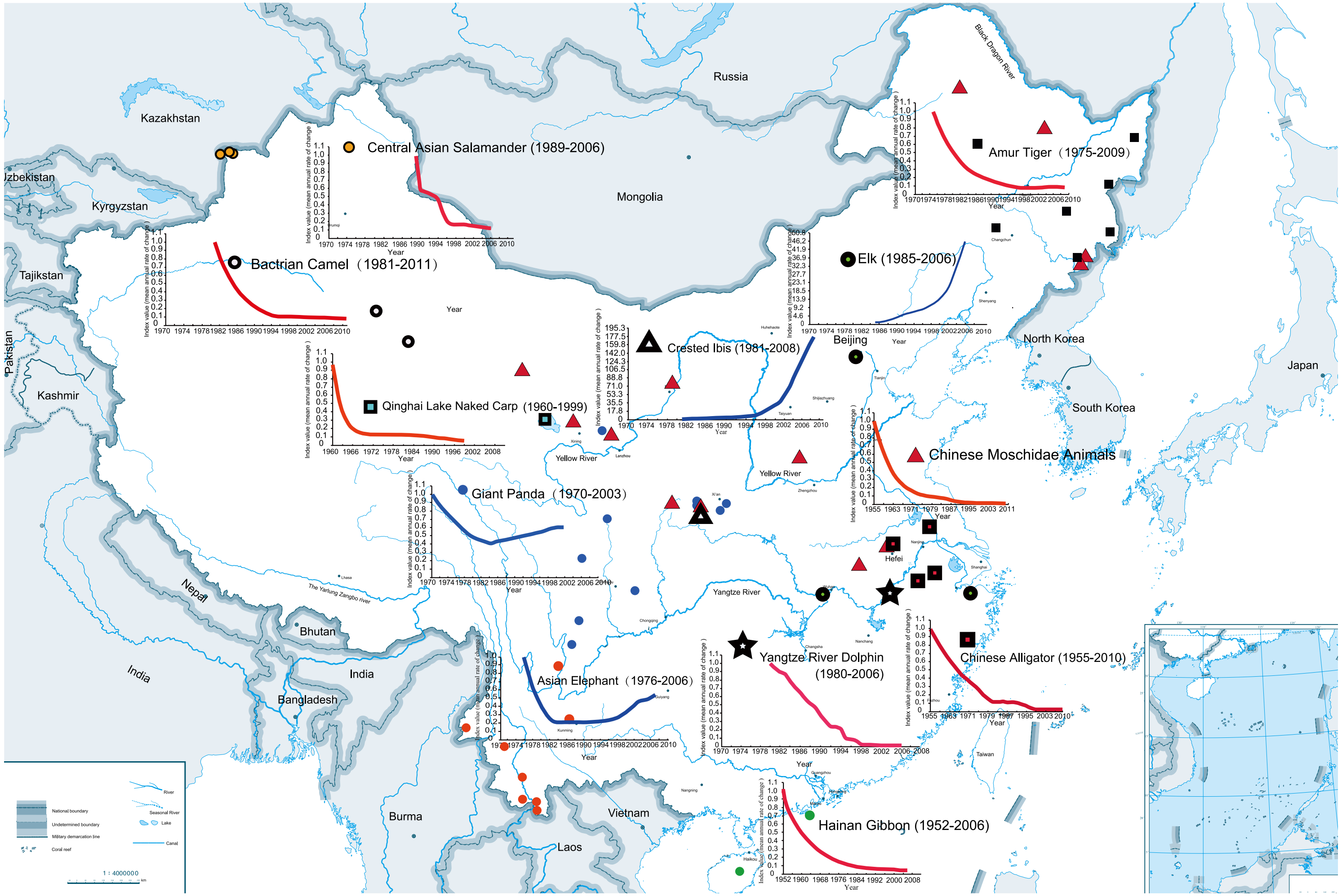


Figure 1.30 Trends in flagship and keystone species populations in different ecosystems in China

Data source: Institute of Zoology, Chinese Academy of Sciences, 2012

Species Name	Status
Japanese Crested Ibis	Endangered species: Between 1989 and 2006, the population decreased by 88% due to habitat loss, habitat modification from deforestation, or logging related activities and intensive agriculture or grazing.
Musk Deer	Endangered: The population decreased by 99% from 1955 to 2010 due to excessive hunting for musk before 1980s rampant smuggling, habitat loss and poaching despite China's accession to the CITES Convention.
Giant Panda	Endangered, flagship species of temperate forest ecosystems: The population dropped by about 60% from 1970-1985 because of hunting and habitat degradation. It has gradually recovered as a result of conservation efforts and protection measures.
Asian Elephant	Endangered, flagship species of tropical and subtropical forest ecosystems: The population is recovering slowly after a rapid decrease in the 1980s.
Qinghai Lake Naked Carp	Keystone species living in the saline lake ecosystem of Qinghai Lake: The population dropped by 90% from 1960 to 1990, due to over-fishing and environmental change.
Central Asian Salamander	Endangered species: Between 1989 and 2006, the population decreased by 88% due to habitat loss; habitat modification from deforestation, or logging related activities and intensive agriculture or grazing.
Père David's Deer	Extinct in the wild, flagship species of wetland ecosystems: This introduced population has increased 50 times between 1985 and 2005.
Amur Tiger	Endangered, flagship species of coniferous forest ecosystems: The population decreased by 92% from 1975 to 2009 due to hunting, deforestation, habitat loss and intensified human activities.
Bactrian Camel	Critically endangered, flagship species of desert ecosystems: The population decreased by 90% in the 1990s due to hunting before the Wildlife Conservation Law came into effect. Its population has been unable to recover owing to low numbers, desertification and extensive human activities such as grazing and mining.
Chinese Alligator and Yangtze River Dolphin	Critically endangered, flagship species of the Yangtze River ecosystem: The Chinese Alligator population decreased by 97% from 1955 to 2010 and the population of the Yangtze River Dolphin decreased by 99.4% from 1980 to 2006.
Hainan Gibbon	Critically endangered, flagship species living in the tropical forest ecosystem of Hainan island: The population decreased by 96% from 1952 to 2006 due to hunting and agricultural development from the 1950s to 1970s, and deforestation and intensive human activities from the 1980s onwards.

