DASOS HABITAT FOUNDATION

INVESTING IN BIOLOGICAL HABITAT AND BIODIVERSITY

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MESSAGE FROM DASOS CAPITAL

We have been happy to read the recent news about the recovery of white-tailed eagle. This very large sea-eagle underwent dramatic declines and became extinct in many regions of western, central and southern Europe by the 1970s. After decades of intensive conservation action, the white-tailed eagle population has recovered steadily and it has today re-colonized several traditional breeding areas in Europe. The increase of the population is notable especially in the shores of Gulf of Finland, Gulf of Bothnia, Scotland and Ireland.

Although a story of ultimate success, the rollercoaster type of history of the white-tailed eagle population provides a typical example of the failure of our economic system to internalize changes in natural capital and biological habitat. The history has been frequently repeated. Some 150 years ago, the trend of rapid deforestation and forest degradation was widespread in Europe whereas over the past decades the European forest resources have grown substantially. Currently, it is understood that wood prices form a strong incentive for sustainable forest management and investment. Flourishing silviculture operations only appear in the context of dynamic and transparent markets for wood. Robust market expectations allow forest management decision making based on discounting periods and time horizons ranging over decades to the future. In contrast, the causes for deforestation and forest degradation are frequently found in market and/or policy failures resulting in reduced stumpage values, and effectively in poor return on forestry investments, especially when compared to some alternative land uses.

While the property rights for forestland are typically well established in Europe, the forest related ecosystem services are not symmetrically priced. A market price is virtually existing only for timber. The tragedy of biodiversity and other ecosystem services has largely been related to the fact that such non-market products remain unrecognized by the price mechanism.

To some extent forest ecosystem services are generated through a case of joint production. For example, a larger forest resource is not only an indication for increased wood availability but also a greater carbon storage service. However, in some cases the price system should guide the forest owner to produce biodiversity services rather than timber. Correct and available pricing for all ecosystem services, not only timber, would allocate the management effort by the forest owner to produce a full range of ecosystem services in appropriate balance and magnitudes.

This report reviews the nature of biological habitat and proposes means to encourage and incentivize the production of a wider portfolio of ecosystem services. The focus is in the attributes facilitating biological habitat and biodiversity as an investable asset class. Ultimately, we need instruments to invest in the conservation of such species as white-tailed eagle.

18 January 2017

Olli Haltia
Dasos Capital Oy

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IMPORTANT INFORMATION

Dasos Capital Oy has prepared this report to provide information on the investment opportunities related to ecosystem services. We have based this document on information obtained from sources it believes to be reliable but which may contain errors and omissions since they have not been always independently verified. All charts and graphs are proprietary data or from publicly available sources. Dasos Capital Oy makes no representation or warranty (express or implied) of any nature, or accept any responsibility or liability of any kind for the accuracy or sufficiency of any information, statement, assumption or projection in this document, or for any loss or damage (whether direct, indirect, consequential or other) arising out of reliance upon this document.

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DASOS CAPITAL OY

Dasos Capital Oy is an Investment Advisory and Fund Management Company located in Helsinki, Finland providing timberland investment advisory services to institutional investors, foundations, endowments, family offices and private equity clients. Dasos acts as an investment advisor for Dasos Timberland Fund I and II, FS Partnership and the Foraois Limited Partnership, which are private equity funds specialized in sustainable timberland investments in Europe and emerging markets.

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ABBREVIATIONS AND ACRONYMS

AFOLU	Agriculture, Forestry and Other Land Uses
ATFS	American Tree Farm System
BBOP	Business and Biodiversity Offsets Programme
CAP	Common Agricultural Policy
CIFOR	Center for International Forestry Research
CO_2	Carbon dioxide
CSA	Canadian Standards Association
DFI	Development Finance Institution
EC	European Commission
EFI	European Forest Institute
EIB	European Investment Bank
EIP	Ecosystem Investment Partners
ESG	Environmental, social and governance
ETS	European Emissions Trading System
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment (FAO)
FSC	Forest Stewardship Council
GDP	Gross domestic product
GHG	Greenhouse gas
GNP	Gross National Product
ICMM	International Council on Mining and Metals
IEEP	The Institute for European Environmental Policy
LPI	Living Planet Index
METSO	The Southern Finland Forest Biodiversity Programme
MTCS	Malaysian Timber Certification Scheme
MTK	The Central Union of Agricultural Producers and Forest Owners (Finland)
MUSD	Million United States dollars
NCD	Natural Capital Declaration
NCFF	Natural Capital Financing Facility
OECD	Organisation for Economic Cooperation and Development
PEFC	Programme for the Endorsement of Forest Certification
PES	Payments for environmental/ecosystem services
REDD	Reducing emissions from deforestation and forest degradation
SEA	Strategic Environmental Assessment
SFI	Sustainable Forestry Initiative Inc.
Sitra	Finnish Innovation Fund
SRI	Socially responsible investing
T	Ton
TEEB	The Economics of Ecosystems and Biodiversity
UK	The United Kingdom
UNFCCC	The United Nations Framework Convention on Climate Change
US	The United States
USA	The United States of America
USD	United States Dollar
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute
WTTC	World Travel and Tourism Council
WF	Worldwide Fund for Nature

A NEW ROLE FOR FORESTS: FROM FORESTS AND TIMBER TO BIODIVERSITY AND ECOSYSTEM SERVICES

Natural Capital and Ecosystem Services as Business Opportunity and Source of Risk

Human welfare across the globe ultimately depends on goods and services provided, and replenished by the natural environment, natural capital. Natural capital is another term for the stock of renewable and non-renewable resources, such as forests, air, water, soils, and minerals that yield a flow of benefits to people (Figure 1). The benefits provided by natural capital include raw materials (wood, non-wood forest products) we use in the creation of products, clean air, food, water for various uses, energy, medicine, and important benefits, such as flood and climate regulation, and, e.g., a natural environment for recreation.

Natural capital is the most fundamental form of capital since it provides the basic conditions for human existence. It sets the ecological limits for our socio-economic systems, and maintains financial, manufactured and social capital which require continuous flows of material inputs and ecosystem services. The number and variety of plants, animals and other organisms that exist is known as biodiversity. Biodiversity is integral to sustainable ecosystem functions and, therefore, vital for the availability of ecosystem services, from tourism to timber or non-timber products.

Figure 1 Natural Capital and Ecosystem Services

The Millennium Ecosystem Assessment (2005) defines four categories of ecosystem services:

- *Provisioning services*: Involve the production of renewable resources. The goods or products obtained from ecosystems, such as raw materials (wood), food, freshwater, medicinal resources, and genetic resources.
- *Regulating services:* The benefits obtained from an ecosystem's control of natural processes such as carbon sequestration and storage, erosion prevention and soil fertility, water flows, pollination and biological control, as well as protection from natural hazards, such as floods.
- *Cultural services:* Represent human value and enjoyment. The non-material benefits obtained from ecosystems such as outdoor recreation, nature-based tourism, spiritual values, and aesthetic enjoyment of e.g. forest landscapes.
- *Supporting services:* The natural processes, such as nutrient cycling and primary production that maintain the other services.

Beneficiaries of these services can be at the local, regional, and/or global scale, and include current and future generations. For instance, a forest may provide wood to a sawmill or a pulp mill while providing berries, mushroom, wild food, natural fibers, and fuelwood to local people. At a regional level, it may be part of a watershed preventing landslides, filtering water, and offering outdoor recreation services. At a global level, this forest can provide carbon sequestration and biodiversity services.

The value that nature provides to revenue-generating activities depends on the stocks and flows, and the quality of ecosystem goods and services available. Over-exploitation resulting in deforestation, forest degradation, pollution and environmental damage are undermining the earth's long-term capacity to deliver the ecosystem services and stable environmental conditions required to sustain economic activities and welfare of a growing world population. A major report Global Biodiversity Outlook finds that reducing deforestation rates have been estimated to result in an annual benefit of United States dollar (USD) 183 billion in the form of ecosystem services (Secretariat of the Convention on Biological Diversity 2014).

Today, it is widely recognized that average global consumption of natural capital far outstrips its ability to regenerate. The Millennium Ecosystem Assessment (2005) - the first global assessment of the world's forests, wetlands, and other ecosystems - found that ecosystems have declined more rapidly and extensively over the past 50 years than at any other comparable time in human history. In fact, 15 of the 24 ecosystem services evaluated have degraded over the past half century. The Millennium Ecosystem Assessment predicts further declines over coming decades, driven by population growth, economic expansion, and global climate change. With the human population set to reach nine billion by mid-century, critical ecosystem services, such as water supply, provision of wood and non-wood forest products from natural forests, and the capacity to store carbon and regulate climate are coming under intense pressure.

Ecosystem degradation is highly relevant to business because companies not only impact ecosystems and the services they provide but they also depend on them. Ecosystem degradation can pose several risks to corporate performance, while ecosystem services can create new business opportunities to forest owners and managers, industry and investors.

The main risks and opportunities include:

Market:

- *Risks*: In 2015, the World Economic Forum flagged in its Global Risks Report biodiversity loss and ecosystem collapse, failure of climate change adaptation, and water crises among the top ten risks to the global economy (World Economic Forum 2015). Customers can switch to other products with more sustainable supply chains and reduced environmental and reputational risks, and public procurement can favor products with lower ecosystem or carbon impacts.
- *Opportunities*: There is an estimated USD 200-300 billion funding gap to finance the preservation of the world's precious ecosystems (Credit Suisse and McKinsey 2016). Sustainable forest and land resources and habitats, biodiversity, water and other natural capital stand to become more scarce and hence more valuable. There is great potential for impact investing to achieve environmental and social benefits alongside market-rate financial returns. New financial vehicles are emerging to enable growth of this type of investments – including performance-based compensation for delivering environmental services. Growth in impact investing is predicted to continue, with increasing interest in financing conservation.

Financing/Investment:

- *Risks:* Environmental degradation can lead to hidden risks, such as potential loss or devaluation of assets and lower than anticipated cash flows, and higher costs of raw materials as they become increasingly scarce. Environmental risks are increasingly reflected in the corporate discount rates and add to the cost of capital and associated debt cost.
- *Opportunities:* There is an estimated USD 200-300 billion funding gap to finance the preservation of the world's precious ecosystems (Credit Suisse and McKinsey 2016). Sustainable forest and land resources and habitats, biodiversity, water and other natural capital stand to become more scarce and hence more valuable. There is great potential for impact investing to achieve environmental and social benefits alongside market-rate financial returns. New financial vehicles are emerging to enable growth of this type of investments – including performance-based compensation for delivering environmental services. Growth in impact investing is predicted to continue, with increasing interest in financing conservation.

***Regulatory*:**

- *Risks* include lower than expected cash flows due to meeting compliance requirements.
- *Opportunities* include global, regional and national policies, regulations and incentive schemes to protect or restore ecosystems that provide services. For example, the global climate agreement reached in Paris in 2015 (UNFCCC 2015), and its ratification in 2016 mark a turning for forests as they are now enshrined in international climate action. This is expected to stimulate additional investments and financing for advancing the low carbon, energy-efficient economy, including reducing deforestation and SFM. National regulatory mechanisms are also creating demand for ecosystem restoration and conservation.

Operational:

- *Risks* include, e.g., higher costs for freshwater due to scarcity, and lower output for hydroelectric facilities due to siltation caused by degraded watersheds, as well as loss of raw materials
- *Opportunities* exist, e.g., for paying for sustainable forest management in watershed areas, or rehabilitation of degraded land.

Image:

- *Risks* include, e.g., loss of reputation when retail companies are targeted by non-governmental organization campaigns for purchasing wood or paper from sensitive forests, or banks face similar protests due to investments that degrade pristine ecosystems. There are also increased reputational risks to institutions involved in potentially controversial lending or investing.
- *Opportunities* include implementing and communicating sustainable purchasing and production practices, or adopting investment practices to differentiate corporate brands and investing in sustainable practices that can verifiably demonstrate the delivery of environmental and social benefits.

The interest of the private sector to address issues related to deforestation and forest degradation, including reduced flow of ecosystem services, is demonstrated by increased markets for carbon, biodiversity and water services. A growing number of corporations - such as McDonald's, Unilever, Cargill, Nestle, Marks & Spencer, Danone and Mars - are committed to sustainable land-use initiatives, such as zero (net) deforestation to make their supply chains more sustainable. In September 2014, members of governments, companies, indigenous communities and civil society met to sign the New York Declaration on Forests, committing to support the goal to remove deforestation from agricultural production by 2020. More than 400 multinational and national companies, under the Consumer Goods Forum, are committed to improve their supply chains with the aim of achieving zero net deforestation by 2020 in their own operations. Similar commitments have been made within the financial community, most notably through the Banking Environment Initiative. The progress towards deforestation free economy is being tracked by the Forest 500 initiative that identifies and ranks the most influential companies, financial institutions, and governments in their action towards deforestation free supply chains (http://forest500.org).

Categories of Forest Ecosystem Services

Forests are a major natural capital asset and provider of ecosystem services. Forests provide ecosystem goods and services, such as timber and woody biomass for processing and energy production, clean water, and carbon sequestration and storage. Forests cover about a third of the earth's land area and are essential to the health of our environment. For example, trees and forests absorb and store much of the carbon dioxide (CO_2) that otherwise would be contributing to climate change. Forests are home to about 80 percent of remaining terrestrial biodiversity (WWF 2016). The key ecosystem services provided by forests are described in Table 1.

