

What Is Natural Capital?

In the following section, a foundational explanation of natural capital is provided in order to form the basis of the final three analyses of this report.

Economies depend upon four key types of capital: built, natural, financial, and human. Built capital consists of cars, houses, machinery, software, and the “tangible systems that humans design, build and use for productive purposes.”⁴¹ All built capital is created from natural capital, which is composed of energy and materials from nature. Natural capital consists of the “minerals, energy, plants, animals, ecosystems, (climatic processes, nutrient cycles and other natural structures and systems) found on Earth that provide a flow of natural goods and services.”⁴² Financial capital consists of the stocks, bonds, equity, collateral, currency, precious metals, paper and electronic currency that people accept as holding exchange value. Human capital consists of people, their education, health, skills, labor, knowledge, and talents.⁴³

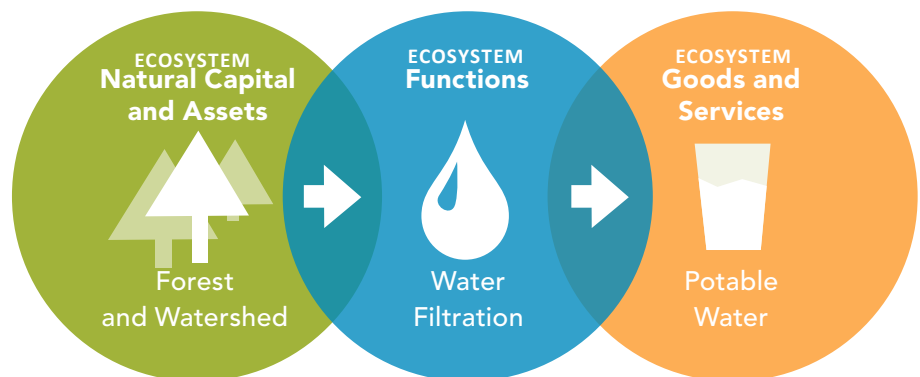
Ecosystem goods and services are the benefits that people derive from nature.

Like any form of capital, natural capital provides a flow of goods and services. These ecosystem goods and services are the benefits that people derive from nature. In other words, the infrastructure and assets (e.g., forests and watersheds) of any given ecosystem perform natural functions (such as intercepting rainfall and filtering water) that provide goods and services that humans need to survive (e.g., a clean water supply and reduction of peak flood flows downstream).

Most of these goods and services are largely taken for granted. Breathable air, drinkable water, nourishing food, flood risk reduction, waste treatment, and stable atmospheric conditions are all prime examples of underappreciated ecosystem goods and services.

► **Figure 5.**

The Link between Natural Capital and Functions and the Provision of Ecosystem Goods and Services



Natural capital performs a wide range of functions that are critical to human health and well-being. Without natural capital, we would not have the benefit of its service. Figure 3 illustrates the relationship between natural capital and the production of ecosystem services.

The Importance of Valuing Ecosystem Services and Accounting for Natural Capital

The benefits of ecosystem goods and services are similar to the benefits typically valued in the economy, such as the services and outputs of skilled workers, buildings and infrastructure.

Understanding and accounting for the value of natural capital assets and the ecosystem services they provide can reveal the economic benefits of investment in natural capital. Throughout economic history, new means of measuring economic contributing factors has been necessary. In 1930, all nations lacked measures of Gross Domestic Product (GDP), unemployment, inflation, consumer spending, and money supply. Benefit-Cost Analysis and rate of return calculations were initiated after the 1930s to examine and compare government investments in built capital assets such as roads, power plants, factories, and dams. Private companies have relied on increasingly sophisticated approaches to calculating the expected rate of return on investments (ROI). As these examples demonstrate, decision-makers, both private and public, were investment blind without the basic economic measures and tools which are now widely accepted and expected in guiding the vast scale of investment in today's economy. It is high time that valuation of natural capital assets and ecosystem services because a part of investment planning.