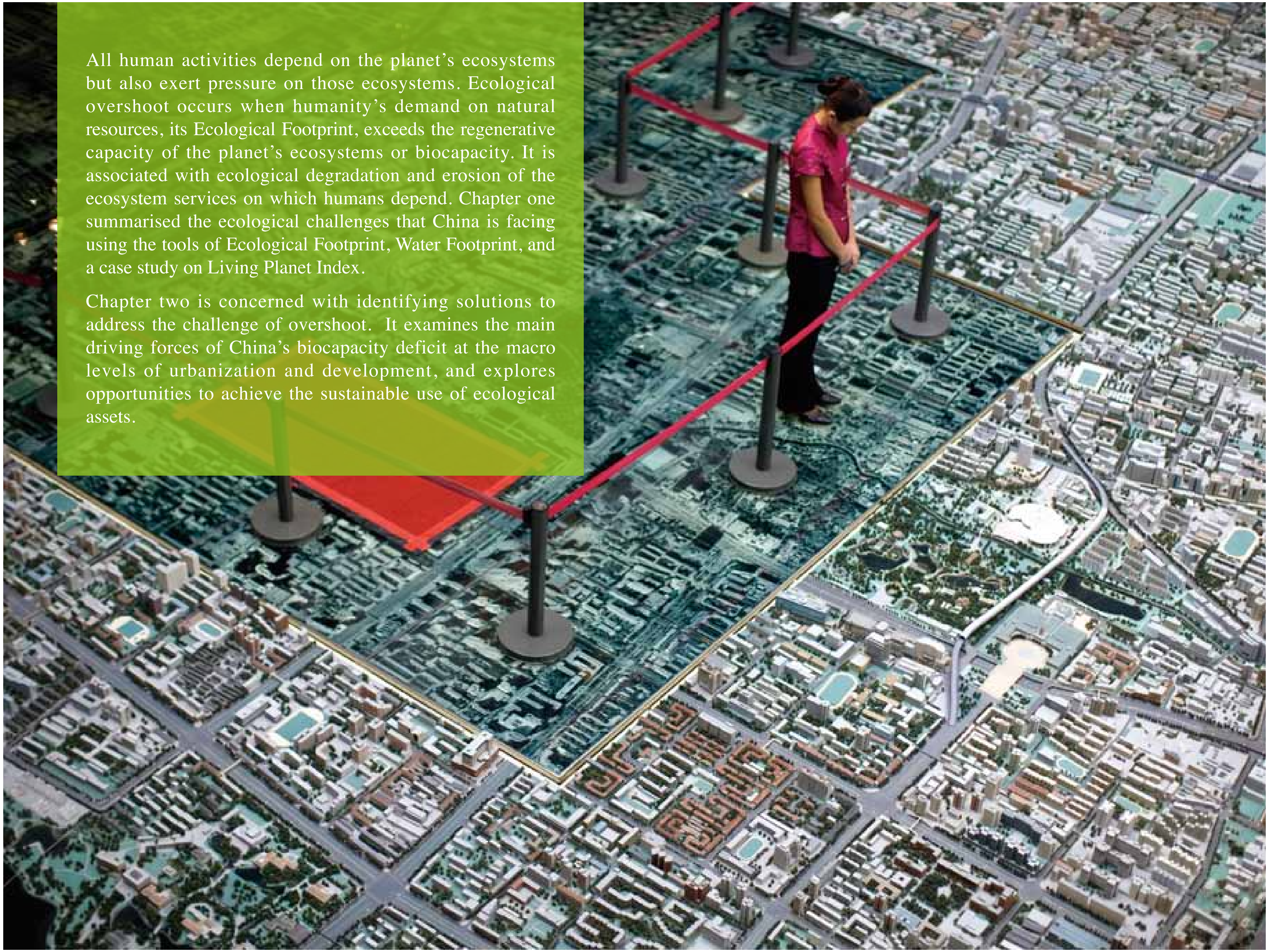
© Elma Okic / WWF-Canon

Chapter Two:

Key Drivers Analysis — Consumption, Resource Intensity and Urbanization

All human activities depend on the planet's ecosystems but also exert pressure on those ecosystems. Ecological overshoot occurs when humanity's demand on natural resources, its Ecological Footprint, exceeds the regenerative capacity of the planet's ecosystems or biocapacity. It is associated with ecological degradation and erosion of the ecosystem services on which humans depend. Chapter one summarised the ecological challenges that China is facing using the tools of Ecological Footprint, Water Footprint, and a case study on Living Planet Index.

Chapter two is concerned with identifying solutions to address the challenge of overshoot. It examines the main driving forces of China's biocapacity deficit at the macro levels of urbanization and development, and explores opportunities to achieve the sustainable use of ecological assets.



© Brent Stirton / WWF-Canon

Population, consumption and production

A biocapacity deficit occurs when a population's demand for renewable resources and carbon sequestration exceeds nature's capacity to keep up with this demand, or in other words, when its Ecological Footprint exceeds its available biocapacity. The Ecological Footprint of a region is driven by three factors: population, individual consumption, and resource intensity. Biocapacity is driven by two factors: the area of bioproductive land, and the bioproductivity per hectare.

The driving forces of footprint growth have changed over time (Figure 2.2). Between 1961 (the first year of available data) and 1978, the main factor driving the growth of China's Ecological Footprint was increasing population size. Since 1978, the growth in per capita Ecological Footprint has played an increasing role and since 2003 it has become the dominant driver of the expansion of China's total Ecological Footprint and its biocapacity deficit.

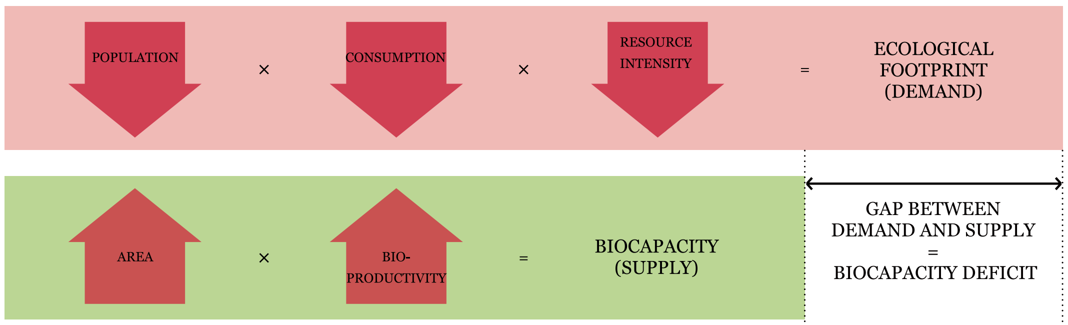


Figure 2.1 Five factors determine the overall scale of biocapacity deficit or surplus

The Ecological Footprint of a region is a product of population, per capita consumption and resource intensity of consumption. It increases with population and per capita consumption, and decreases with greater production efficiency. Biocapacity – as a measure of ecological supply – is the product of land area and land productivity. The balance between ecological supply and demand in a country or region is the biocapacity deficit or surplus.

The per capita Ecological Footprint is driven by consumer habits (per capita consumption) and the efficiency with which goods and services can be provided (production efficiency). In the past 30 years since 1978, the drivers of the average Chinese person's Ecological Footprint have changed, with a significant turning point around 1985 (Figure 2.3). Between 1978 and 1985, China's per capita consumption increased at the same rate as its production efficiency. But since 1985, there has been a widening disparity between the growth rates of per capita consumption and production efficiency. This has two implications: the first is the need to increase production efficiency, the second is that production efficiency alone may not be enough. Changes in consumption patterns will also be required.

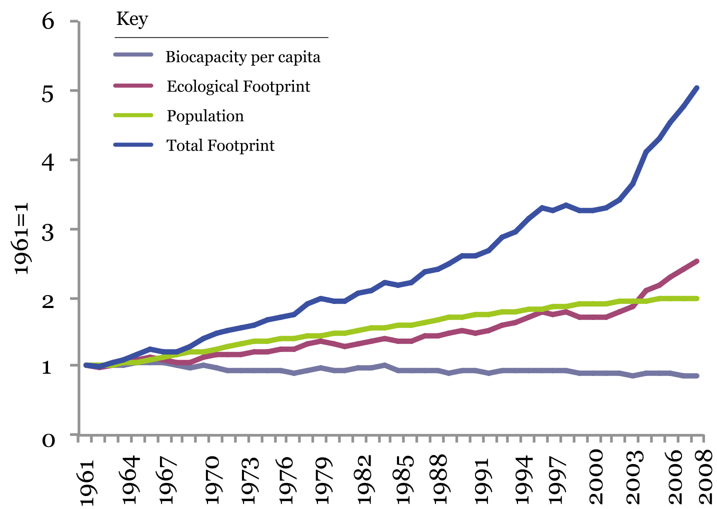


Figure 2.2 Analysis of drivers of China's biocapacity deficit

Variables are shown as an index value where the value in 1970 is 1.

Data source: Global Footprint Network, 2011

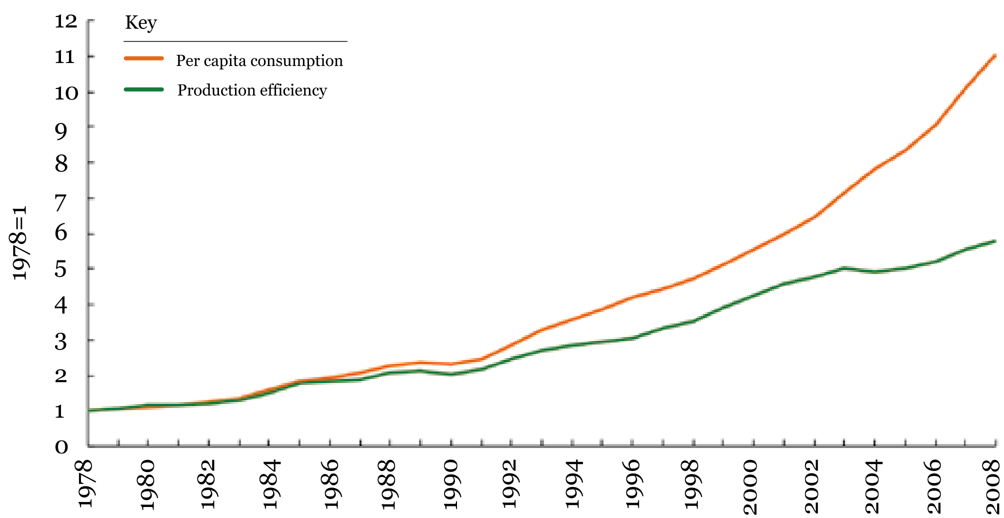


Figure 2.3 Drivers of China's per capita Ecological Footprint

Taking 1978 as the benchmark (1978=1) to track the change in per capita consumption and production efficiency (the economic value generated by each unit of natural resource), this figure shows that from 1978 to 1985, China's per capita consumption increased at the same rate as its production efficiency. Since 1985 there has been a widening disparity between the growth rates of per capita consumption and production efficiency.