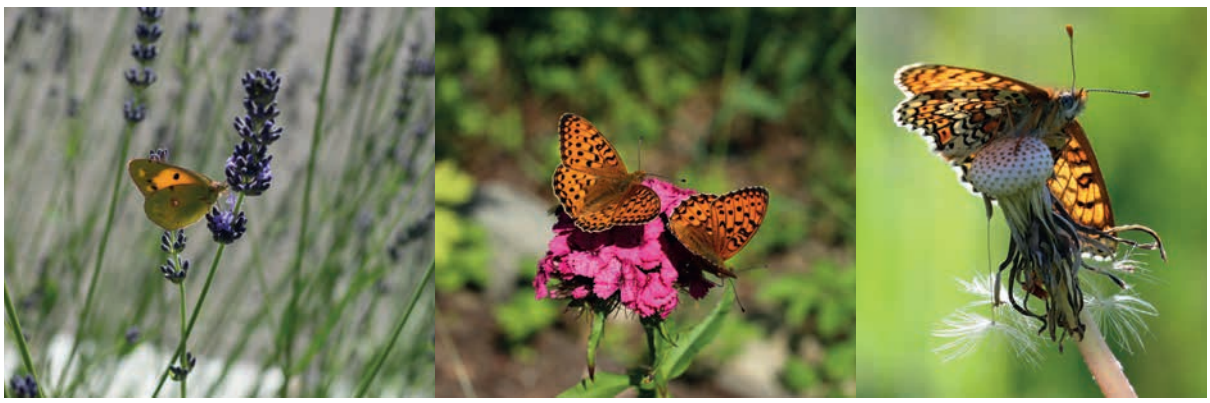


Table 1 Forest Ecosystem Service Categories

Supporting services have biodiversity as their bedrock in addition to ecosystem functions, such as soil conditioning, primary production through nutrient cycling and photo-synthesis, global carbon cycle, water cycle, habitats maintaining species populations and ecological capacity	*Provisioning services*	Timber; bio-energy; clean water; non-timber forest products (fruit, honey, nuts, game, fish, berries, mushrooms); medicine; fiber; the forage and shelter forests provide to wildlife; genetic resources; and agro-forestry products
	Regulating services	Climate regulation (carbon storage; water quality and the volume of water run-off; erosion control; soil quality control; pollination
	Cultural services	Outdoor recreation; nature-based tourism; nature-related heritage; providing physical and mental well-being; spiritual and aesthetic pleasure; science and education

Source: Modified from the Millennium Ecosystem Assessment (2005)

The value of supporting forest ecosystem services cannot be overstated; they form the basis not only for the delivery of various forest ecosystem services but contribute to maintaining the life on the planet. The move towards a circular economy is likely to put more emphasis on the value of these supporting services provided by the forests.

There are numerous studies estimating the value of ecosystem services but no reliable global, regional or national statistics on the supply and market value of forest ecosystem services. The available studies indicate that non-wood forest values tend to dominate over "traditional" timber values. Most of the value originates from regulating services, such as climate regulation, purifying air and water and recycling of nutrients and waste as well as food production. A highly-cited study by Costanza et al. (1997) estimated that that the annual value of the world's forest ecosystem services and goods was about USD 4.7 trillion, i.e. about 26% of the global gross national product (GNP). Costanza and his colleagues updated this study, and estimated that the value of world's forest ecosystem services and goods was USD 16.2 trillion in 2011 (Costanza et al. 2014). The "official" forest sector's (ecosystem goods) contribution to the global GNP is only 1% (can vary between 0 and 4% at a national level); this represents mainly the marketed forest goods, i.e. timber (FAO 2016).

One of the most comprehensive studies to date - examining the marketed and non-marketed economic values associated with forests in eight Mediterranean countries - found that timber and fuelwood generally accounted for less than a third of total economic value of forests in each country. Values associated with non-wood forest products, recreation, hunting, watershed protection, carbon sequestration, and passive use represented 25%96% of the total economic value of the forests, depending on the country. Many of these services produced jointly (Merlo and Croitoru 2005). A study on the ecosystem service value of the US forests concluded that non-wood forest values linked e.g. to climate regulation, biological control and supporting food production accounted for most of the total economic value (Krieger 2001).

These ecosystem services are extremely valuable to human society, but they have been largely under-valued by the market and decision-makers, causing reduction in the natural capital stocks, climate change, biodiversity loss, pollution, and other environmental problems that threaten human wellbeing and long-term sustainability, and cause various risks to corporations.

The economic value of timber is already quite efficiently valued by the markets especially in the developed countries. The financial incentives are in place to manage the forest sustainably for wood production and even expand production through improved silvicultural and reforestation/afforestation. In Finland, the

forest growing stock has doubled in 60 years; at the same time the carbon absorption capacity of forests has also more or less doubled. This has been made possible through public-private partnerships and a mix of incentives targeted at private forest owners.

As natural capital and ecosystem services become under increasing pressure and scarce in the future, we can only expect the value of ecosystem services to increase and become more integrated with formal markets. This will require supporting policies and regulations as well as mechanisms and platforms to enable market-based pricing on non-timber values and provision of incentives to private forest and land owners for conserving e.g. endangered species or habitats at risks, similar to the provision of incentives for timberland development. One must move from "timberland optimum" to a more holistic "forestry and land use optimum" that includes the ecosystem services in addition to timber.

Ecosystem markets have emerged as an increasingly important tool for channeling finance to land, forest, water and biodiversity protection. It is recognized that private sector, including companies and financial sector, can play a major role in addressing these challenges (e.g., Credit Suisse and McKinsey 2016; NCD 2015; Hanson et al. 2012; TEEB 2010).

EVOLUTION OF BIODIVERSITY AND OTHER ECOSYSTEM MARKETS

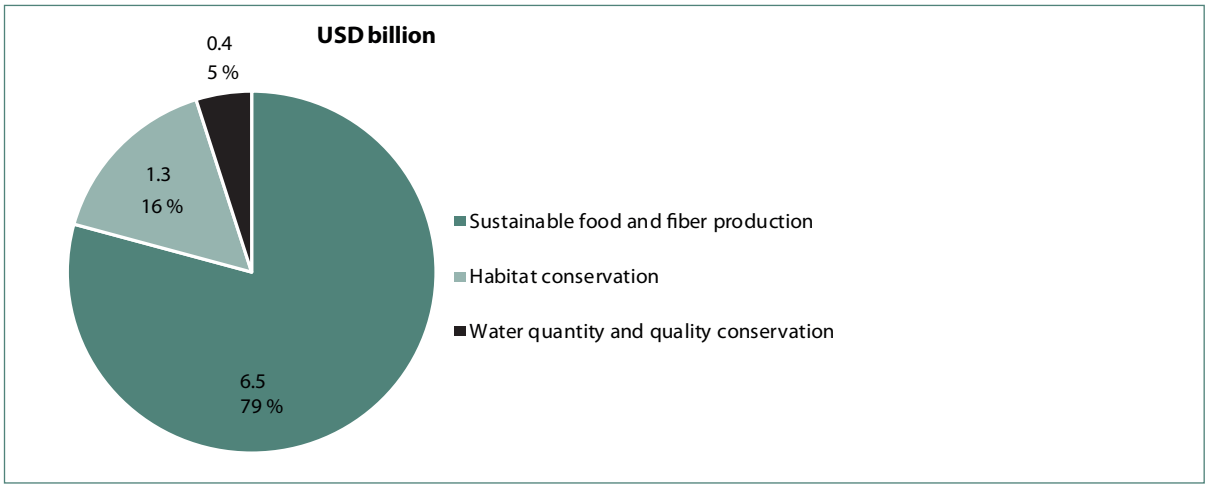
Ecosystem Market and Investment Trends

The first-ever survey of conservation impact investing Investing in Conservation: A Landscape Assessment of an Emerging Market by EKO Asset Management Partners and NatureVest (2014) - revealed a market of approximately USD 23 billion in 2009-2013, of which private sector represented about 9%. A new study by Ecosystem Market Place "State of Private Investment in Conservation" (Hamrick 2016) shows that just in two years the total private capital committed conservation investments jumped by 62% to USD 8.2 billion in 2016 from USD 5.1 billion in 2013. Of the three categories of conservation investment studied, Development Finance Institutions (DFIs) invested largely in water quality and quantity projects, while private investors invested largely in sustainable food and fiber production.

The 2016 survey by Hamrick shows that the 8.2 billion private capital committed to conservation impact investments in 20042014 fell into three main categories (Figure 2):

- *Sustainable food and fiber production USD 6.5 billion*, including investments in sustainable forestry, agriculture, aquaculture, and wild-caught fisheries. Sustainable forestry makes 44% of these commitments. These investments almost doubled between 2014 and 2015.
- *Habitat conservation USD 1.3 billion*, including real asset investments to conserve habitats, land easements, mitigation banking, and forest carbon.
- *Water quantity and quality conservation 0.4 billion*, including e.g. user-driven watershed investments and trading in credits related to watershed management.

Figure 2 Total Private Capital Committed by Conservation Category in 2004–2015



Source: Hamrick 2016

Excluding the Chinese payments for environmental/ecosystem services (PES) system, wetland mitigation offsets represent the largest ecosystems market followed by carbon and then biodiversity offsets (Table 2). The overall market for ecosystem services is dominated by the Chinese market for watershed services that, in fact, is not really a proper market-based system since the payments are made by the government.

In total, these markets have provided investments that cover an area of more than 500 million hectares, most of it forests.

Table 2 Approximate Global Market for Forest-Related Ecosystem Services

Ecosystem service	*Type of market*	*Mandate*	*Data year*	*Annual value USD million*	*Main geography*	*Ha under management*
Biodiversity	Government-mediated PES	Compliance	2010	2,200		n.a.
	Wetland compensatory mitigation	Compliance	2014	1,800	USA	>0.2 million ha
	Species/habitat compensatory mitigation	Compliance	2010	600–750	USA	0.005 million ha
	Voluntary biodiversity offset	Voluntary	2010	25	USA	1.1 million ha
Carbon	Forest carbon credit	Compliance	2015	800	Australia, followed by USA	More than 28 million ha
	Forest carbon credit	Voluntary	2015	88	Amazon, Indonesia, Congo Basin	
	REDD+	Voluntary	2014	230		
Water	Public watershed service subsidies/ payments	Compliance	2015	23,700	Primarily China	About 486 million ha; most of it in China
	User-driven watershed investments	Compliance, voluntary	2015	657		
	Water quality trading and other pure market mechanisms	Compliance	2015	124	USA	

Ekosystem Marketplace 2016a and 2016b; Forest Trends 2015; Madsen et al. 2010 and 2011

While the private sector component of total conservation financing is still relatively small, it has grown 26% per annum from 2009 through 2013 (EKO Asset Management Partners and NatureVest 2014). This trend is partly linked to the growth in the conservation impact investments. Forestry investment managers are among the major players in a growing conservation impact investment due to long experience in multiple-use forest management and incorporation of revenue from conservation-related sources into their investments to enhance returns. The Finnish Dasos Capital Oy can be considered a leading impact investor in the forest sector in Europe.

The Finnish Innovation Fund Sitra aims to introduce the impact investing model in Finland: this will involve building a suitable ecosystem, bringing together various stakeholders – the public sector, service providers and investors – and testing the model's suitability for Finnish society.

There are still no functioning biodiversity or wetland mitigation markets in Europe similar to the level of deepness and scale of the US markets. However, markets are slowly emerging, along with regulatory development, and there have been pilots in several countries, and more are being planned.

STATUS AND TRENDS IN KEY FOREST ECOSYSTEM SERVICES AND THEIR MARKETS

Increasing Scarcity of Natural Capital and Non-Wood Ecosystem Services

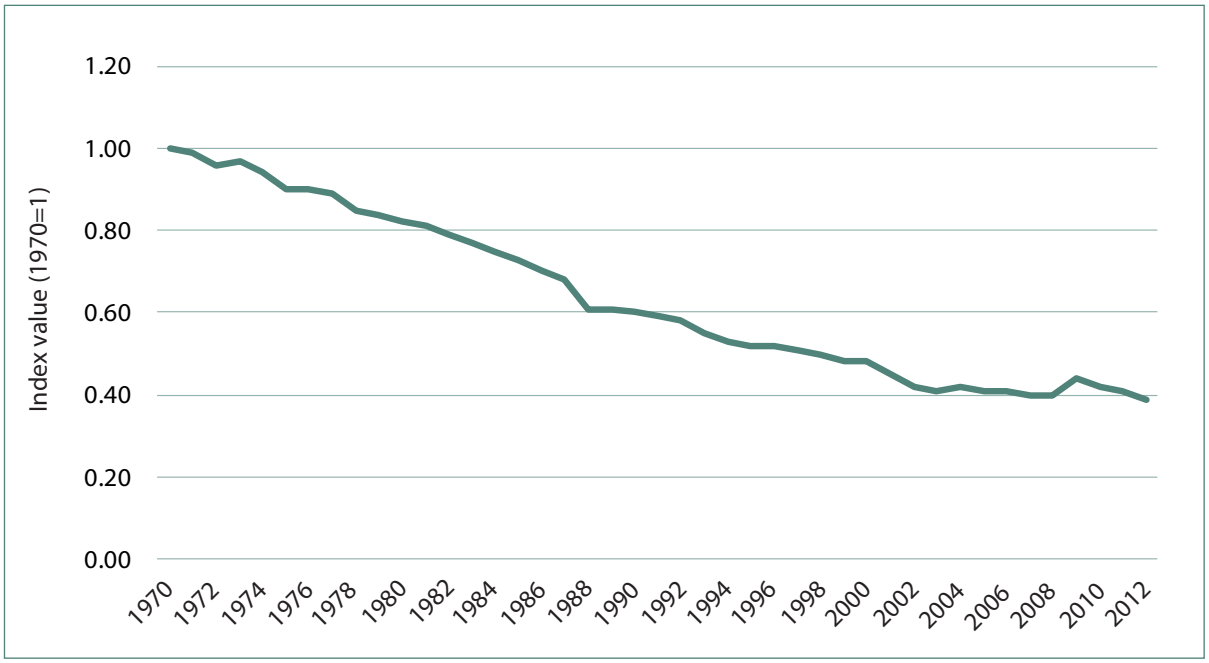
Natural capital is declining in 116 out of 140 countries and at current rates, these trends are expected to further erode natural wealth worldwide by over 10% by 2030. Habitat loss and degradation are the most common threats to terrestrial populations, followed by overexploitation (Ceballos et al. 2015; UNU-IHDP/UNEP 2014; IUCN 2007; Millennium Ecosystem Assessment 2005; Hanski 2005). Habitat loss is typically accompanied by fragmentation that poses an extra threat to biodiversity (Hanski 2015).