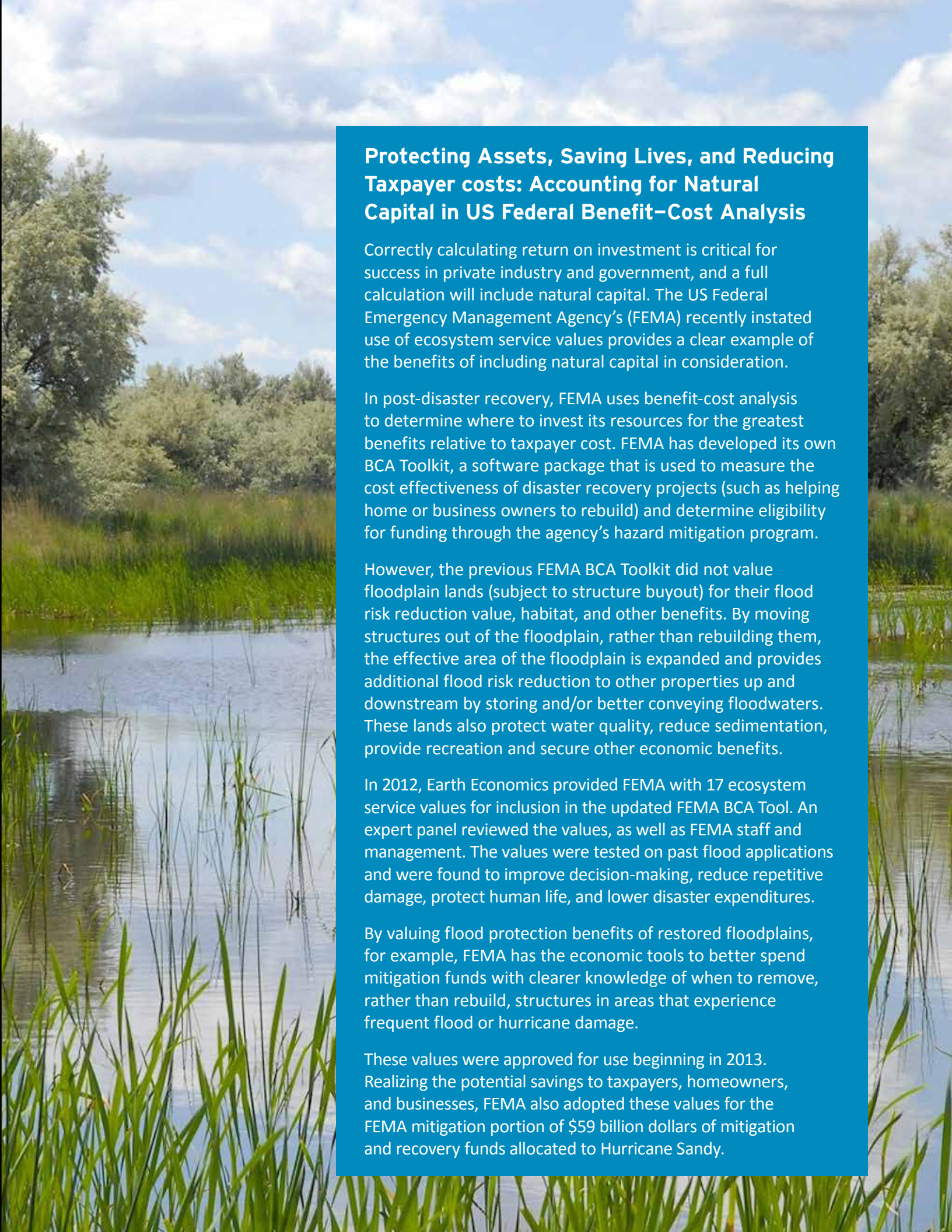
The benefits of ecosystem goods and services are similar to the economic benefits typically valued in the economy, such as the services and outputs of skilled workers, buildings and infrastructure. Many ecosystem goods such as fish, fruit and water are already valued and sold in markets. Some ecosystem services, however, are not amenable to markets and have not been traditionally valued, even though they provide vast economic value. Flood protection and climate stability are prime examples of ecosystem services that provide vast value and yet go largely unvalued within traditional accounting. To illustrate, when the flood protection services of a watershed are lost, economic damages from floods can include job losses, infrastructure repairs, reconstruction and restoration costs, property damages and deaths. Conversely, when investments are made to protect and support these services, local economies are more stable and less prone to the sudden need for burdensome expenditures on disaster mitigation. In addition to the economic value associated with these avoided costs, natural capital such as healthy watersheds provides a