Data source: IGSNRR, 2012

Humanity's footprint is generated both by day-to-day demands for goods and services such as food and transportation, and longer-term investment in fixed or long lived assets such as buildings. Thirty-eight percent of China's Ecological Footprint is accounted for by investment in fixed assets, known as gross fixed capital (Figure 2.5). This large percentage reflects the current economic growth in China that is associated with investment in public and private infrastructure. In South Africa, the USA and the UK, about 80% of the national Ecological Footprint comes from household consumption, and transformation towards resource efficient lifestyles would have a large impact on the total Ecological Footprint in these countries. In China, transformation of investment in fixed assets towards a green investment model could promote sustainable lifestyle patterns and help stabilise China's Ecological Footprint in the long term. For example, transport

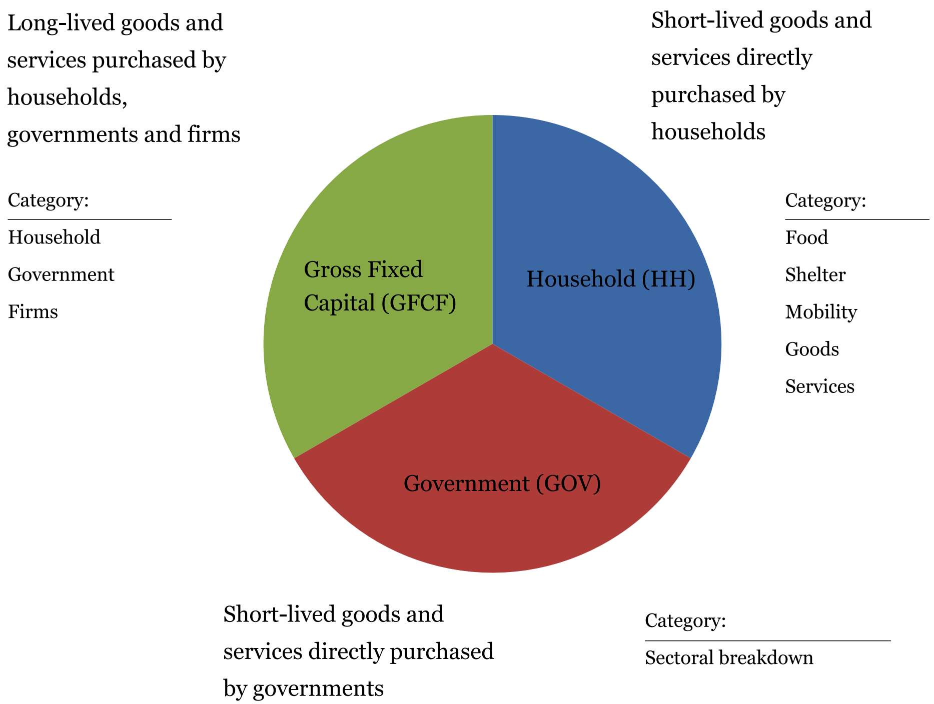


Figure 2.4 Categories of Demand for Goods and Services

The Ecological Footprint can be subdivided into three types of final consumption demand: household consumption, government consumption, and investment in fixed assets.

Household consumption (food, housing maintenance and use, personal transportation, use of goods and services) and government consumption (public services, schools, management and military defense) are of a short-term nature. The time frame for these two types of consumption is often less than one year.

In contrast, investment in fixed assets is of a long-term nature, more than one year. It represents investment by households, companies and government on items in long-lived assets such as houses, factories or machinery and transportation infrastructure.

Data source: Global Footprint Network, 2012

infrastructure can be designed in such a way as to minimise carbon footprints, particularly by prioritising the construction of public transportation systems such as subways, light rail, trains and buses. However, avoiding infrastructure-related lock-in to resource intensive lifestyles will not be sufficient to prevent the growing pressures on Chinese and global ecosystems, and parallel efforts to avoid mimicking the unsustainable household consumption patterns found in high-income countries will also be necessary.

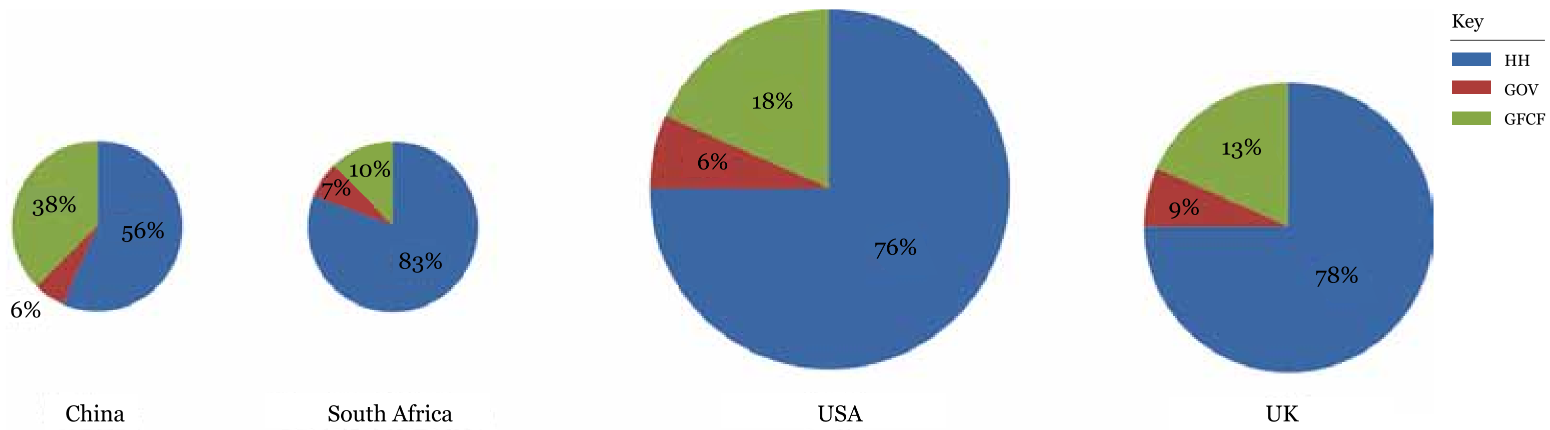


Figure 2.5 Analysis of the Ecological Footprint in China, South Africa, the USA and the UK in 2008.

The per capita footprint in China is lower than that of high-income countries such as the USA and the UK.

If China were to follow the development patterns of these countries, then its national Ecological Footprint would increase by two or three times.

Data source: Global Footprint Network, 2011

Urbanization

In China, urbanization is clearly associated with an increase in the average per capita Ecological Footprint. The strong relationship between increasing urbanisation and footprint is illustrated by time series data at the national level (Figure 2.6), and together with a comparison of urbanisation and per capita footprint by province (Figure 2.7). The underlying drivers in this association between urbanization and increased Ecological Footprint are consumption and the change in consumption patterns associated with the increase in wealth in urban areas.