The loss and degradation of forests are not only destroying biodiversity but their ability to provide carbon sequestration and watershed-related ecosystem services. Forest-related land use changes are a major source of greenhouse gas (GHG) emissions. Habitat loss is affecting watershed areas and is reducing supply of clean water and increasing soil loss and floods

Biodiversity is being lost at a much faster rate than the global forest area is declining. Worldwide Fund for Nature's (WWF) Living Planet Index (LPI) from 2016 shows an average annual biodiversity loss of 2 percent and there is no sign yet that this rate will decrease. According to the latest global forest resource assessment (FRA) in Food and Agriculture Organization (FAO) of the United Nations (FAO 2016b), the extent of the world's forests continues to decline; the annual deforestation rate in 1990 2015 is estimated at 0.13 percent. This means that biodiversity is losing at a rate that is ten times faster than the global deforestation rates.

Across the range of biodiversity measures, current rates of loss exceed those of the historical past by several orders of magnitude and show no indication of slowing. These estimates reveal an exceptionally rapid loss of biodiversity over the last few centuries (WFF 2016). In Europe, continuing biodiversity loss is a serious problem; a high proportion of protected species and habitats are under threat (EEA 2015) (Figure 3).

Figure 3 Global Biodiversity Loss Trends in 1970–2012, Living Planet Index



Source: WWF 2016.

The fact that biodiversity and habitats supporting a range of ecosystem services are declining at a much faster rate than the forest area means that the value of these services is likely to increase over time simply because they are becoming more scarce. At the same time, when the natural capital supplying ecosystem services is being eroded, the demand for ecosystem services, including those related to biodiversity and water, is increasing, driven by economic and population growth as well as urbanization.

As natural capital and ecosystem services become more stressed and more scarce in the future, we can only expect the value of ecosystem services to increase and become more integrated with formal market.

Biodiversity

Nature of Services, Status and Trends

Forests are biologically diverse systems, representing some of the richest biological areas on Earth. Forests hold most of the world's terrestrial species. Forest biodiversity supports ecosystem functions vital for human well-being, such as agricultural crops, timber, medicinal plants and industrial raw materials. Furthermore, the services provided by healthy ecosystems indirectly benefit humans by, e.g., purifying air and water, regulating climate, generating atmospheric oxygen, supporting food production, and providing recreational opportunities.

However, forest biodiversity is increasingly threatened because of deforestation driven largely by agricultural conversion, illegal land encroachment, and fragmentation caused e.g. by infrastructure development, and indirectly because these resources are economically undervalued. The Millennium Ecosystem Assessment (2005) highlighted a substantial and largely irreversible loss in the diversity of life on Earth, with some 10-30% of the mammal, bird and amphibian species threatened with extinction due to human actions. Fragmentation of natural habitats, which is a common problem in Europe, is one of the main drivers of biodiversity loss (EEA 2015; Hanski 2015).

Despite accelerating policy and management responses to the biodiversity crisis, the impacts of these efforts are unlikely to be reflected in improved trends in the state of biodiversity in near future (WWF 2016; Tittensor et al. 2014).

In EU, nature directives have resulted in new conservation measures, but Europe's biodiversity still continues to be eroded. Direct payments (agri-environment measures) have been provided under the Common Agricultural Policy (CAP) for years to support voluntary preservation of environment by farmers but the conservation challenge is formidable. For the whole of the EU, only 16% of the protected habitats and 23% of the protected species are currently at a favorable conservation status (EEA 2015). More direct pressures on European ecosystem resilience derive from urbanization, particularly from landscape fragmentation due to urban sprawl and expanding transport infrastructure. In the last two decades, industrial areas and infrastructure in Europe have expanded 7-8 faster than population. These developments put pressure on land and biodiversity and accelerate fragmentation of forests, and at the same time, create demand for compensation and offset mechanisms (*http://www.eea.europa.eu/soer-2015/europe/biodiversity*).

In Finland, there is a clear biodiversity conservation gap in Finnish forests, particularly in the southern parts of the country. The proportion of the area of threatened forest habitats of the total area of all forest habitat types is 49% in southern Finland and 27% in northern Finland. Finnish nature conservation has traditionally been carried out through targeted conservation programs based on inventories of particular habitat types, and consequent establishment of protected areas. Most of the protected areas are in the northern, less productive parts of the country, where state-ownership of land dominates (Suomen ympäristökeskus 2008). Private forest owners own most of the forests in the southern part of Finland, which suggests a need for engaging private-sector and private forest owners in conservation voluntarily, e.g. through compensation and offsetting schemes (Primmer et al. 2016).

The failures in halting the biodiversity loss, budget constraints, and significant financing gaps, have paved a way for private-sector and market-oriented approaches such as conservation offsets and mitigation banks, starting first in the United States (US). In Europe, the development until today has been much slower, but the situation is gradually changing. However, in some countries, such as Germany, France and Finland, mitigation/habitat banks are already being considered or piloted.

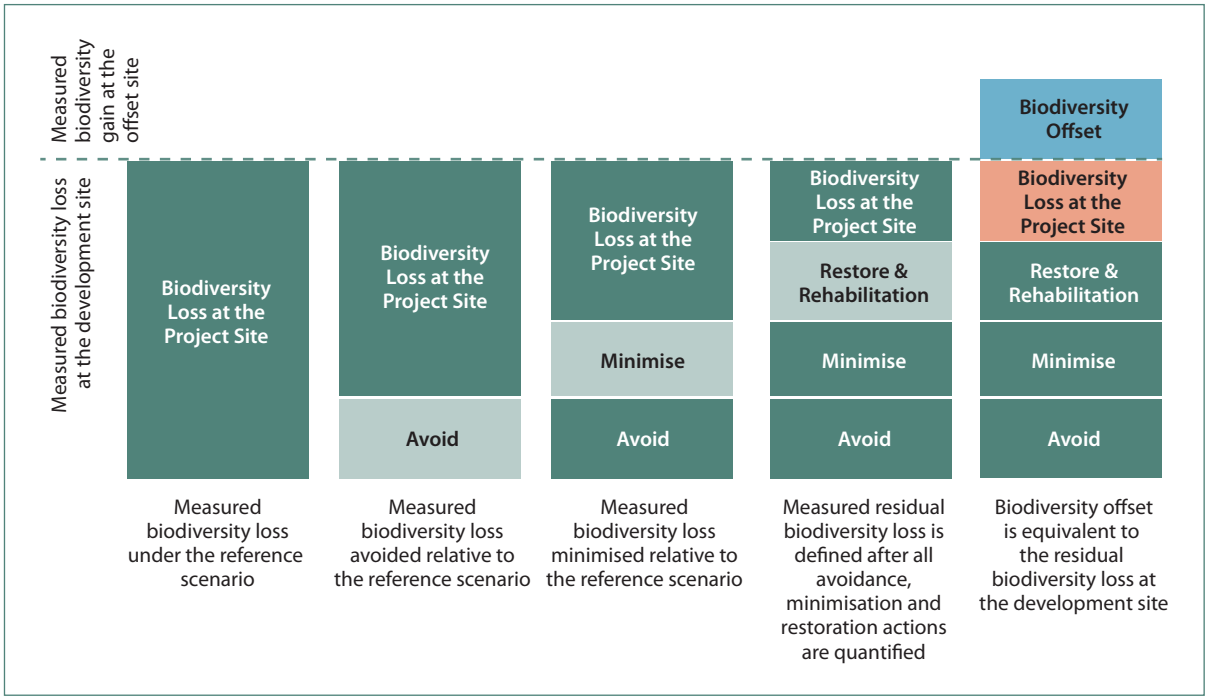
Biodiversity Offsets as a Conservation (Financing) Tool

The uptake of biodiversity offsets, as a mechanism for mitigating the residual impacts of development projects on species and ecosystems, has rapidly increased over recent years, with a growing number of companies stating commitments to No Net Loss, and the emergence of national offset frameworks and roadmaps in new geographies (Fauna and Flora International 2015; ICMM and IUCN 2013).

The Business and Biodiversity Offsets Programme (BBOP) of the IUCN defines biodiversity offsets as "measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken" (BBOP 2012). Offsetting itself is generally implemented using one of three approaches: one-off offsets; in-lieu fees; and biobanking, and they can be on-site or off-site.

The goal of biodiversity offsets or compensation is to achieve No Net Loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use, and cultural values associated with biodiversity. The principles of biodiversity offsetting are presented in Figure 4.

Figure 4 Principles of Biodiversity Offsetting



Although wetland mitigation and conservation offsets schemes have expanded rapidly, they have not always met the ecological goal of No Net Loss due to inadequate monitoring and compliance; mitigation ratios have not always truly reflected the value of the land lost and gained for the species; authorities not always seeking compensation for impacts; projects have been being permitted regardless of whether or not biodiversity offsets exist as a true mitigation option; and offsets being too localized paying inadequate attention to broader conservation needs to deal with negative impacts of habitat fragmentation (Fauna and Flora International 2015; Kormos et al. 2015).

Market Prospects

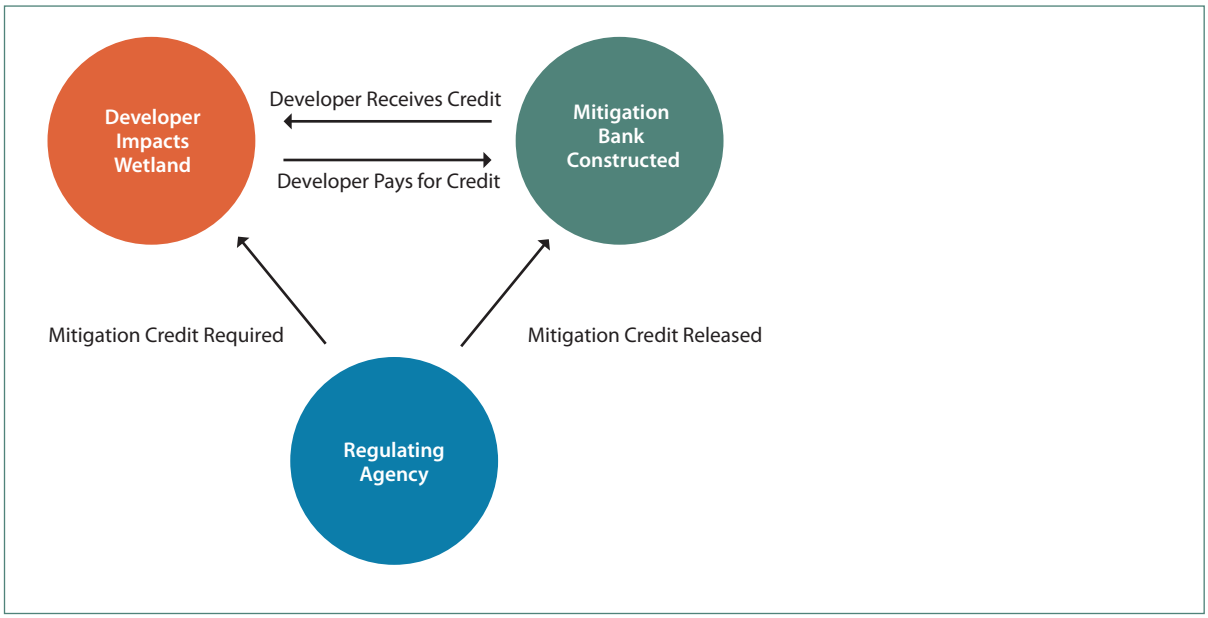
Markets for biodiversity conservation are expanding and diversifying

The global annual biodiversity market is estimated at USD 2.44.0 billion, and likely much more, as 80% of existing programs are not transparent enough to estimate their market size. The US is predicted to continue to dominate activity in biodiversity markets driven by regulations and enabling legislation, policies and programs.

The US wetlands compensatory mitigation and conservation banking programs account for the greatest volume of payments and area of the global biodiversity market, bringing in USD 2.0 3.4 billion and protecting over 15,000 ha annually (Ecosystem Marketplace 2011). Biodiversity offsets are becoming a more established and growing asset class. Figure 5 demonstrates the principles of wetland banking; the same principles apply to biodiversity/conservation mitigation banking. Mitigation bank is a site, or suite of sites, where resources (e.g., wetlands, streams, habitat, species) are restored, established, enhanced and/or preserved to generate credits and provide compensatory mitigation for impacts. Developers can offset their negative impacts on wetlands by purchasing credits from a wetland/conservation mitigation bank. This creates a market in which there is supply and demand for restoring and protecting ecologically sensitive areas. Through consolidating the mitigation for many small projects into one large mitigation site, banking could secure certain environmental benefits (e.g., complexity of habitats, viability of populations, buffering from edge effects) unattainable at smaller sites. An example of a private mitigation bank is provided in Box 1.

There is increasing interest in market-based approaches to biodiversity conservation not only in the US but elsewhere simply because there is a huge need for complementary financing to the public-sector financing and because conservation needs are increasing. Biodiversity offsets could generate USD 5.29.8 billion in 2020, according to the Little Biodiversity Finance Book, published by the Global Canopy Programme (2012). Furthermore, the Ecosystem Marketplace assesses in the State of Biodiversity Markets version (2010) the potential of voluntary biodiversity offsets at USD 100 million by 2020 and USD 400 million by 2050.

Figure 5 Principles of Wetland Mitigation Banking



Box 1 Example of a Conservation Mitigation Bank: Habitat Bank LLC in the State of Washington, USA

Since 2001, Habitat Bank LLC. has been the leader in developing mitigation banks in Washington State. It introduced the first privately sponsored wetland mitigation bank approved through Washington State's pilot banking program (Snohomish Basin Mitigation Bank in 2006), and the first joint Wetland and Endangered Species Conservation Bank Project (in 2016). In addition, it has successfully certified the following projects through the Mitigation Banking Program: Columbia River Wetland Mitigation Bank; East Fork Lewis Wetland Mitigation Bank, Battle Ground Project, and Keller Farm Mitigation Bank.