myriad of other services, including water supply, carbon sequestration, water filtration, biodiversity and more. All ecosystem services provide additive economic value locally, regionally and globally.

Today, there are now economic methods available to quantify and value natural capital and many non-market ecosystem services. When valued in dollars, these services can be incorporated into a number of economic tools, including benefit-cost analysis, accounting, environmental impact statements, asset management plans, and rate of return on investment calculations. Their inclusion ultimately strengthens decision-making. When natural capital assets and ecosystem services are not considered in economic analysis, they are effectively valued at zero. This omission can lead to poor decisions, inefficient capital investments, higher incurred costs, and losses due to unexpected events.

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Ecosystem goods and services flow from natural capital and provide direct economic benefits to people from a range of terrestrial and marine ecosystems. As such, ecosystem services and natural capital accounting are inherently related to people. However, due to the remote nature of deep seabed mining, far fewer ecosystem goods and services, and ultimately people, are impacted. For example, there is no surface or groundwater freshwater contamination at the mine site in Solwara 1 (discussed further in Analysis II). This is remarkable, if not unprecedented, in the history of copper mining, and it removes a major environmental impact from the mining process. The mine site itself is unaffected by surface and groundwater contamination, but damage to surface and groundwater can still take place later on in the process as the ore is concentrated and refined at the smelting site.



Protecting Assets, Saving Lives, and Reducing Taxpayer costs: Accounting for Natural Capital in US Federal Benefit–Cost Analysis

Correctly calculating return on investment is critical for success in private industry and government, and a full calculation will include natural capital. The US Federal Emergency Management Agency's (FEMA) recently instated use of ecosystem service values provides a clear example of the benefits of including natural capital in consideration.

In post-disaster recovery, FEMA uses benefit-cost analysis to determine where to invest its resources for the greatest benefits relative to taxpayer cost. FEMA has developed its own BCA Toolkit, a software package that is used to measure the cost effectiveness of disaster recovery projects (such as helping home or business owners to rebuild) and determine eligibility for funding through the agency's hazard mitigation program.

However, the previous FEMA BCA Toolkit did not value floodplain lands (subject to structure buyout) for their flood risk reduction value, habitat, and other benefits. By moving structures out of the floodplain, rather than rebuilding them, the effective area of the floodplain is expanded and provides additional flood risk reduction to other properties up and downstream by storing and/or better conveying floodwaters. These lands also protect water quality, reduce sedimentation, provide recreation and secure other economic benefits.

In 2012, Earth Economics provided FEMA with 17 ecosystem service values for inclusion in the updated FEMA BCA Tool. An expert panel reviewed the values, as well as FEMA staff and management. The values were tested on past flood applications and were found to improve decision-making, reduce repetitive damage, protect human life, and lower disaster expenditures.

By valuing flood protection benefits of restored floodplains, for example, FEMA has the economic tools to better spend mitigation funds with clearer knowledge of when to remove, rather than rebuild, structures in areas that experience frequent flood or hurricane damage.

These values were approved for use beginning in 2013. Realizing the potential savings to taxpayers, homeowners, and businesses, FEMA also adopted these values for the FEMA mitigation portion of \$59 billion dollars of mitigation and recovery funds allocated to Hurricane Sandy.