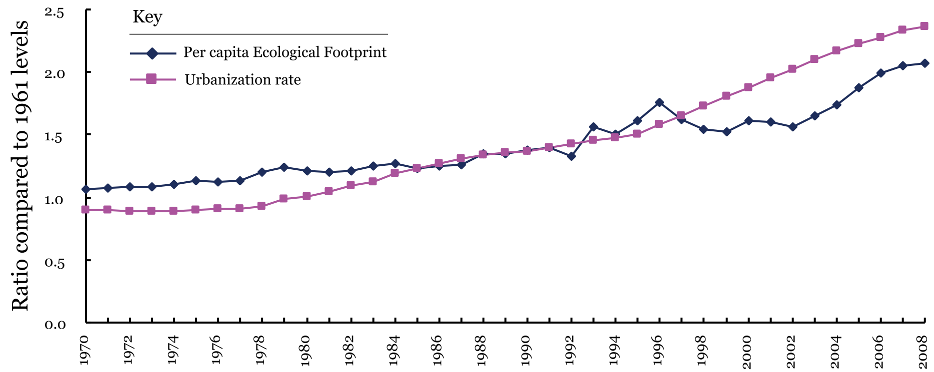


Figure 2.6 China's per capita Ecological Footprint vs rate of urbanization

Per capita Ecological Footprint and urbanization have increased hand in hand at a national level in China.

However since 1997, China's per capita Ecological Footprint has risen less rapidly than the level of urbanization.

Data source: IGSNRR, 2012

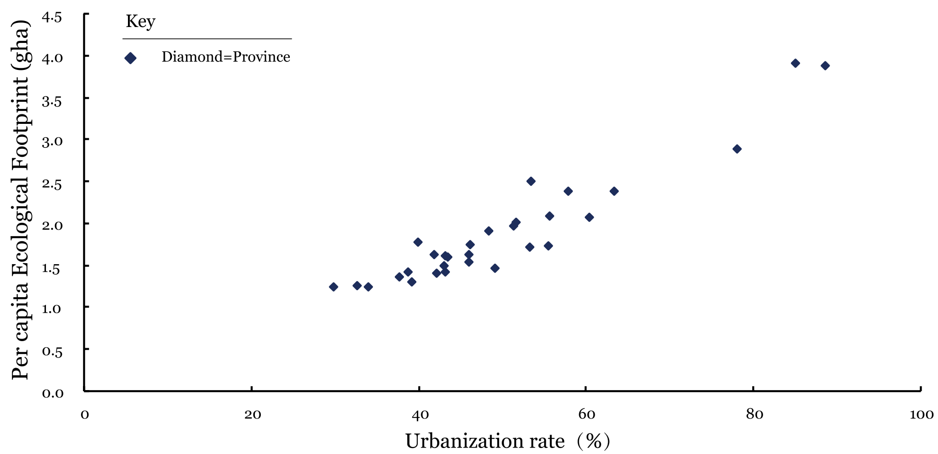


Figure 2.7 per capita Ecological Footprint vs rate of urbanization by mainland province (2009)

Provincial data indicate that there is a general relationship between China's per capita Ecological Footprint and levels of urban development. This suggests that the ongoing process of urbanization will be associated with a further increases in China's Ecological Footprint and biocapacity deficit.

Data source: IGSNRR, 2012

The per capita Ecological Footprint in urban areas is higher than that in rural areas across all mainland provinces in China (Figures 2.8 and 2.9). The difference in carbon footprint gap between urban and rural residents is particularly pronounced and is greater than that of all other footprint components combined.

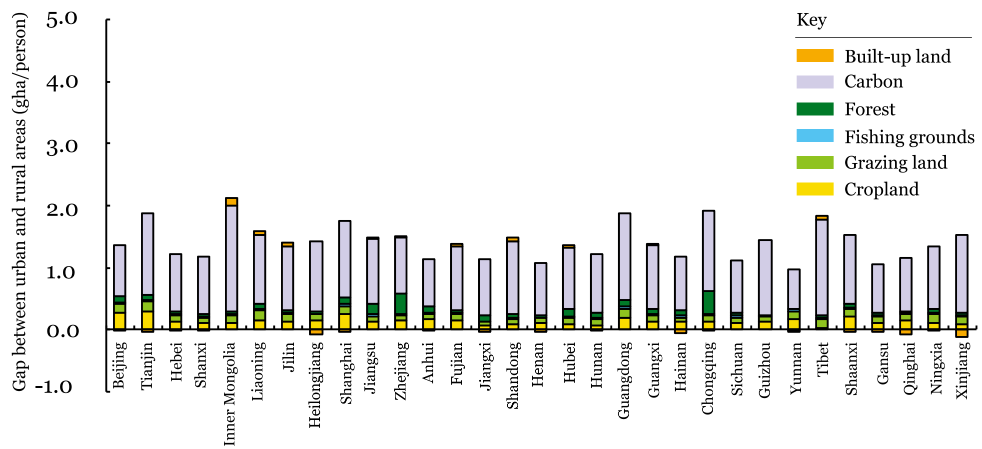


Figure 2.8 Ratio of urban to rural capita Ecological Footprint by mainland province (2009)

The average ratio of urban to rural per capita Ecological Footprint is about two, smaller than the equivalent ratio for income disparity.

Data source: IGSNRR, 2012

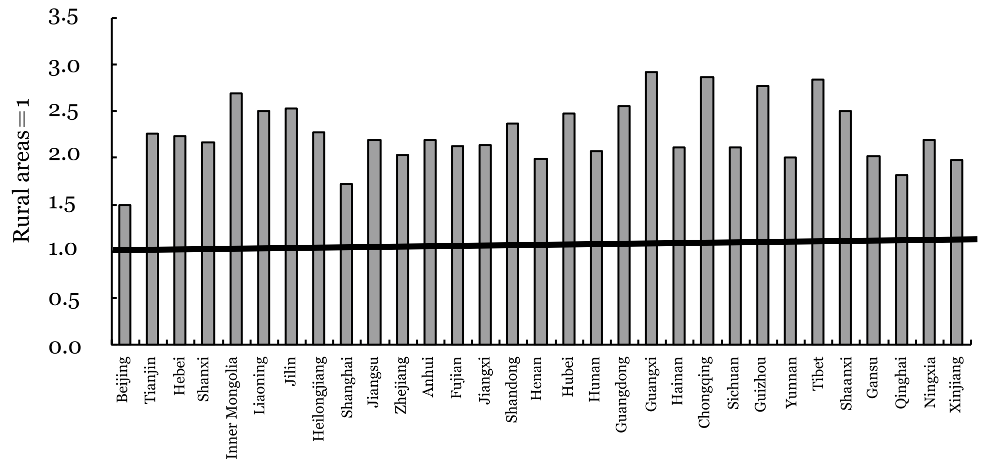


Figure 2.9 Difference in per capita Ecological Footprint between rural and urban residents by mainland province (2009)

The absolute gap in urban-rural per capita Ecological Footprint in most provinces is 1-2 gha.

Data source: IGSNRR, 2012

While China's urbanization process is associated with increasing demand for infrastructure, energy and natural resources and the direct pressures on ecosystems, cities also present an opportunity to promote low footprint lifestyles. For example, the carbon footprint of household energy consumption in Beijing's urban areas is currently lower than that of its rural areas, since urban inhabitants have access to extensive public transportation systems and to central heating systems for their homes. In contrast, rural areas are facing ongoing challenges in view of the energy demands for heating and cooling of individual homes, increasing use of private vehicles, and the difficulty of adequately serving dispersed rural populations through public transportation networks.

Development and Ecological Footprint

Sustainable development can be defined as improving the quality of human life while living within the carrying capacity of supporting ecosystems (IUCN, UNEP & WWF, 1991).

Currently the most widely used indicator for development is the United Nations Development Programme's (UNDP) Human Development Index (HDI). A country or region's progress towards sustainable development process can be assessed through a combined analysis of the HDI and the Ecological Footprint. An HDI value of 0.8 signifies very high human development. At the same time a per capita Ecological Footprint that is lower than global per capita biocapacity can be considered a minimum condition for global sustainability in that it is replicable at the global level. This model suggests that if the HDI of a location is higher than 0.8 and the per capita Ecological Footprint of consumption is lower than global per capita biocapacity of 1.8 gha, then sustainable development is possible.