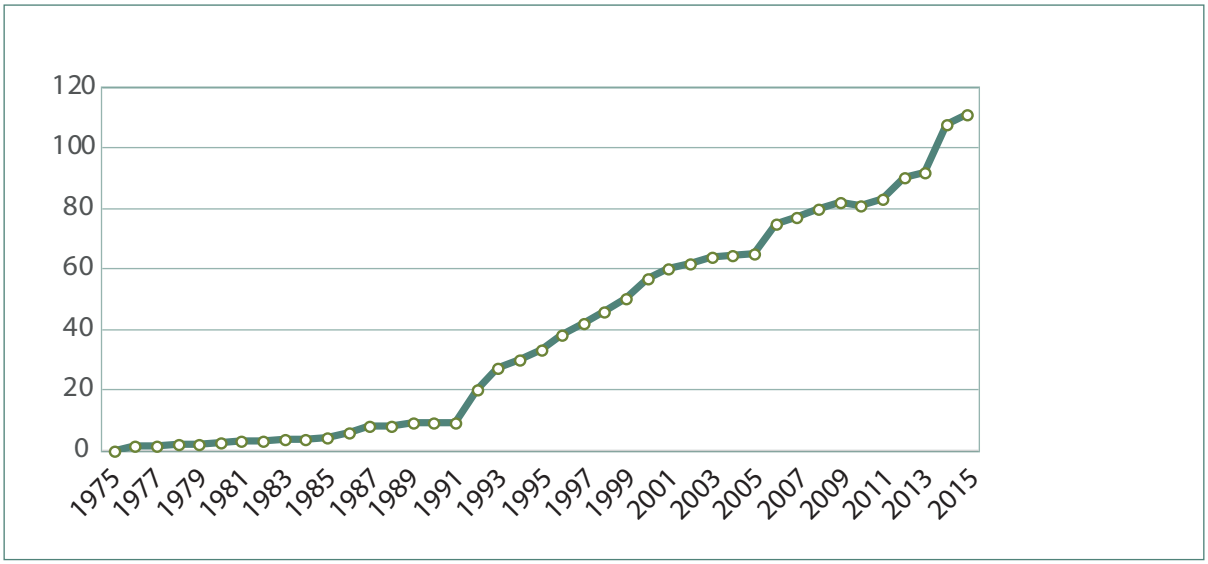
As an example, the Coweeman River Mitigation Bank includes approximately 100 acres within the tidally influenced portion of the Coweeman River floodplain and approximately 200 acres of old growth forest surrounding the river. The old growth forest includes wetlands and small tributaries that flow into the Coweeman River. The project restores wetlands and riparian areas within the floodplain and preserve critical wetland, upland and riparian habitat within the old growth forest areas.

Since the Snohomish Basin Mitigation Bank began in 2006, wetlands, riparian areas and adjoining upland habitats have been reestablished throughout the site. The diversity of habitats includes riparian stream channel, aquatic bed, emergent, shrub and forested wetland habitats as well as floodplain upland areas. The bank offers compensatory wetland, stream, and buffer credit for Local, State and Federal permits when there are unavoidable impacts to aquatic areas within the bank's service area. When completed, the bank project will include over 200 acres of restored habitat.

Source: www.habitabank.com

Biodiversity offsets have emerged as a prominent policy approaches to align economic development with nature protection across many jurisdictions, including the European Union (EU). Biodiversity offsets are attracting increasing interest as governments and the private sector seek to address biodiversity loss that occurs through development projects and activities. Also, biodiversity offsetting, and related forms of ecological compensation, are a pragmatic recognition that some degree of ecological impact is an inevitable consequence of economic development. More than 100 countries have laws or policies in place that require or enable the use of biodiversity offsets, or are currently considering their use (Figure 6).

Figure 6 Countries with Offset Policies or Are Considering Their Adoption



Source: TBC 2016.

Biodiversity markets are emerging gradually in Europe

Biodiversity markets are emerging slowly in Europe with more piloting of offsetting and banking envisaged. Biodiversity offsets and other compensation mechanisms continue to gain recognition as a policy tool, with several countries – including the United Kingdom, France, Spain and Sweden – taking initial steps to develop markets for biodiversity. However, there are no real compliance markets in the EU. The regulatory framework is not really in place at the EU or country level despite some progress. Also, voluntary offsets are currently at a low level in the EU. Only Germany currently has operating habitat banks but at a low volume; in some other EU countries biodiversity offset projects are being piloted.

However, nascent markets could see a boost thanks to the recent European Commission (EC) commitment to a "No Net Loss" strategy that embraces the use of payments for ecosystem services. Voluntary investments in biodiversity conservation by the private sector are becoming increasingly widespread, and some Member States are now putting regulatory requirements or guidance in place to incentivize the growth of biodiversity offsets and habitat banking. The European Forest Institute (EFI) sees potential in payments for biodiversity and other ecosystem services in the Mediterranean countries (Prokofieva et al. 2012). The European Investment Bank (EIB) and EC have launched the Natural Capital Financing Facility (NCFF) to support application of new market and private sector oriented financing models for biodiversity and ecosystems across the EU (Box 2).

Swedish and Finnish schemes for paying for forest ecosystem services (PES) are described in Box 3.

Box 2 Natural Capital Financing Facility of the European Commission and European Investment Bank

The Natural Capital Financing Facility (NCFF), jointly administered by the EIB and the EC, is a new financial instrument with a focus on risk-pooling of Natural Capital projects in the areas of PES schemes, Green Infrastructure, biodiversity offsetting and pro-biodiversity business. The initial EUR 120 million capitalization of the fund will be allocated in the form of direct and indirect lending in the region of EUR 5-12 million per investment assorted with grants for technical assistance. NCFF will provide direct loans and equity finance to projects, pool investment risk through co-financing and provide technical and business development expertise to project developers. The aim is to develop the commercial applicability of projects by absorbing short-term investment risks. More than finding revenues (that could eventually come from corporate participants), the scheme difficulty is to find a bankable structure that could receive the loans.

A key criterion for inclusion of projects within the NCFF pipeline is that the project design needs to demonstrate either a viable revenue stream or cost savings to the beneficiary, which will support repayment of the finance provided. It is envisaged that 9-12 projects will be financed under the NCFF within its initial pilot phase (20152017) across the four project categories. It is hoped that, by tackling market failures that constrain current finance for natural capital projects, the facility will demonstrate the viability of applying new financing models for biodiversity and ecosystems across the EU.

Source: www.eib.org/ncff

In Finland, the METSO Programme tries to attract non-industrial private forest-owners to participate in conservation on a voluntary basis, through payment for environmental services. The payments are largely based on income loss rather than output. Currently, the Finnish Environment Institute is looking at the possibility of establishing a biodiversity habitat bank. Mikko Tiirola from the Central Union of Agricultural Producers and Forest Owners (MTK) has proposed on December 16, 2016 (Maaseudun Tulevaisuus 2016) that Finland needs a national forest conservation (METSO) fund where also private people, companies, and organizations could put funds for conservation of biodiversity and valuable forest habitats to complement public sector and forest owner funding. Researchers from the Finnish Environment Institute and the Institute for the European Environmental Policy (IEEP) (Primmer et al. 2016) have also recommended more active engagement of the private sector.

Budget constraints will lead to increasing pressure to identify new opportunities for public-private collaboration and potential new ways to generate funding for conservation, e.g. through compensation or offsetting arrangements where enterprises causing biodiversity losses participate in conservation (Primmer et al. 2016). Earlier in 2015 in the Finnish Economics of Ecosystems and Biodiversity report (TEEB report), piloting of habitat banking was proposed (Jäppinen and Heliölä 2015).

Box 3 Swedish and Finnish Schemes for Paying for Forest Ecosystem Services

The Swedish KOMET is a joint program between three government bodies, initiated by the Swedish government. The aim of the program is to inspire landowners to protect valuable forests on their properties and inform them of the options available for habitat protection. It is a voluntary program for 2010-2015, with a budget of SEK 11 million in 2011. The areas within which land owners can choose to join the scheme, cover 9% of Sweden's forestland. Agreements may last for between 1 to 50 years, depending on the significance of the site. Owners receive fixed-rate payments as compensation for the limitations placed on forest management in the interests of nature conservation. For habitat protection sites and nature reserves, owners receive full compensation and an additional 25%.

METSO. Finland has the Forest Biodiversity Programme METSO 2008–2025 that aims to halt the ongoing decline in forest biodiversity and species, and to establish stable favorable trends in Southern Finland's forest ecosystems. It is a collaborative effort between the Ministry of the Environment, the Ministry of Agriculture and Forestry, the Finnish Environment Institute and the Forest Development Centre Tapio. METSO introduced nature values trading and bidding competition. They were based on voluntary offering of sites and negotiations on payments for conservation. The METSO nature values trading resulted mainly in ten year contracts where compensation was paid for loss of forest income, and to some degree, based on the biodiversity values on the sites (Paloniemi and Varho 2009). A bidding competition was used to attract landowners whose lands hosted certain biodiversity values in targeted areas. They led through negotiations, mostly to permanent conservation or land purchases. At the end of 2014, private nature reserves offered by landowners covered about 37,000 ha and 13,000 ha was protected by the State. Further, there are some 33,000 ha of fixed-term conservation agreements and 4,000 hectares of active nature management in commercial forests. The budget of METSO will be reduced significantly from EUR 44 million in 2015 to one fourth, i.e. EUR 11 million in 2019. The cuts in METSO funding endanger meeting the original private sector conservation targets.

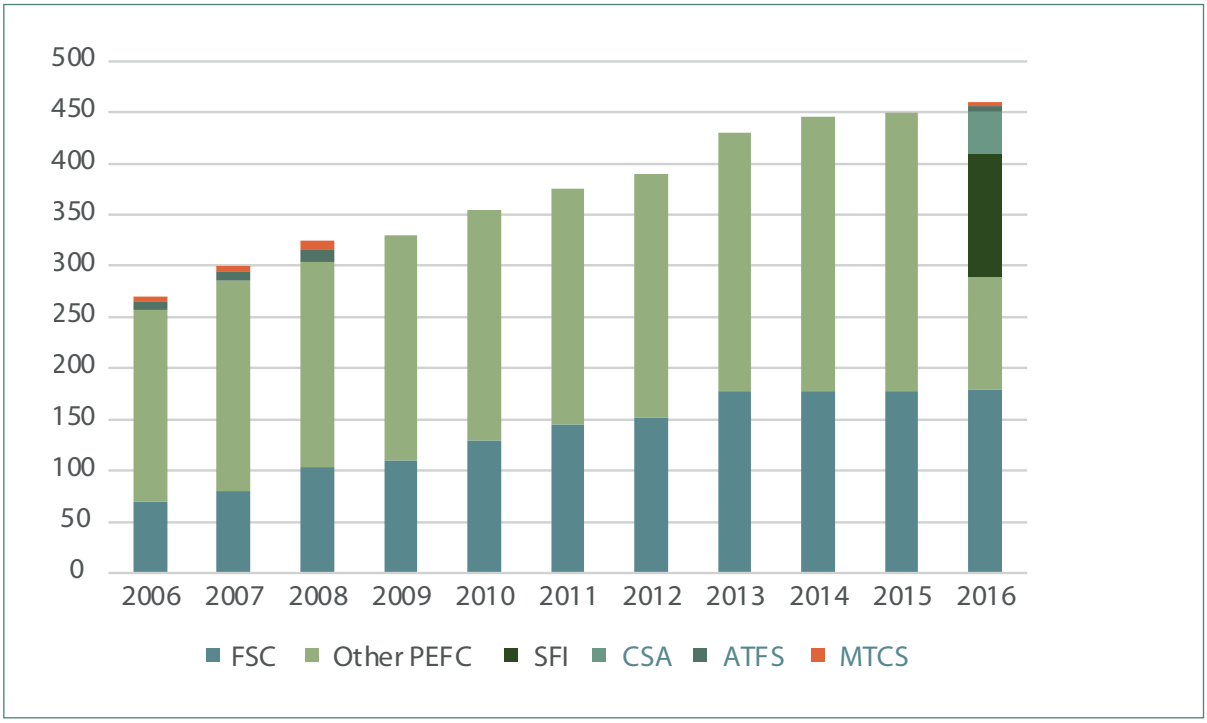
Markets for biodiversity embedded in SFM-certified forest products are growing

It is also important to acknowledge the "indirect" market for forest-related biodiversity services through increasing demand for sustainably produced forest products. The market for certified forest products – demonstrating sustainability also in terms of impact on biodiversity and social values - has been growing rapidly especially in Europe, and also in North America.

Sustainable forestry investments create opportunities to internalize environmental benefits and allow, e.g., demonstrating how the investment contributes to addressing climate change concerns. In case of forestry investments, investors interested in promoting sustainability may rely on annual internationally accredited third-party assessments of individual project's compliance with social and environmental performance standards. There are two international (global) certification schemes Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC) with such standards and verification of compliance through independent accredited third party audits.

The area under certification has been increasing steadily. In mid-2016, the total certified area, in accordance with either PEFC or FSC standards, reached 433 million hectares after adjusting for double counted areas under the PEFC scheme; or 11% of the total global forest area (4.03 billion hectares). Two-thirds of all certified forests globally are certified to PEFC. Most of the certified forests are in Europe and North America (Figure 7).

Figure 7 Cumulative Certified Forest Area by Mid-2016



Notes: FSC and Sustainable Forestry Initiative Inc. (SFI) data as of May 2016; PEFC, Canadian Standards Association (CSA), American Tree Farm System (ATFS) and Malaysian Timber Certification Scheme (MTCS) data as of and including March 2016. Data for systems endorsed by the PEFC (the ATFS, the CSA, the MTCS, and the SFI) are included in the PEFC data after the date of endorsement. Data for 2016 differentiate by the major systems endorsed by the PEFC. Includes double counted areas under PEFC.

Source: UNECE/FAO 2016.

Forest certification standards of sustainable forest management have focused on wood production while also ensuring environmental and social sustainability. Certification of forest ecosystem services in "bundles" integrates and balances trade-offs among forest ecosystem services. At the same time bundling can lead to increased forest owners' incomes and reduced certification costs.

Building on its world-renowned certification system FSC is developing new ecosystem services tools that will reward participating FSC certificate holders by improving their access to ecosystem service payments and impact investments. Tools and methodologies are needed for the FSC certificate holders to demonstrate the impact of their forest management activities on ecosystem services. Also, buyers of services need to be provided independent, reliable assurance that the impacts they are paying for do preserve ecosystem services. FSC is also exploring the creation of saleable assets. In addition to a FSC high conservation value credit, there is a possibility of "layering" FSC ecosystem services on top of external saleable carbon credits and water assets (http://forces.fsc.org).



The above issue is linked to the potential of bundling forest ecosystem services. Most existing incentive programs pay landowners to protect and restore a specific service rather than the suite of services produced from well-functioning ecosystems. New programs need to be developed that value a greater proportion of the ecological benefits that flow from ecosystems. One option is to allow landowners to bundle payments for ecosystem services. Collaborative efforts among public and private entities are needed to develop accounting tools to measure bundled ecosystem services and payments on the ground. Methods are needed to spatially target payments to areas where multiple ecosystem services, combining biodiversity conservation with carbon and water services, can be jointly provided (Box 4).

Box 4 Bundling of Ecosystem Services: Investing in Forest Carbon to Gain Biodiversity Benefits

Numerous studies have demonstrated the potential for joint production of forest ecosystem services. In the international climate agenda, so called co-benefits – i.e. additional positive outcomes social, environment and economic outcomes - associated with offset projects have been discussed intensively in the recent years. For example, conserving natural forests to act as carbon sinks deliver often biodiversity benefits. In 2015 forest carbon projects protected habitat for endangered species, and areas with High Conservation Values.

These are benefits which are not automatically priced into the value of an offset, but they can still drive investment decisions. Nearly half of forest carbon offset buyers are engaged in the markets primarily because of social and biodiversity-related co-benefits. Especially impact investors are interested in benefits beyond carbon (Ecosystem Market Place 2016a; Goldstein 2016). Further, carbon credits, which can verify delivery of such co-benefits according to an accepted standard, fetch premium prices in the voluntary carbon market.

Third-party standards offer frameworks for measuring and reporting on co-benefits. The Climate, Community & Biodiversity Standards cover environmental, social, economic and technological co-benefits for offset projects. To obtain the certification, projects must meet certain criteria and comply with a monitoring and verification plan. The California Cap and Trade carbon market recognizes co-benefits of sustainable forestry carbon projects. Australia is considering adopting a standard and methodology for quantifying and verifying co-benefits.

Sources: Goldstein, A. 2016; Gold Standard 2014; www.climate-standards.org/ccb-standards*; www.goldstandard.org*

Group certification as a tool for biodiversity offsets and reducing transaction costs

Most certification schemes involve setting up conservation areas and protection zones. They can be expressed as percentages of total land area to be set aside (e.g., 5%) or as the characteristics of ecological valuable habitats or sites to be set aside. The practices vary between certification standards, national conditions and forest management guidelines and biomes.

In addition, a certification standard can define specific measures for harvesting operations or forest road constructions in specific forest conditions (e.g., reduced impact logging). Typically, an example of specific conditions are production forests in which forestry operations must respect environmental conservation, for example, maintenance of decaying wood, protection of individual endangered species, adjacent water bodies, etc. In total, set aside areas and special harvesting sites may cover even more than 10% of certified forest land, depending upon the certification scheme applied .

Certified timber has become increasingly appreciated by the market. It is essential that the market should pay a price premium for certified wood or products made thereof. When deciding about certification, a rational forest owner typically faces the issue of market access as well as a consideration whether the additional premium covers the associated cost, i.e. the forgone revenue from the protected areas and harvesting restrictions.

However, establishing protection areas by individual small-scale forest owner based on the arbitrary biodiversity status of each single property is often far from optimum from a conservation and/or

an economic efficiency viewpoint. Fragmented and small properties are often too small to achieve a conservation objective if expressed as a percentage share of set aside areas in their property. For instance, the property of forest owner (1) may have abundance of areas which are worth setting aside for biodiversity purposes whereas forest owner (2) has areas where timber production prospects dominate over the biodiversity value. In this case forest owner (2) would face a foregone revenue due to conservation requirement without any substantial environmental benefit.

Group certification schemes can be designed to mitigate such certification inefficiencies. Within a group certification scheme, the members of the group could allocate the conservation zones and effort in the total area controlled by the group members to (i) maximize the conservation value; and (ii) minimize the transaction cost of certification.

In Box 5, we apply a simple analytical framework to illustrate group certification can work in such a situation where one owner has no high conservation value areas to be set aside and another owner has more such sites than defined in the certification standard as percentage of property .

Box 5 Economics of Group Certification – Analytical Framework

Consider a forest owner 1 with area A1 having a high biodiversity and conservation value. Forest owner 1 targets to gain appropriate return on her property:

P1 = rvA1

where
r = return on capital in equally risky ventures
v = value per ha.

Next, another forest owner 2 enters to establish a group certification scheme with forest owner 1. To draw full advantage of the group certification scheme, forest owner 2 targets to maximize her profit:

$$P2 = \big((1-c)ppg(A2)A2\big) - pg(A2)A2) + \int_0^x (ppf(x) - rv)dx, \qquad 0 \le x \le A1$$

such that ppf(x) = rv

where
c = share of the protection area, 0<c<1
p = stumpage price of non-certified timber
pp = stumpage price of certified timber; assume pp>p
g(A2) = mean annual increment (MAI) of A2 illustrating the level of sustainable harvesting
x = area to be protected by forest owner 1 on behalf of forest owner 2
rv= compensation by forest owner 2 to forest owner 1 for protection.

Note that the group certification requires that the total area to be established under protection is c(A1+A2).

Function f(x) is an adapted density function depicting the mean annual increment for each area unit in the potential protection zone cA2 in a descending order, i.e. df(x)/dx < 0.

For example, assume f(x) is a rather general function of Weibull-family:

$$P2 = \big((1-c)ppg(A2)A2\big)f(x) = \frac{1}{\propto} e^{-\frac{\beta x}{\propto}}, \qquad 0 \le x \le A1$$

Here, profit P2 is maximized at

$$\hat{x} = \frac{-\propto}{\beta} \ln \frac{\propto vr}{pp}$$

denoting for the exact area for conservation "purchased" by forest owner 2 from forest owner 1 within the group certification scheme.

Figure a. Optimal Arrangement of Conservation within Group Certification

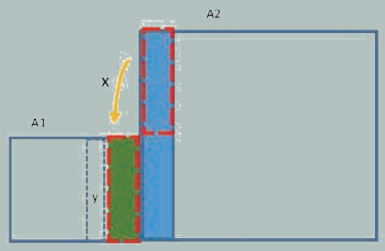


Figure a. illustrates a resulting possible conservation arrangement. Compared to a situation without a group certification scheme, forest owner 2 will trade part (= x, marked by a dotted line in red) of her total conservation area (blue color) to forest owner 1 against a compensation.

Moreover, forest owner 1 may enter into a similar arrangement with a further forest owner 3 concerning the area y.

The advantages of such a group certification scheme include:

- focusing conservation effort on areas with the highest conservation value;
- minimizing the opportunity cost of conservation;
- scope for establishing large unified (vs. fragmented) conservation areas;
- providing an incentive for conservation.

To demonstrate some key sensitivities, assume the following parameters: A1=50 ha, A2=1000 ha, r= 5%, p= EUR 31/m3 (average stumpage all wood grades), pp=EUR 32.5/m3 (basic case), α= 0,075, β=0,0025.

In the context of Figure b., the following conclusions can be made:

- arranging conservation between the forest owners increases the "profit" of certification. Indeed, a group certification can in fact trigger a decision to certify by making the certification profitable to forest owner 2 when compared to the situation of no group certification (at the origo in Figure c).
- the level of the certification premium largely affect the profit of certification but its impact in the optimal x is minor at fixed parameters of f(x).

Figure b. Profit (P2) and the Variation by Certification Premium (=pp-p). Profit maximizing $\hat{x}$ is marked by arrows

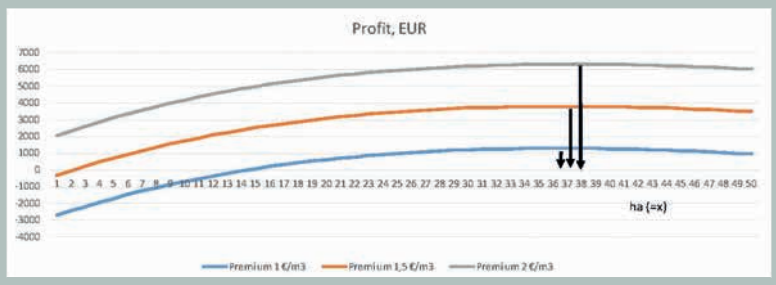
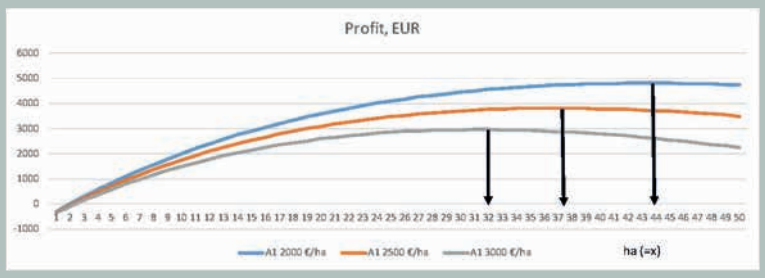


Figure c. Profit (P2) and the Conservation Cost (=v). Profit maximizing $\hat{x}$ is marked by arrows



Note: Figure d. illustrates only the impact of per ha value of the conservation. Identical results can be obtained when looking at r, i.e. the return on capital in equally risky assets.

Analysis of the sensitivity with respect to conservation cost (Figure c.) indicates the following:

- the impact of the conservation cost to profit is stronger in absolute terms for larger areas concerned;
- lowering the conservation cost rapidly increases the optimal conservation area within a group certification, and *vice versa*.

Source: Dasos Capital Oy 2017.

Carbon

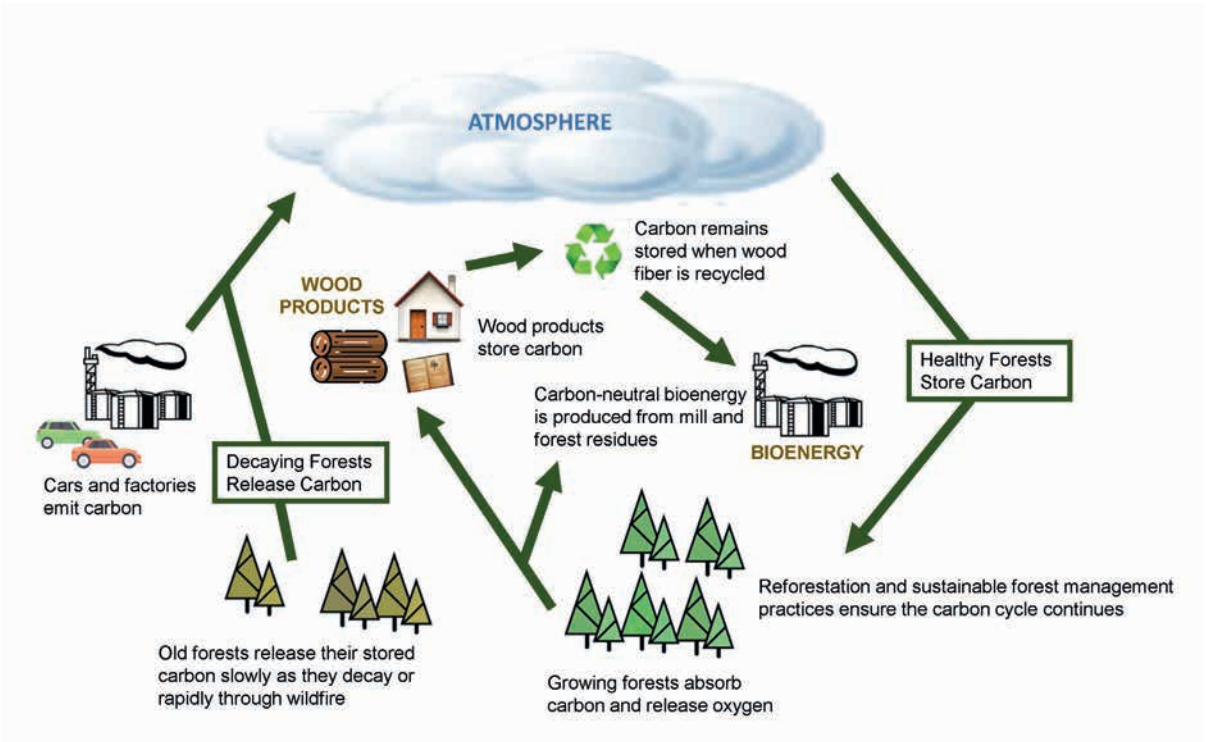
Nature of Services, Status and Trends

Forestry plays an important role in climate change mitigation due to forest's cost-effective potential to increase carbon sequestration and act as carbon sinks, and reduce GHG emissions through avoided deforestation and forest degradation (REDD).

Forests impact net GHG balances in two ways. First, they retrieve CO_2 from the atmosphere and sequester carbon in biomass, thus acting as a carbon sink. The world's forests remove over one quarter of current annual human carbon emissions from the atmosphere each year, the equivalent of about 2.4 billion tons of carbon. Forests alone account for the most significant terrestrial carbon sink. Subsequently part of this carbon is transferred into soils through litterfall, or through harvesting into a variety of products, or used as bio-energy. Forest management tools, such as improved silviculture, afforestation, reforestation and reduced deforestation, increase net carbon sequestration in forests. In addition, carbon sequestration in long-lived wood products, wood structural frames for instance, delays carbon release into the atmosphere.

Second, fuelwood and bioenergy (e.g. pyrolysis oil and second generation biodiesel) can substitute fossil fuels, and timber products can substitute other more energy and emissions-intensive materials. Emissions linked to wood product consumption are generally lower than those created by the consumption of non-wood substitute products. Wood product consumption (substituting for products coming from other materials for building, insulation, packing, furniture, etc.) consequently may enable a reduction in fossil energy emissions. Moreover, wood products can store carbon for decades, or even centuries, for example, in houses made of wood (Figure 8).

Figure 8 Forestry Carbon Cycle Based on Sustainable Forest Management



World forests act as a major carbon sink. Due to the central importance of forests as a global carbon sink, reductions in the forest area and growing stock will mean release of carbon into atmosphere. Deforestation and forest degradation contribute currently about 14% of the global GHG emissions, comparable to the emissions from all the cars and trucks on Earth combined. This provides the rationale for REDD which is a mechanism that has been under negotiation by the United Nations Framework Convention on Climate Change (UNFCCC) since 2005, with the objective of mitigating climate change through reducing net emissions of greenhouse gases through enhanced forest management in developing countries. In the 2015 Paris Agreement, the role of forests and REDD was officially recognized and even highlighted.