Figure 2.10 illustrates the relationship between Ecological Footprint and HDI from a global perspective[5]. None of the countries shown in this figure meets minimum criteria for sustainable development.

Figure 2.11 illustrates the relationship between per capita Ecological Footprint and HDI for each of China's mainland provinces in 2009. Beijing, Shanghai and Tianjin are the only areas to have reached high human development, but their per capita Ecological Footprints exceed 1.8 gha. Provinces with a per capita Ecological Footprint that has not yet exceeded the 1.8 gha threshold are well placed to pursue development pathways that can minimise footprint growth while improving human well-being. The challenge is greater for provinces which have already crossed the Footprint threshold for environmental sustainability, but there are still opportunities to slow and reverse growth in per capita footprints by pursuing a green economy.

5 The HDI conceals disparities in human development in individual countries and does not take into account other important variables, such as inequality. Since 2011, inequality has been taken into account in the new Inequality Adjusted Human Development Index or IHDI. HDI is used in this report since the data required to calculate China's IHDI at the provincial level is not yet available.

Figure 2.10 Human Development, Ecological Footprint and China's development trajectory

The red vertical line shows an HDI value of 0.8 which is the threshold for very high human development. The dark green horizontal line shows the global average per capita biocapacity of 1.8 gha in 2008, which is the threshold for a globally sustainable level of consumption; while the light green horizontal line shows that of the 1970 level. Together these lines define the boundaries for sustainable development as represented by the bottom right quadrant in the figure. The blue line in this figure represent China's development trend from 1970 to 2008.

Data source: Global Footprint Network, 2011

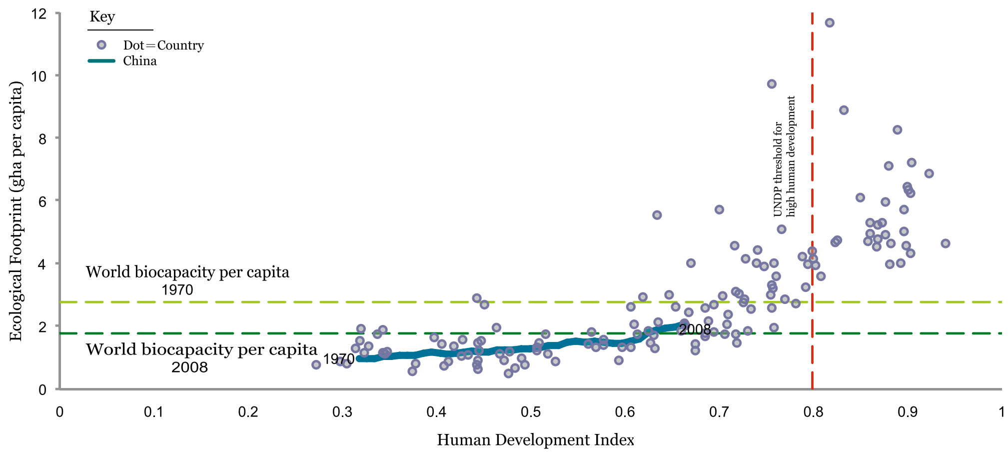
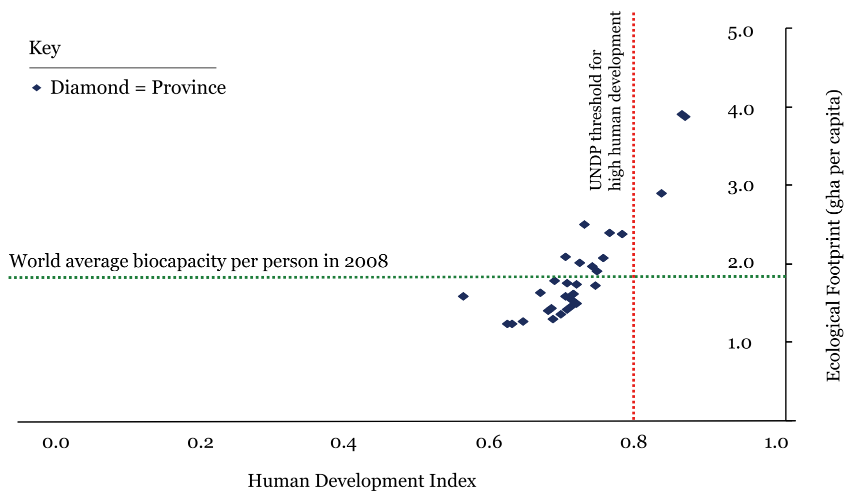


Figure 2.11 Ecological Footprint and HDI by mainland province

The red vertical line shows an HDI value of 0.8 which is the threshold for very high human development. The green horizontal line shows the global average per capita biocapacity of 1.8 gha which is the threshold for a globally sustainable level of consumption. Together these lines define the boundaries for sustainable development as represented by the bottom right quadrant in the figure. At present none of China's provinces meets both criteria for sustainable development.

Data source: IGSNRR, 2012



A detailed analysis of consumption patterns reveals that the consumption of goods and services can be characterised according to development mode (Figure 2.12). Consumption patterns in China can be categorised into three modes: 'developed', 'survival' and 'transition', the latter representing the level between survival and developed. The main contributors to the Ecological Footprint across all three modes are housing and food provision.

The contribution of non-material services (cultural, educational and entertainment activities, health care and public services) shows the largest variation between the modes and comprises a significant proportion of Ecological Footprint in the developed mode. Consumption patterns in Beijing are moving in this direction.

With its Ecological Footprint mainly derived from food, followed by housing, Tibet's consumption patterns can be characterised as survival mode.

The consumption pattern seen in Henan is representative of the transition mode, with an Ecological Footprint primarily derived from demand for housing followed by food. The contribution of services to its Ecological Footprint is relatively low compared to the developed mode while transportation and housing are similar. At present the consumption patterns of most of China's provinces are consistent with the transition mode.

The three modes are associated with differing motivations for the purchase of goods and services. People in survival mode usually consume to secure their basic livelihoods, while those in the transition mode consume for the purpose of upgrading and improving housing quality. People in the developed mode make more use of services and transportation.

This understanding of different needs and motivation in the different development phases as well as an understanding of how these factors may change as provinces develop can help define appropriate policies for managing changing consumption patterns while minimizing growth in footprint.

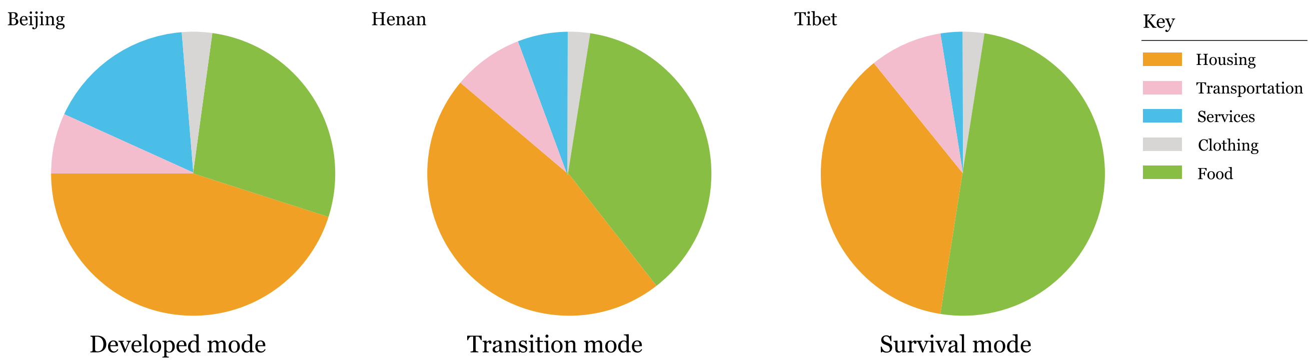


Figure 2.12 Development and consumption modes and the Ecological Footprint

Residential consumption in China can be categorized into five basic activities: food, clothing, housing, transportation and services. Food refers to food consumption by residents; housing includes housing land, household energy and also household facilities and goods purchased for day-to-day living requirements and improvement of living conditions; transport covers direct and indirect transport; services refers to cultural, educational and entertainment activities, health care and public goods.