EU forests and the forest sector play a significant role in the EU GHG balance. Forests and agricultural lands currently cover more than three-quarters of the EU's territory and naturally hold large stocks of carbon, preventing its escape into the atmosphere. These forests and their products reduce emissions, enhance sinks, store carbon and provide a continuous stream of ecosystem services, including wood products, energy and biodiversity conservation. In all their variety, it is estimated that EU forests and the forest sector currently produce an overall climate mitigation impact that amounts to about 13% of the total EU emissions. This includes both the action of forests and harvested wood products as a carbon sink and carbon stock, and the substitution effect of forest products for fossil-based raw materials and products. It is estimated that an equivalent of 22% of the total EU CO2 emissions in 2012 could be potentially mitigated by forests and forest sector by 2050 (EEA 2015; Nabuurs et al. 2015). It is important to note that the production of carbon sequestration services is joint production. That is, it is possible to increase sustainable production of timber and non-wood products through improving the productivity of existing natural forests and hence increase the growing stock that will at the same time result in increased carbon stocks.

Forests as a source of sustainable energy and carbon neutrality

The role of forests in climate change mitigation, and the related investment opportunities, are also closely linked to the role of forestry in promoting low-carbon economy and helping to meet climate mitigation targets through changes in energy use, and the issue of carbon neutrality. The climate impact of bioenergy is a central issue since bioenergy is the most important renewable energy source. About 70 percent of bioenergy in Europe is produced with solid biomass – mainly wood directly harvested from forests or residues from forest-based industries. The burning of solid biomass for heating, cooling and electricity accounts for about 45 percent of total renewable energy production.

The concept of carbon neutrality is important in public policy efforts to address climate change, and it can potentially affect the forest-based industry and investments and management of forestry assets, depending on how carbon neutrality is understood and applied. An energy production activity typically is classified as carbon neutral if it produces no net increase in GHG emissions on a life-cycle basis (Box 6).

Box 6 Can Forests and Wood-Based Bioenergy Contribute to Meeting Climate Change Mitigation Objectives: Neutral or Not Neutral?

Forests can serve as a carbon sink, and forest biomass used in energy production can make major contributions to meet climate change mitigation objectives, but not categorically. Further, instead of looking only at the carbon neutrality and forests as a carbon sink, it is important to look at the broader system including the role of wood-based bioenergy and forest products substituting for more carbon intensive forms of energy and products. Applying "climate smart" forestry mitigation effects of EU forests could nearly be doubled by 2050 (Nabuurs et al. 2017, Hetemäki 2016).

Fresh research (Berndes et al. 2016, Bracmort 2016, a US congressional paper, Nabuurs et al. 2015, and WBCSD 2015) suggest that whether bioenergy is considered carbon neutral depends on many factors, including the definition of carbon neutrality, feedstock type, conversion technology used to convert woody biomass into energy, scale, system boundaries, and time frame examined

At a level of a single forest, cutting trees will release carbon, and the short-term impact on carbon balance is negative. However, if bioenergy production is based on by-products from forest industry processes, and tops and branches of silvicultural operations aimed at improving the quality of the remaining forests, contribution to climate change mitigation will be positive also in the short term. If one looks at the carbon balance over a large landscape where sustainable forest management is practiced, the net growth of the forests can compensate for the emissions incurred during harvesting. If the carbon stored in lasting forest products is included, carbon impact is likely to be positive.

Large amounts of CO_2 are removed from the atmosphere and stored in forest products for long periods of time, decades and even hundreds of years. If the industry is obtaining wood from sustainably managed forests in ways that allow forest carbon stocks to remain stable, this means that the forest carbon cycle for the forest used by the industry is not only in balance, or "neutral" with respect to biogenic carbon, it is a net sink for atmospheric carbon due to carbon storage in products.

Carbon neutrality and sustainability of wood-based bioenergy can be best ensured by focusing on the utilization of "waste" wood from harvesting and industrial processing. Dedicated forest plantations, or cutting and burning large-diameter logs are likely to have negative impacts on climate (IINAS et al. 2014).

Globally, carbon sequestration and storage in forest products offsets a significant fraction of the fossil-fuel related emissions attributable to the forest products value chain. When different types of forest products are examined individually, findings show that for some types of wood products, the sequestration and storage of CO_2 in products is adequate to offset all the GHG emissions in the value chain producing those products.

Managed forests sequester more carbon through growth than is extracted through harvest in a large sustainably managed landscape or a region. Not harvesting forests at all to secure short-term carbon benefits, results losses in the stored carbon due storms, fires, and insect infestations. In the case of regenerated timberland, carbon stocks are maintained or increase over time, creating zero carbon debt.

Market Prospects

Forestry's role in climate change mitigation and financing is set to increase

The financing gap for promoting sustainable land-use and forestry, including REDD+ is significant; to such an extent that without the mobilization of private sector investments the targets will never be met. The Commission on Climate and Tropical Forests (2010) has assessed that the scale of financing required to halve deforestation will increase over the current decade, reaching USD 30 billion annually by 2020. The Global Canopy Programme (2012) estimated annual financing needs of USD 20-40 billion by 2030. The current global annual commitment to REDD+ is just about USD 1 billion, indicating a significant financing gap.

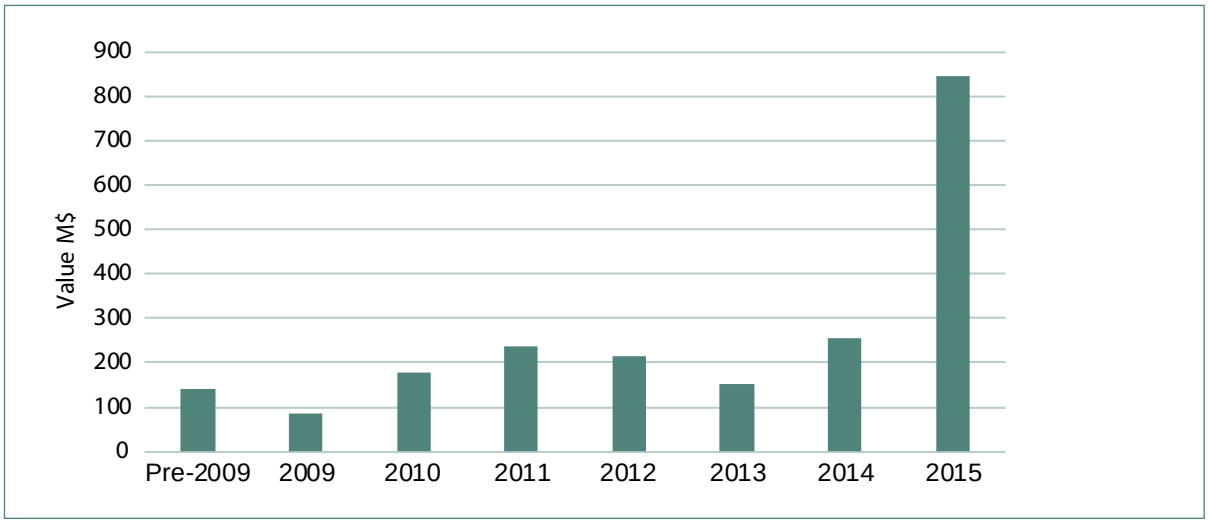
Carbon management has become a prominent environmental issue in the finance sector and is an increasingly mainstream investment consideration. Despite the global, regional and national importance of carbon sequestration services provided by the forests, the markets for forest carbon credits are not yet fully developed. There is still a huge need to mobilize private sector investments into climate change mitigation, including forest carbon projects. E.g., the European Emissions Trading System (ETS), the largest carbon market in the

world, has not yet integrated forest carbon in its cap-and-trade system. Private sector investments have not yet increased as expected because the policy and regulatory environment has been under-developed and even volatile, and hence risky. Carbon prices have also been considered too low in recent years to encourage investment; in the European ETS carbon prices have been low due to oversupply of carbon permits.

According to the 2016 "State of Forest Carbon Finance" report (Ecosystem Marketplace 2016a), the cumulative historical forest carbon finance commitments topped USD 6 billion by the end of 2015. In 2015, USD 888 million in new forest carbon finance commitments were tracked. In addition, an additional USD 4.4 billion was pledged to tropical forest governments for results-based payments to reduce deforestation (REDD+). These pledges will convert to commitments when a contract is signed (Figure 9).

Active forest carbon projects now cover more than 28 million hectares, while jurisdictional programs are poised to scale up avoided deforestation efforts over ever larger land areas.

Figure 9 Historical Market-Based Payments for Forest-Based Emissions Reductions



Source: Ecosystem Marketplace 2016a.

Prospects for the forest carbon market look now more promising

After the Paris Agreement, the prospects for the forest carbon market look now more promising although at present low carbon credit prices pose a serious problem for investors. The demand for carbon credits is predicted to increase, and investment opportunities in forest carbon projects to accelerate, driven by predicted average carbon credit price increases. The main positive drivers are:

- *The Paris Agreement in 2015 acknowledged the role of forestry and REDD+ in meeting the climate mitigation targets and provided a future for international market mechanisms* as a tool for countries to fulfil their agreement on what contribution they intend to make to achieve the worldwide goal. *"Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests"..*
- The *markets for forest carbon credits are expanding.* Carbon pricing is currently in place in 38 territorial jurisdictions, according to the World Bank, encompassing both carbon taxes and emissions trading schemes (ETS).
- *The option of including the net value of the carbon absorbed by forests into emission trading and reduction* is currently under consideration in the EU.
- *The California compliance carbon market is growing, and it has the biggest potential for forest carbon credits currently in the world.*
- *China is poised to launch a national cap-and-trade system and national "carbon market" in 2017 that will "dwarf" all the other markets.* It is also likely to integrate forest carbon in the system, based on experiences from the pilots.

- *The International Civil Aviation Organization approved in October 2016 a global market-based mechanism to address international aviation emissions.* This marks the airline industry the first industry sector ever to adopt a global carbon market and will be the first sectoral system to provide market-based finance for REDD+ activities.
- *New financial tools, such as climate, or green, bonds are emerging to facilitate investments in "climate forestry".*

Forests and Water

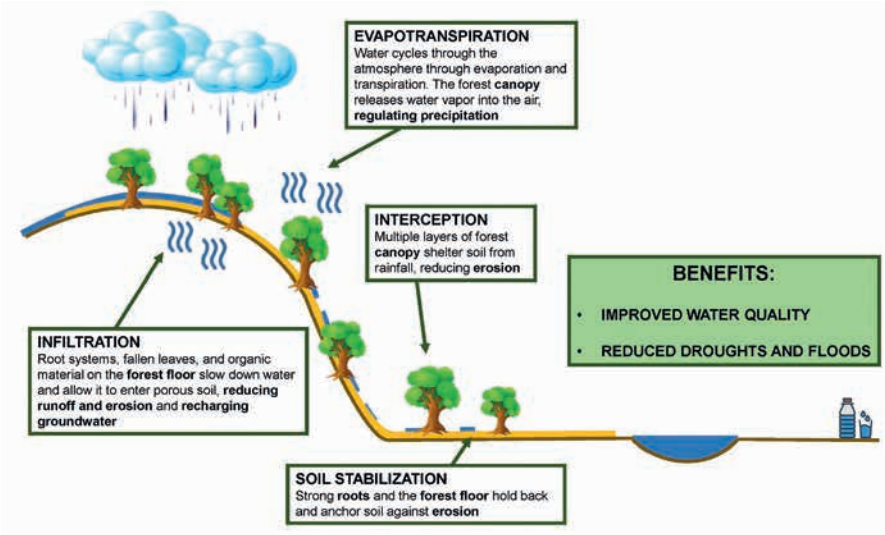
Nature of Services, Status, and Trends

Water is a finite resource for which there is no substitute. Less than 1% of the world's water is available for use and this limited supply is increasingly threatened by pollution, particularly in emerging market countries as they grow and industrialize. Water is essential for feeding the world with nearly 70% of water supply used for agriculture. Industrial use accounts for a little more than 20% of the water supply and further highlights its importance for economic growth. Historically, water demand has grown at twice the rate of population growth and is expected to grow by 41% by 2030. Under current population and growth trends, it is predicted that global water demand will exceed available supply by 40 percent by 2030 (Ecosystem Marketplace 2016b; The Rockefeller Foundation 2015).

The water-related functions of healthy forested landscapes are well-established. Maintaining healthy, forested landscapes and implementing best practices in forest management can be effective strategies for promoting source water quality and regulating flow. For example, forests help to anchor soil against erosion, promote infiltration and minimize overland flow, prevent nutrient delivery to streams, minimize the impact of rain-on-snow events, and maintain snow pack later into the spring. On the other hand, "bad" forest management practices can also cause adverse impacts on the quality of water.

Forests and wetlands provide essential services to water utilities, businesses, and communities—from water flow regulation and flood control to water purification and water temperature regulation. High source water quality and well-regulated flow can reduce the capital and variable costs of providing clean and abundant water. The trunks and roots of forest ecosystems also act like a sponge, controlling the flow of surface and ground water into river systems, which helps to regulate cycles of flood and drought. Forests purify water and help to regulate water flows to downstream areas. Forests, especially forest soils, act like massive filters, purifying water as it drips through the forest ecosystem (Figure 10).

Figure 10 Role of Forests and Sustainable Land Use in Supporting Delivery of Water Services



Source: water.globalforestwatch.org

Forests provide natural filtration and storage systems that supply an estimated 75 percent of usable water globally. This filtration service provides drinking water to over 60 million of the world's population who dwell in tropical rainforests and to some of the world's largest cities. At least one third of the world's biggest cities, such as New York, Singapore, Jakarta, Rio de Janeiro, Bogotá, Madrid and Cape Town, draw a significant portion of their drinking water from forested areas (Global Canopy 2012).

Nearly two-thirds of the water supply in the US trace their source to small headwater streams surrounded by forests that play an integral role in filtering impurities, reducing sedimentation, regulating water flows, and delivering other benefits (WRI 2015).