Data source: IGSNRR, 2012

Chapter Three:

Call for action - Transformation to a Green Economy

China is at a turning point. The choices we make today regarding consumption, production, investment and trade, as well as natural capital, will strongly influence our future. Choosing a sustainable development path will not only benefit China's ecological security and its people's well-being, but will also have an important influence on global sustainable development.

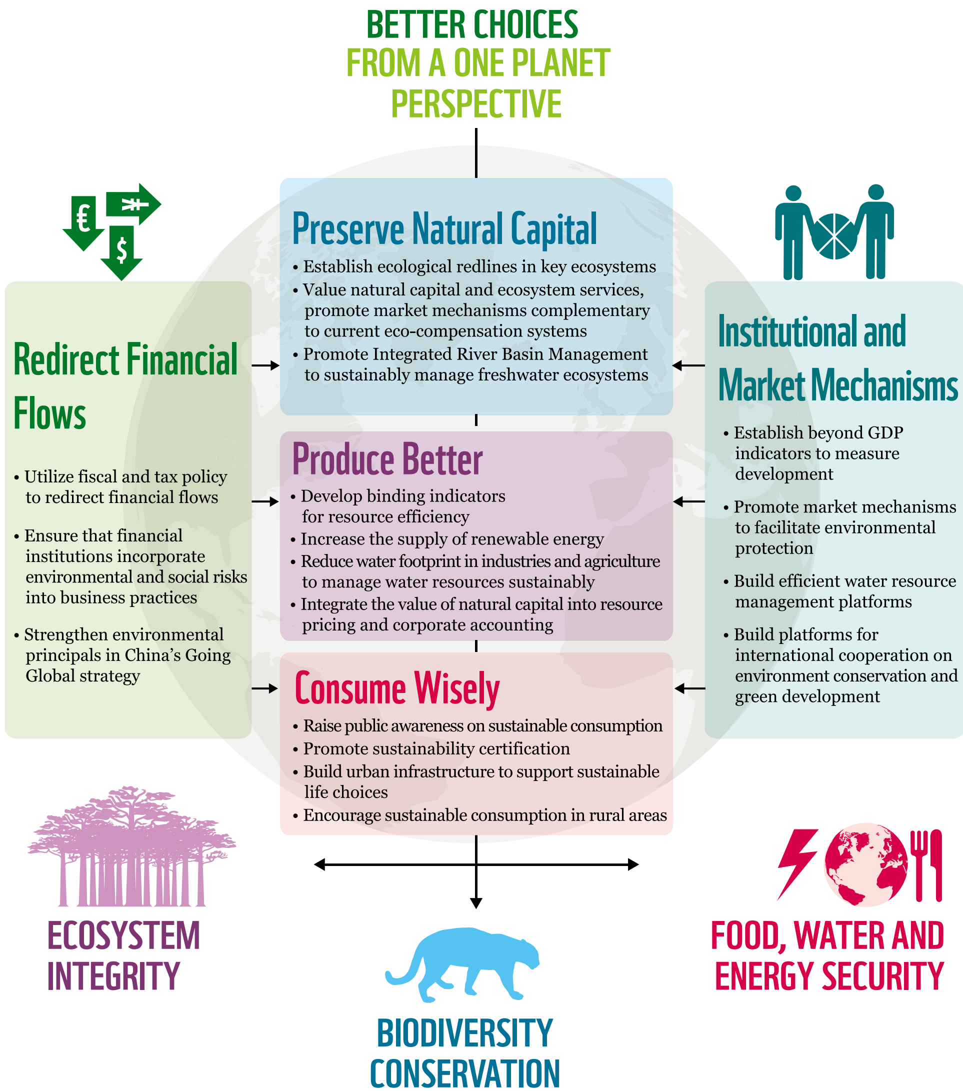


Figure 3.1 Framework for reducing China's Ecological Footprint through development of a green economy

China is undergoing rapid industrialization and urbanization, and is increasingly facing challenges to sustainable development. Other countries have gone through a similar process, but the internal and external context faced by China today is very different to that of previous decades.

Humanity's Ecological Footprint first exceeded the Earth's biocapacity in the 1970s, and since then the planet has been experiencing the effects of an increasing ecological overshoot. The challenge of managing renewable resources sustainably has never been greater and is particularly acute for countries facing resource constraints. China's per capita Ecological Footprint is lower than the global average level, but still amounts to more than twice the per capita biocapacity available within its borders. With its limited ecological assets, China is currently experiencing a biocapacity deficit and serious ecological pressures. China must find a new way to integrate ecological considerations into socio-economic progress, in order to create harmony between humanity and nature.

In order to achieve this, we suggest addressing the following five aspects:

1. Consume wisely: shift consumption patterns towards a sustainable, low footprint model. A new consumption model would emphasize moderation, waste reduction, and the use of resource efficient, environmentally friendly products.

- Raise public awareness of the need for sustainable consumption in order to transform consumer preferences so that they become a driving force for a green economy; the public sector should lead by developing green procurement policies.
- Promote sustainability certification such as the carbon footprint label, FSC[6], MSC[7], etc. Give preferential policies (e.g. taxes, subsidies, etc.) and incentives for consumers to select products with smaller indirect or embodied footprints.
- Lay the foundation for sustainable consumption in urban areas through smart urban planning and infrastructure development, namely by building compact, high density, walkable cities with excellent public transportation systems (e.g.subways, light rail, trains, buses).
- Pay attention to rural consumption trends, including well-coordinated development of urban and rural areas, the provision of proper infrastructure support, and incentives to rural residents towards sustainable consumption patterns.

2. Improve production processes: promote the efficient use of resources and introduce the concept of low footprint into manufacturing and processing.

- Develop binding indicators for resource efficiency.
- Develop renewable energy while increasing energy efficiency. Increase the proportion of renewable energy in the country's total energy mix through a guaranteed price and more ambitious targets.
- Maximize water resource utilization efficiencies and minimize the water footprint in industrial production. Promote sustainable farming, including water saving technologies (e.g. drip and spray irrigation) and appropriate applications of agricultural chemicals and fertilizers.
- Integrate the value of natural capital and ecosystem services into the pricing of natural resources and corporate accounting systems.

6 Forest Stewardship Council.

7 Marine Stewardship Council.

3. Preserve natural capital: leave space for nature while maintaining and supporting biocapacity and meeting human needs.

- Improve zoning systems to conserve ecosystems; establish ecological redlines[8] in key ecosystems.
- Recognize and assess the value of natural capital and ecosystem services and promote market mechanisms that are complementary to the current eco-compensation systems in China.
- Promote Integrated River Basin Management, including connectivity of riverine and lake systems, equitable water allocation, effective flood and drought management, sustainable hydropower and river restoration to conserve freshwater ecosystems.

4. Redirect financial flows: promote green finance and investment, leverage financial resources to support conservation, sustainable resource management and innovation.

- Utilize fiscal and tax policy to redirect financial flows to resource efficient and environmentally friendly industries, while discriminating against industries that have negative environmental impacts.
- Ensure that banks and other financial institutions incorporate environmental and social risks into their loan assessment processes based on the Green Credit Guidelines published by the China Banking Regulatory Commission in February 2012.
  - Develop sectoral lending guidelines for different industries.
  - Increase loans to projects or businesses in renewable energy, energy efficiency, and resource efficient industries, while restricting loans to industries and businesses with negative environmental impacts.
  - Strengthen the supervision of green credit through establishing an evaluation and monitoring system while supporting capacity building.
- International financial flows from China should become an important driving force in global conservation and sustainable resource management. Environmental standards should be further integrated into China's Going Global strategy.

5. Utilize institutional and market mechanisms to promote ecological progress.

- Establish an indicator system that goes Beyond GDP and integrates economic, social and environmental aspects to measure progress on development; use Ecological Footprint and biocapacity as indicators to measure ecological progress.
- Promote market mechanisms to facilitate environmental protection, including payments for ecosystem services, carbon emissions trading and water rights trading.
- Build efficient water resource management platforms, increase stakeholder participation, and establish an effective social mechanism to cope with water catchment risks.
- Enhance domestic and international cooperation in environmental protection, so as to promote the development of partnerships and the sharing of experiences, resources and knowledge.