Forests also impact on rainfall at a regional and even continental level. A study, in the influential Global Change Biology scientific journal, shows that reducing forest area reduces regional and continental rainfall (Ellison et al. 2012). Afforestation and reforestation on the other hand can be used as an invaluable climate change adaptation tool to bring increasing moisture to regions where rainfall is on the decline.

More than 25 million ha of forests in Europe are designated for the protection of water supplies, the prevention of soil erosion and the provision of other important ecosystem services. An increase in the scarcity of water has led to a focus on the provision of drinking water from forests. Forests serve to replenish and provide clean drinking water. One third of European lakes are in forested catchment areas. Forests growing in flood plains have significant roles in water retention. 4.5% of European forests can be defined as floodplain forests. One third of European rivers are flowing through forested catchment areas (European Environment Agency 2015).

Overall, more than half of the river and lake water bodies in Europe are reported to hold less than good ecological status or potential. The EU Water Framework Directive aims to ensure restoration of Europe's water bodies to "good ecological status" by 2027. Many Member States will struggle to meet this target, with around half of EU river catchments currently reporting below standard water quality.

Human transformation of freshwater ecosystems is rapidly exceeding the capacity required to sustain the conditions we need to survive and thrive. Water crises are already impacting people around the globe. The availability and quality of water in many regions of the world are more and more threatened by overuse, misuse and pollution, and it is increasingly recognized that both are strongly influenced by forests. Habitat loss is affecting watershed areas and is reducing supply of clean water and increasing soil loss and floods. Moreover, climate change is altering forest's role in regulating water flows and influencing the availability of water resources. Water scarcity can reduce crop yields and productivity, including power plant output, which can subsequently push up food and energy costs and disrupt businesses and their supply chains in addition to adverse impacts on people's welfare (Water Resources Group/ McKinsey 2009).

Water services are becoming more valuable for the society, and are increasingly recognized in the market. There are a range of estimates for the value of water regulation and supply. One study puts the figure at USD 2.3 trillion globally. Another study, focused at the national level in China, estimates that the value of the water storage function of that country's forests is estimated as 7.5 trillion yuan (approximately USD 1 trillion); three times the value of the wood in its forests (CIFOR 2012).

Information from the four European cities of Berlin, Vienna, Oslo and Munich allows an illustration of the benefits of protected areas and sustainable forest management for water purification and provision. The annual economic benefits of water purification are EUR 7 16 million, and the value of water provision between EUR 12 million and EUR 91 million, depending on the city. In case of Oslo, 100% of water-related ecosystem services were provided by forests, and in case of Munich 75% (IEEP 2011a). The New York City and Catskill-Delaware watershed provides a classic example from the United States.

Market Prospects

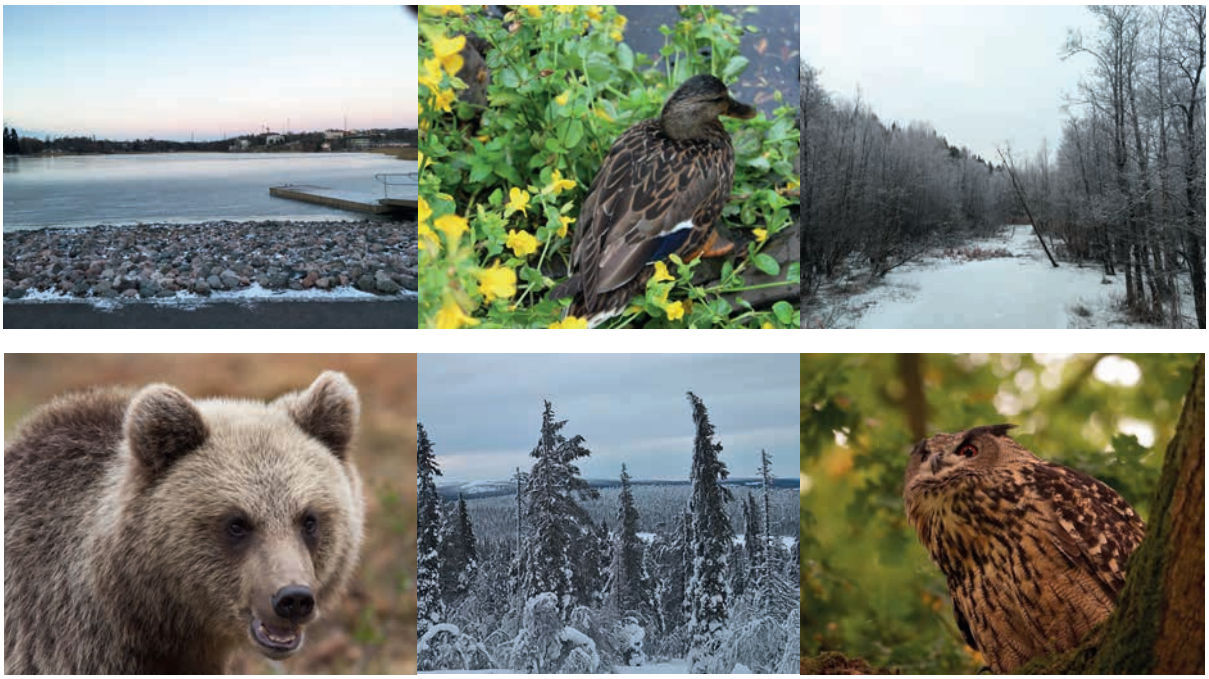
Watershed investments are gaining prominence worldwide

As more policymakers and water providers recognize the range of public and private benefits of natural infrastructure, watershed investments are gaining prominence worldwide. The fresh Ecosystem Marketplace report "State of Watershed Investment" (Ecosystem Marketplace 2016b) states that the direct payments for watershed services, both by the public and private sectors, have continued to increase to record levels.

In 2015, governments, water utilities, companies, and communities spent nearly USD 25 billion on payments for green infrastructure for water. More than 400 programs in 62 countries invested in the natural ability of forests, wetlands, grasslands, and other ecosystems to ensure clean, reliable water supplies for cities and communities, and to combat threats from rapid urban expansion and agricultural pollution. The total amount invested in watersheds has increased by 12 percent per year on average in 2008-2015, and the number of programs has more than doubled in that period (Ecosystem Marketplace 2016b). A first ever global inventory of schemes provisioning water for cities (FAO 2011) demonstrated the importance of forests in delivering water to cities and identified many related PES schemes worldwide.

These payments protected, rehabilitated, or created new habitat on more than 486 million ha of land around the world, an area nearly 1.5 times the size of India. In total an estimated USD 16 billion were paid to landholders to reward good stewardship. Public subsidies and payments for watershed protection (wherein governments reward landholders for good stewardship), dominated the investments in 2015 like in the past. Public subsidies of this type are the largest and steadily growing source of watershed investments.

Albeit still a relatively small market, water quality trading and offsets programs jumped from USD 20.8 million in transactions in 2013 to nearly USD 32 million in 2015, hitting an all-time high. Water quality markets have been established in the US, Canada, Australia and New Zealand. There is also interest in these schemes in China and Europe, although no programs are currently in place. Environmental water markets, which connect buyers and sellers of water use rights seeking to restore water to overdrawn river systems and aquifers, have also been growing, led by Australia followed by the US (Ecosystem Marketplace 2016b; the Rockefeller Foundation 2015). Examples of market-oriented investments to securing forest-related water services are provided in Box 7.



Box 7 Examples of Investments in Securing Forest-related Water Services

The New York City - Catskill-Delaware payment for watershed services scheme. The watershed supplies 90% of the City's drinking water PES scheme is by far the largest scheme in the world putting into effect direct payments by a beneficiary of hydrological services to the service providers. The New York City water utilities pay farmers carrying out watershed protection upstream in the Catskill Mountains to reduce the high cost of treating water downstream closer to the city. Annual payments for watershed management services have average about USD 167 million. Payments fund conservation easements on the forests and open spaces around reservoirs, habitat restoration, and related activities.

Coca-Cola in Los Angeles and San Gabriel Watershed. One third of Los Angeles County residents and businesses get their water from the San Gabriel watershed. Coca-Cola uses a lot of water to produce its beverages – including its popular water brand, Dasani. The water used to make the products is locally sourced. Coca-Cola is now investing in restoring a portion of the San Gabriel watershed through a memorandum of understanding.

Nestle (Vittel-Nestlé Waters), a multinational drinks company recognized a few years ago, that its aquifer in northern France was being polluted by nitrate fertilizers and pesticides from nearby farms. It devised a scheme to pay farmers to change their methods and deliver the ecosystem service of unpolluted water. It discovered that it would be cheaper to invest in conserving the farmland surrounding their aquifers than to build a filtration plant to address water quality issues found in 1990. These schemes cover now some 10,000 ha.

Danone-Evian has developed sophisticated PES schemes in France in their water source areas to pay farmers who adopt sustainable agricultural practices that avoid water pollution

Trinkwasserwald® e.V., and Bionade (private soft drink company) Germany. Trinkwasserwald association converts privately and publicly owned areas of forest to increase the natural benefits of groundwater recharge in forests. The planting is financed partly by companies wishing to offset their use of water during production activities. Private contracts are signed between Trinkwasserwald and the public or private forest land owners for a period of more than 20 years. The association has established cooperation with the private soft drink company Bionade Corporation that pays for the establishment of "drinking water forests".

Latin American examples: In Quito, Ecuador and in several smaller cities in Honduras and Costa Rica, the water utility and electric power companies pay local people to conserve the watersheds from which water is drawn. Costa Rican hydropower company Energia Global (now Enel Latin America) makes payments to a forest protection fund that pays landowners upstream of the company's dams to conserve or reestablish tree cover, thereby reducing river siltation and the need for reservoir dredging. In Venezuela, the power producer CVG-Edelca pays a proportion of its revenues towards the preservation of the Rio Caroni watershed.

Panama Canal case provides a unique and powerful example of the payment scheme to deliver crucial watershed services (green infrastructure). The dry season traffic through the canal is threatened due to too low water flow caused by deforestation of the watershed. A reduction in water flows that disrupts operation of the Panama canal can potentially affects the global community. Financial incentives are provided to land owners to reforest and protect land so that water flow could be improved and secured to enable smooth navigation through the canal.

Water is becoming more scarce and valuable over time

The issues surrounding water – its use and abuse, its scarcity, its relative availability, and its cost to consumers - are set to be high on the global agenda for the foreseeable future. The year 2015 was a year of weather extremes with continuing severe droughts in California and São Paulo, deluges in India and the eastern US, perpetual water scarcity in the Middle East, and rising seas in Bangladesh. Water-related challenges such as these will become even more frequent, severe, and unpredictable. Population growth, uneven distribution of resources, increasing urbanization and new government policies and regulations are the key factors influencing the rise in demand for water. Deforestation, pollution and climate change are taking a toll on supply.

What is certain is that water will become more scarce and hence valuable, and forests will play an important role in maintaining, and even improving the water supply and quality in many parts of the world. Investments in "green infrastructure", such as sustainably managed forests in watersheds and forest restoration, are needed to mitigate the adverse impacts on water services. Forest management practices must also pay attention to maintaining the quality of water. With the situation becoming more critical, governments, international development agencies and businesses are all stepping up efforts to find solutions.

In 2016, FAO together with UNECE launched an initiative that emphasizes the links between forests and water. Valuation and payments for forest ecosystem services in relation to water were addressed as part of work.

The EU Water Framework Directive aims to ensure restoration of Europe's water bodies to "good ecological status" by 2027. Many Member States will struggle to meet this target. New economic instruments, including payments for ecosystem services, with a particular focus on watershed protection and tree planting, are now considered as mechanisms that could play an important role in promoting land use change to deliver water quality targets. In California, the state entering its sixth year of drought, Governor Jerry Brown signed on September 2016 a landmark law, Assembly Bill 2480, declaring that "source watersheds are recognized and defined as integral components of California's water infrastructure." This will make it possible to funnel billions of dollars in infrastructure finance towards the restoration of forests and the maintenance of meadows, streams and rivers.

Markets for watershed services are expanding

The new report by the Ecosystem Marketplace (2016) concludes that environmental water markets are becoming more flexible and accessible to private investors, making them a promising mechanism for conservation finance in the coming years. This will contribute to creating a buoyant marketplace for water-related investing in coming years.

Impact investing, with its pragmatic approach to profit and its commitment to delivering social and environmental benefit, is likely to play a more important role in this market. The Nature Conservancy - one of the world's leading conservation organizations introduced in mid-2016 Water Sharing Investment Partnerships program targeted at impact investors to leverage existing water markets for conservation purposes. Essentially, they solicit investor capital to acquire a portfolio of water rights. Most of these rights are either leased or sold back on the market, giving investors a financial return and ensuring farmers and cities have access to enough water (*https://global.nature.org/content/water-share-report*).

Direct conservation/protection agreements and voluntary offsets are also likely to increase. Compared to the carbon (at another extreme) watershed services markets are much more local by nature which favors agreements. For example, private water companies in England and Wales have scaled up their investment in watershed management rapidly in the past decade. In 2004, just two companies included watershed management proposals in their business plans; by 2014 the number of proposals had risen to 300, representing EUR 125 million in investment in England and Wales (Ecosystem Marketplace 2016b).

In case of voluntary offsets, buyers pay for watershed protection projects to symbolically mitigate for their own impacts on water supplies or quality. These are not true offsets in the sense that project outcomes are not an exact match biophysically, spatially or temporally for the buyer's actual impacts, but instead roughly equivalent. Examples include Bionade Corporation in Germany's funding of reforestation projects to improve natural groundwater recharge capability, with the goal of recharging a volume of water to the aquifer equal to Bionade's water use in its operations. Buyers are typically companies with clear operational and reputational risks related to water: the Coca-Cola Company, Nestlé, and SABMiller to date have been the largest buyers.

Nature-based Tourism, Recreation, and Cultural Values

Nature of Services, Status and Trends

Forest provide an environment for tourism, outdoor recreation, and wilderness experiences. Forests, mountains, coasts, lakes and rivers are major attractions for tourists around the world, and provide opportunities for investment both directly and indirectly along the tourism value-chain. Forests can be utilized for many recreational activities, including enjoying natural scenery, landscapes and peace; hunting; fishing; collecting berries and mushrooms; trail-riding, bird watching, and other recreational activities. Further, forest can provide cultural values. Around 1.25 million sites with cultural and spiritual values have been recorded within forests and other wooded land across Europe, of which around three quarters were classed as 'Cultural Heritage' (State of Europe's Forests 2015).