8 The ecological redline indicates areas that the Chinese government considers to be key ecological function areas, or marine or terrestrial areas that are considered sensitive. This concept was introduced in May 2012 by the Ministry of Environmental Protection, and these 'redline' areas will see limited development and increased environmental protection. These redline areas will also be taken into account when policies, procedures and standards are established for neighboring regions.

ANNEX 1 TECHNICAL QUESTIONS

FREQUENTLY ASKED QUESTIONS

1.How is the Ecological Footprint calculated?

The Ecological Footprint measures the amount of biologically productive land and water area required to produce the resources an individual, population or activity consumes and to absorb the waste it generates, given prevailing technology and resource management. This area is expressed in global hectares (hectares with world average biological productivity). Footprint calculations use yield factors to normalize countries' biological productivity to world averages (e.g., comparing tonnes of wheat per UK hectare versus per world average hectare) and equivalence factors to take into account differences in world average productivity among land types (e.g., world average forest versus world average cropland).

A detailed methods paper and copies of sample calculation sheets can be obtained from www.footprintnetwork.org

2.What is included in the Ecological Footprint? What is excluded?

To avoid exaggerating human demand on nature, the Ecological Footprint includes only those aspects of resource consumption and waste production for which the Earth has regenerative capacity, and where data exists that allow this demand to be expressed in terms of productive area. For example, toxic releases are not accounted for in Ecological Footprint accounts. Nor are freshwater withdrawals, although the energy used to pump or treat water is included.

Ecological Footprint accounts provide snapshots of past resource demand and availability. They do not predict the future. Thus, while the Footprint does not estimate future losses caused by current degradation of ecosystems, if this degradation persists it may be reflected in future accounts as a reduction in biocapacity.

Footprint accounts also do not indicate the intensity with which a biologically productive area is being used. Being a biophysical measure, it also does not evaluate the essential social and economic dimensions of sustainability.

3. What is the data source of Ecological Footprint?

In this report, Ecological Footprint and biocapacity results are presented based on the National Footprint Accounts (conducted by GFN) as well as analysis conducted by IGSNRR. The National Footprint Accounts are based mostly on United Nations datasets and reported at the national level. IGSNRR results are based on datasets from the National Bureau of Statistics in China and include sub-national results by urban and rural populations. All Ecological Footprint and biocapacity results are expressed in units of global average bioproductive hectares (global hectares). In this report, all the global data is updated to 2008, while all the Chinese provincial level data is updated to 2009.

4.How does the Ecological Footprint account for the use of fossil fuels?

Fossil fuels such as coal, oil and natural gas are extracted from the Earth's crust and are not renewable in ecological time spans. When these fuels burn, carbon dioxide (CO_2) is emitted into the atmosphere. There are two ways in which this CO_2 can be stored: human technological sequestration of these emissions, such as deep-well injection, or natural sequestration. Natural sequestration occurs when ecosystems absorb CO_2 and store it either in standing biomass, such as trees, or in soil.

The Carbon footprint is calculated by estimating how much natural sequestration would be necessary to maintain a constant concentration of CO_2 in the atmosphere. After subtracting the amount of CO_2 absorbed by the oceans, Ecological Footprint accounts calculate the area required to absorb and retain the remaining carbon based on the average sequestration rate of the world's forests. CO_2 sequestered by artificial means would also be subtracted from the Ecological Footprint total, but at present this quantity is negligible. In 2008, 1 global hectare could absorb the CO_2 released by burning approximately 1,450 litres of gasoline.

Expressing CO_2 emissions in terms of an equivalent bioproductive area does not imply that carbon sequestration in biomass is the key to resolving global climate change. On the contrary, it shows that the biosphere has insufficient capacity to offset current rates of anthropogenic CO_2 emissions. The contribution of CO_2 emissions to the total Ecological Footprint is based on an estimate of world average forest yields. This sequestration capacity may change over time. As forests mature, their CO_2 sequestration rates tend to decline. If these forests are degraded or cleared, they may become net emitters of CO_2.

Carbon emissions from some sources other than fossil fuel combustion are incorporated in the National Footprint Accounts at the global level. These include fugitive emissions from the flaring of gas in oil and natural gas production, carbon released by chemical reactions in cement production and emissions from tropical forest fires.

5. Does the Ecological Footprint say what is a "fair" or "equitable" use of resources?

The Footprint documents what has happened in the past. It can quantitatively describe the ecological resources used by an individual or a population, but it does not prescribe what they should be using. Resource allocation is a policy issue, based on societal beliefs about what is or is not equitable. While Footprint accounting can determine the average biocapacity that is available per person, it does not stipulate how this biocapacity should be allocated among individuals or countries. However, it does provide a context for such discussions.

6. What is Water Footprint?

Water Footprint (WF) of a country or region shows the total volume of water directly or indirectly used to produce the goods and services consumed by inhabitants there. Water footprint consists of two parts: the internal and the external.

The Water Footprint can be considered from the perspective of production or consumption. The Water Footprint of production of a country or a region is the volume of freshwater used to produce goods and services within a given area, irrespective of where those goods and services are consumed.

The Water Footprint of Consumption of a region is the volume of water used in the production of goods and services that are consumed by the residents of that region, irrespective of where the goods and services are produced.

Water stress can be defined as the proportion of renewable surface water and underground water that is consumed by households, industry and agriculture in a given country or a region on a year round basis.

7. What is the methodology of Water Footprint?

The unit of cubic meters is used to express Water Footprint. Water Footprint classification and accounts are generally consistent with those reported in the WWF Living Planet Report. The Water Footprint calculations are based on the Food and Agriculture Organization datasets.

8. What is the Living Planet Index?

The Living Planet Index (LPI) is an indicator of the state of global biological diversity, which is calculated basing on trends in vertebrate populations of species from around the world (WWF, 2010).

The 2012 LPI is based on trends in 9014 populations of 2688 species of mammal, bird, reptile, amphibian and fish from around the globe.

LPI can be used in different scales from global level, to national level, regional level and so on. A national or regional LPI is of great use at national scale for tracking progress towards different biodiversity targets, and for assessing the long-term effectiveness of conservation actions and policies (BIP, WWF and ZSL 2008) .

9. How is the Living Planet Index calculated?

The data used in constructing the global LPI are time series of either population size, density, abundance or a proxy of abundance. To set up a LPI, the first step is to calculate the annual rate of change in the population of each species based on databases. The index then calculates the average changes across all populations for each year from 1970, when data collection began, to the latest data for which data is available (Collen et al., 2009; ZSL,WWF,2012).

10. Where do the data in China's LPI Database come from?

All data in the database are vertebrate population time series of either population size, density, abundance or capture rate. The population information were collected from published scientific literatures, monographs, government reports, investigative reports of conservation zones, and records of species distribution and population numbers issued by authorities. Only those species with time-series information data (a measure of population size that is available for at least two years) are included, and information available on the data collection method, as well as the unit of measurement. All data in the same population time series must be collected using the same method, and the data source referenced and traceable (WWF et al., 2012). The dataset also includes all the species' biological, ecological and conservation information (taxa, geographic coordinates, habitat types, population dynamics, conservation measures, references, etc.).

11. The quality of the data in the China's LPI Database

To assess the quality of the data, a score was generated for each time series by: type of source (3, journal article; 2, government report or secondary source; 1, expert judgement or unpublished report; 0, un-known), type of method (3, full population count, index, density measure, or measure per unit effort; 2, estimate; 1, proxy; 0, unknown), and whether or not a measure of variation was calculated (1, yes; 0, no) (Collen et al, 2009). 91.53% of the 1417 times series scored between 6-7, which were considered high quality (Collen et al, 2009).

12. How is the Trend Index for selected flagship and keystone species calculated?

There are more than one population time series for most of the species. Firstly, for each population, the rate of change from one year to the next is calculated, annual data points were interpolated for time series with less than six data points, and for those longer time series generalized additive modelling was used to fit a curve through the data points. Secondly, the average rate of change across all of the populations for a single species is calculated for each year (Collen et al, 2009, WWF et al., 2010, 2012). In our case studies, we only used GAM model in three species with continuous monitoring records: Pere David's deer, Qinghai lake naked carp and Crested Ibis.

ANNEX 2 GLOSSARY OF TERMS

Ecological Footprint	A measure of how much biologically productive land and water an individual, population or activity requires to produce all the resources it consumes, and to absorb the waste it generates, using prevailing technology and resource management practices. The Ecological Footprint is usually measured in global hectares. Because trade is global, an individual or country's Footprint includes land or sea from all over the world. Ecological Footprint is often referred to in short form as Footprint (Global Footprint Network, 2012).
Carbon footprint	The demand on biocapacity required to sequester (through photosynthesis) the carbon dioxide (CO_2) emissions from fossil fuel combustion. Although fossil fuels are extracted from the Earth's crust and are not regenerated in human time scales, their use demands ecological services if the resultant CO_2 is not to accumulate in the atmosphere. The Ecological Footprint therefore includes the biocapacity, typically that of unharvested forests, needed to absorb that fraction of fossil CO_2 that is not absorbed by the ocean (Global Footprint Network, 2012). There are several calculators that use the phrase "Carbon Footprint", but many just calculate tonnes of carbon, or tonnes of carbon per Euro, rather than demand on bioproductive area.
Biocapacity	The capacity of ecosystems to produce useful biological materials and to absorb waste materials generated by humans, using current management schemes and extraction technologies. Biocapacity is measured in global hectares (Global Footprint Network, 2012).
Biocapacity deficit/surplus	The difference between the biocapacity and Ecological Footprint of a region or country. A biocapacity deficit occurs when the Footprint of a population exceeds the biocapacity of the area available to that population. Conversely, a biocapacity surplus exists when the biocapacity of a region exceeds its population's Footprint.
Water Footprint	The Water Footprint of an individual, community or business is defined as the total volume of freshwater that is used to produce the goods and services consumed by the individual or community, or produced by the business. The Water Footprint of a nation is defined as the total amount of water that is used to produce the goods and services consumed by the inhabitants of the nation.
Green Water Footprint	Green water footprint is the volume of rainwater that is taken up by crops from the soil and subsequently evaporated;
Blue Water Footprint	Blue water footprint is the combined volume of surface and underground water used in households, agriculture and during the production of goods.
Gray Water Footprint	Grey water footprint is the volume of water required to dilute water pollutants to such an extent that the quality of ambient water remains above designated quality standards.
Water Footprint of Production	The Water Footprint of production of a country or a region is the volume of freshwater used to produce goods and services within a given area, irrespective of where those goods and services are consumed.
Water Footprint of Consumption	The Water Footprint of Consumption of a region is the volume of water used in the production of goods and services that are consumed by the residents of that region, irrespective of where the goods and services are produced.
Water stress	Water stress can be defined as the proportion of renewable surface water and underground water that is consumed by households, industry and agriculture in a given country or a region on a year round basis.
LPI	The LPI-Living Planet Index- reflects changes in the health of the planet's ecosystems by tracking trends in a large number of populations of vertebrate species. Much as a stock market index tracks the value of a set of shares over time as the sum of its daily change, the LPI first calculates the annual rate of change for each species' population in the dataset. (see annex1 for more details.)
HDI	The HDI – Human Development Index – is a summary composite index that measures a country's average achievements in three basic aspects of human development: health, knowledge and a decent standard of living. The HDI contains three components: 1. Health: Life expectancy at birth (number of years a newborn infant would live if prevailing patterns of mortality at the time of birth were to stay the same throughout the child's life). 2. Knowledge: A combination of the adult literacy rate and the combined primary, secondary and tertiary gross enrollment ratio. 3. Standard of living: GDP per capita (PPP US$). (Source: Human Development Report webpage).

ANNEX 3 REFERENCES

Ben Collen, Jonathan Loh, Sarah Whitmee, Luouise Mcrae, Rajan Ammin and Jonathan E. M. Baillie. 2008. Monitoring change in vertebrate abundance: the Living Planet Index. Conservation Biology, 23(2), 317-327.

Galli, A., Kitzes, J., Wermer, P.,Wackernagel, M., Niccolucci, V. and Tiezzi, E. 2007. An exploration of the mathematics behind the Ecological Footprint. International Journal of Ecodynamics. 2 (4): 250-257.

Hoekstra, A.Y. and Mekonnen, M.M. 2012. The Water Footprint of humanity. PNAS, published ahead of print February 13, 2012, doi:10.1073/pnas.1109936109.

IUCN, UNEP, WWF. 1991. Caring for the Earth: A Strategy for Sustainable Living. IUCN, Gland, Switzerland.

Kitzes, J., Galli, A., Bagliani, M., Barrett, J., Dige, G., Ede, S., Erb, K.-H., 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. 68 (7): 1991-2007.

Louise McRae, Christoph Zöckler, Michael Gill, Jonathan Loh, Julia Latham, Nicola Harrison, Jenny Martin and Ben Collen. 2010. Arctic Species Trend Index 2010: Tracking Trends in Arctic Wildlife. http://www.arcticbiodiversity.is/index.php/en/the-report

Pomeroy, D., Lutaaya, B., and Tushabe, H. 2006. State of Uganda's Biodiversity 2006. National Biodiversity Databank and Makerere University Institute of Environment and Natural Resources, Kampala, Uganda. http://nbdb.mak.ac.ug/Products/BiodiversityMonitoring2006.pdf

Wackernagel, M., Schulz, N.B., Deumling, D., Linares, A.C., Jenkins, M., Kapos, V., Monfreda, C., Loh, J., Myers, N., Norgaard, R. and Randers, J. 2002. Tracking the ecological overshoot of the human economy. PNAS. 99: 9266–9271.

WWF, GFN, ZSL. 2010. Living Planet Report 2010- Biodiversity, biocapacity and development, 100-101. http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/living_planet_report_timeline/2010_lpr2/

WWF, GFN, ZSL. 2012. Living Planet Report 2012- Biodiversity, biocapacity and better choices, 18-22. http://wwf.panda.org/about_our_earth/all_publications/living_planet_report/

WWF, ZSL & Global Footprint Network 2007. Canadian Living Planet Report 2007. http://assets.wwf.ca/downloads/canadianlivingplanetreport2007.pdf

With Special thanks for review and contributions from:

Xia Guang, Pan Jiahua, Li Zuojun, Li Yonghong, Zhu Dajian, Liu Junguo, Wang Wenyuan, Zhang Jianping, Huang Miao, Yu Hai, Li Jianquan, Li Haiying, Zhang Gengtian, Lei Hongpeng, Wang Qiang, Jonathan Loh, Louise McRea, Mathis Wackernagel, Pati Poblete, David Moore, Juan Carlos Morales, Kyle Gracey, Leena Launay, Gemma Cranston, Stephanie Lai, Monique Grooten, Natasya Oerlemans, Li Lifeng, Richard McLellan, Carina Borgstrom-Hansson, Li Nan (Market Transformation Initiative) , Zhu Jiang, Lei Gang, Donald Pols, Sun Yiting, Li Nan (China for a Global Shift) , Wang Songlin, Zeng Ming, Dong Le, Feng Jinlei, Wang Lei, Liu Yifeng, Wei Yu, Li Suxiao, Zhang Cheng, Gao Ying, Guo Lina

Special thanks to WWF-Netherlands for financial support.

Front cover image: Fisherman in Dongting Lake using traditional fishing methods after the introduction of co-management © WEI BAOYU/WWF China

China Ecological Footprint Report 2012

Water

Promote integrated river basin management, build multi-stakeholder water resource management mechanisms and sustainably manage freshwater ecosystems.

Ecological Footprint and Biocapacity

China's per capita Ecological Footprint, although lower than world average level, has already surpassed global per capita biocapacity and is over two times its own biocapacity.

Biodiversity

Establish China Living Planet Index to provide reference to conservation policy making.

Green Development

Conserve natural capital, consume wisely, produce better and redirect financial flows.

100% RECYCLED

WWF® • China Ecological Footprint Report 2012

CHINA

WWW.WWFCHINA .ORG

WWF®

Why we are here.
To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

www.wwfchina.org