More than a third of travelers are found to favor environmentally-friendly tourism and be willing to pay for related experiences. Traditional mass tourism has reached a stage of steady growth. In contrast, ecotourism, nature, heritage, cultural, and "soft adventure" tourism are taking the lead and are predicted to grow rapidly over the next two decades. It is estimated that global spending on ecotourism is increasing about six times the industry-wide rate of growth (UNEP 2011). How much of this growth is related forest landscapes and biodiversity is difficult to assess, but their share is likely to be significant.

Biodiversity plays different roles in different types of tourism. All tourism – even in city centers – relies on natural resources for supplies of food, clean water and other 'ecosystem services' that ultimately depend on biodiversity. For most other types of tourism, biodiversity contributes significantly to the attractiveness and quality of destinations, and therefore to their competitiveness. Thus, sustainable management of forested landscapes and habitats, and their preservation, as well as active management, are needed to deliver the services needed to support nature-based tourism.

The cultural value of trees, woods and forests is becoming an increasingly important aspect of sustainable forest management. Measures of this value are now included in European Commission impact assessments, the Montreal Process and pan-European indicators of the Ministerial Conference for the Protection of Forests in Europe.

The forest ecosystem services related to nature-based tourism and cultural values can be provided in principle in two ways. The most common approach is the establishment of conservation areas by the public sector, such as national or state national parks. Another approach is multiple use management of forests to deliver both recreation and production services; this can be done both by the private sector and public sector organizations. In the US, the forest industry and timberland investors already have add-ons included in their management programs and (complementary) revenue earning strategies. This includes hunting leases, hunting permits and other recreational leases.



Market Prospects

Worldwide, tourism as a whole has been estimated to account for 9.8% of the gross domestic product (GDP) (WTTC 2016). Nature-based tourism is frequently described as one of the fastest growing sectors of the tourism industry, and a very important justification for conservation. How much of this is related forest landscapes and biodiversity is difficult to assess, but their share is likely to be significant.

Wildlife recreation is arguably one of the largest ecosystem markets, when the indirect expenditures are also taken into account along the entire value-chain. A survey by the US Fish and Wildlife Service (2006) estimated that 87 million Americans hunt, fish or view wildlife while spending more than USD 20 billion a year on such pursuits. While wildlife watching was the most popular activity, anglers and hunters still spent the most on wildlife recreation in the US. Some of the investments in the protection of wetlands are related to conservation of the habitat to enable both birdwatching and hunting (Southwick Associates 2011).

In Europe, the total expenditure related to tourism and recreation supported by Natura 2000 (sites) in the EU region has been estimated between EUR 50 and 85 billion.

In the US and in Canada, these markets have been growing rapidly, engaging also increasingly the private sector both as a buyer and supplier of recreation-related forest ecosystem services. For timberland investors, recreational leasing is considered a supplemental source of income, not a primary driver of investment return. As a rule, recreational leases can add about 15 to 60 basis points of return to a US based timberland portfolio. It is possible to manage the forest habitat to improve a property's desirability among recreationalists and add hence value (Fu 2009).

In Canada, the Ducks Unlimited Canada has signed a 30-year provincial umbrella agreement with the provincial governments to formalize the cooperation of the two parties on wetland habitat preservation and enhancement with a special emphasis on wetlands deemed essential to waterfowl. Over 130 site-specific agreements have been signed with Ducks Unlimited authorizing it to manage specific wetland values including the construction and operation of dams and other works to manage water flows. Ducks Unlimited is also paying directly for forests owners in Canada and the US for the preservation of wetlands for hunting purposes.

In Europe, payments are provided through the CAP to protect forest landscapes and conserve high-value habitats and their associated biodiversity. This support includes the conservation, restoration and promotion of the traditional semi-natural landscape including green infrastructures that can become new attractive touristic areas.

FUTURE PROSPECTS

The markets and investment opportunities for forest ecosystem services will expand and diversify

The US and to some extent Australia, will remain market leaders both in terms of volume and range of available investment platforms and vehicles. The development in Europe, regarding e.g. biodiversity offset markets or forest carbon markets, will be slower mainly due to the underdeveloped regulatory framework. In the coming years, explicit No Net Loss Policy combined with mandatory compensation requirements along the mitigation hierarchy may become a reality. Until that voluntary schemes and pilots will dominate.

The *main drivers for the growth in forest ecosystem markets and private sector investments* in the emerging biodiversity-based asset class are:

- *increasing scarcity of biodiversity and water;*
- *improved understanding of the economic value of non-wood forest resources and ecosystem services;*
- *citizens' and companies' growing concerns about shrinking biodiversity;*
- *regulatory development;*
- *financing gap in conservation financing;*
- *emerging investment trends, including the growth of the impact investing; and*
- *emerging investment vehicles and enhanced role for the private sector.*

Forest-related ecosystems services will become increasing scarce and valuable

Increasing scarcity of biodiversity and other natural capital. Across the range of biodiversity measures, current rates of loss exceed those of the historical past by several orders of magnitude. The fact that biodiversity and habitats supporting a range of ecosystem services are declining at a much faster rate than the forest area will mean that the value of these services is likely to increase over time simply because they are becoming more scarce.

Improved understanding of the economic value of non-wood forest resources and ecosystem services. Several in-depth studies, and analysis of biodiversity and climate changes related business risks, have demonstrated the importance of the economic values of forest ecosystem services (provisioning, regulating, cultural, and supporting) globally, regionally, nationally and locally not only for the public but the business community.

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The important role forestry can play in climate change mitigation. The global climate agreement reached in Paris in 2015, and its ratification in 2016, will stimulate additional investments and financing to the sector in low carbon, energy-efficient economy, and sustainable forest management and supply chains. The option of including the net value of the carbon absorbed by forests into emission trading and reduction is currently under consideration in the EU which would for the first time create forest carbon investment opportunities in the European market. There are also major ongoing efforts to change food and other products supply chains towards from materials and products coming from sustainable sources. At the World Economic Forum in Davos in January 2017, Norway announced a new USD 400 million fund to tackle agriculturally-linked deforestation in support of New York Declaration on zero deforestation.

Need for accelerated market-based conservation financing and new investment platforms and vehicles

Financing gap in conservation financing. There is an estimated USD 200-300 billion global funding gap to meet the biodiversity and other conservation objectives (Credit Suisse and McKinsey 2016; EKO Asset Management Partners et al 2014; Credit Suisse et al 2014). It is increasingly recognized in Europe that the public sector alone cannot provide the additional financing, and further, more flexible market-driven approaches to conservation financing are needed. In 2011, a pioneering study indicated that the costs of undertaking environmentally beneficial land management on agricultural and forested land in 2020 within EU amount at least to EUR 34 billion annually, while annual funding directly and indirectly related to conservation has been less than one third (IEEP 2011b). About EUR 3.5 billion per annum should be provided to restoration, rehabilitation, conservation and management of forests to deliver environmental benefits. Currently, most of biodiversity loss prevention is financed via government budgets. In the future, funding must rely more on the private sector given the pressure of government budgets.

Emerging investment trends including the growth of the impact investing. The trend of robust growth in sustainable and impact investing is continuing as investment managers apply environmental, social and governance (ESG) criteria across broader portions of their portfolios, often in response to client demand. Also, low interest rates encourage investors to seek alternative sources of returns. Asset managers, institutional investors, advisors and individuals are moving toward sustainable and impact investing to advance critical social, environmental and governance issues in addition to seeking long-term financial returns. In the US, sustainable, responsible investing (SRI) assets grew by 33% between 2014 and 2015, up to USD 8.72 trillion from USD 6.57 trillion in 2014. Even Goldman Sachs Asset Management entered the game with its July 2015 acquisition of impact investing advisory firm Imprint Capital. Foundations have deepened their practice of mission investing - using a variety of strategies to create positive environmental impacts aligned with their mission. Examples of impact investors linked to the forest sector are provide in Box 8. The Finnish Dasos Capital can be considered a leading impact investor in the forest sector in Europe through its investments in certified, sustainable forests.

Emerging investment vehicles. There is great potential for conservation impact investing to achieve environmental and social benefits alongside market-rate financial returns. New financial vehicles are emerging to enable growth of this type of investments – including performance-based compensation for delivering environmental services and over time establish a conservation finance asset class. Increased blending of public and private financing. The number of investment vehicles and financial institutions incorporating ESG criteria continues to grow. New financial tools such as climate, or green, bonds are emerging to facilitate investments in "climate forestry". Green bonds, and specifically green climate bonds, or Agriculture, Forestry and Other Land Uses (AFOLU)/REDD climate bonds, can help to leverage significant amounts of private capital from institutional investors to help overcome the upfront investment costs and financing requirements of protecting and managing forests sustainably

The development of new instruments and facilities such as the NCFF of the Europe and green (forestry) bonds will also stimulate the investments in biodiversity conservation. In late 2014, Credit Suisse introduced "Nature Conservation Notes", which appears to be the first major bank to offer non-institutional clients a conservation investment product that targets market-rate returns. Conventional investment firms are increasingly active in creating and marketing targeted products for sustainable investors. In recent years, they have launched a variety of ESG-themed funds.

Box 8 Examples of Forestry-Related Impact Funds

Ecosystem Investment Partners (EIP) closed its third fund at USD 303 million in 2016, surpassing its USD 200 million target. Like its predecessors, EIP III LP will invest in land-based environmental offset markets. Ecosystem raised USD180.7 million for its second fund in 2012. EIP's investment strategy remains focused on the Land-Based Environmental Offset markets established to offset or "mitigate" unavoidable, permitted impacts to wetlands, streams and other important natural resources throughout the US. To capitalize on these markets, EIP acquires, entitles, restores, sustainably manages and ultimately divests properties that generate revenues through the sale of wetland, stream, endangered species and other environmental credits to entities seeking compliance under these and other environmental regulations that require offsets to unavoidable impacts.

Althelia Climate Fund, based in Europe, has recently raised USD 122 million for investing in ecosystems conservation, sustainable agroforestry, and climate change mitigation. Returns are generated through the production and sale of real assets in the form of sustainable agriculture and forestry commodities such as certified cocoa and timber as well as environmental services including carbon emission reductions and other payment for ecosystem services such as biodiversity and water. Forest-based emissions reductions financed by the Fund will also be validated and verified to both the Verified Carbon Standard and the gold level of the Climate Community and Biodiversity (CCB) Standard for projects delivering smallholder/community-led equitable benefits and exceptional biodiversity benefits, as appropriate. The Fund will also work to ensure that its investments are developed in such a way as to be eligible for recognition within jurisdictional (sub-national and national) REDD+ programs that are under development.

The EKO Green Carbon Fund invests in and is designing ecosystem-based investment strategies to address global climate change through the development of carbon offsets primarily from land-based carbon sequestration projects, including forestry Investments also aim at providing co-benefits such as healthier ecosystems that support biodiversity, sustainable wildlife habitat and fresh water. There is a "Parallel Fund" which invests alongside the main fund. The Parallel Fund distributes carbon offsets in kind to investors as opposed to delivering financial returns. The bulk of the investments in the portfolio are Improved Forest Management projects that are generating carbon offset credits for the California Air Resource Board cap-and-trade program.

The Eco Products Fund is a USD 100 million private equity vehicle investing in mainly US-based markets for ecosystem services. The fund returns are driven by the sale of environmental credit positions related to carbon, biodiversity and water related assets. The fund primarily invests in US forest carbon markets; wetlands and stream mitigation banks and endangered species conservation banks regulated by US federal legislation; and nutrient trading.

Ecotrust Funds (I and II) manage land on behalf of investors and forestland owners to enhance forest health and productivity, and to produce a diverse array of forest products and services including timber, biomass, carbon, and improved habitat and water quality. The investment manager seeks to capture a wide array of funding sources such as carbon credits, conservation easements, and restoration funding — to supplement private capital resources in the acquisition and management of forestland.

The *private sector investors see lack of suitable (in terms of risk-return profile, governance, reporting, etc.) investment vehicles and platforms as the main bottleneck in allocating more investments to the conservation market.* Voluntary offsets, compensation mechanisms based e.g. on agreements, and new financial vehicles aligning with the longer time-frame of ecological restoration projects, are needed in Europe, building on the lessons learned over the last 2-3 decades in the US. Private sector can play an

extremely important role in terms of developing and piloting new approaches, e.g., jointly with the conservation community, research agencies and government organizations. They can also have positive demonstration impacts.

Need for strong European action

Europe is still far behind the US in the establishment of functioning ecosystem markets. The policy and regulatory framework does not yet fully support establishment of such markets, and there's shortage of pilots suitable for investors seeking opportunities to combine environmental and social objectives with financial returns. In Europe, new pilots are very much needed. Europe still has limited experience market-driven conservation financing. Also, the range of applicable tools is limited compared to the US situation that has wetlands mitigation banking, conservation mitigation banking, conservation easements, conservation agreements and a major carbon market place in California that includes forest carbon credits, and pays also attention to co-benefits such as conservation of biodiversity.

The underdeveloped European markets require professional market leaders to develop the market and to offer institutional quality investment vehicles. Finland, and Europe, in general, need new solutions and innovations to deliver ecosystem services efficiently and effectively. For biodiversity and other ecosystem services investing to become a mainstream investment approach, there is naturally a need for improved regulatory framework but there is also a great need to develop accepted standards and appropriate metrics to facilitate the development of biodiversity markets.

Need for new supporting tools and improved scientific knowledge-base

In addition to policy and regulatory developments, the *development of market-based conservation financing, and especially its scaling up in the EU, will require addressing some quite crucial more technical challenges*:

- *Need for scientific, concrete, and implementable standards and metrics and verification systems to make habitat banking and offsetting to be successful.* It is important to develop metrics that provide full representation of biodiversity and outcomes that are equivalent. Investors and buyers of compensations want to be sure of the long-term delivery of ecological benefits.
- *Identification of suitable sites and demonstrating* additionality is not always easy, and can be costly with large-upfront costs. Further, you need capable conservation managers. The biodiversity improvements at offset sites should provide new contributions to biodiversity conservation over and above the existing levels which requires the establishment of a baseline reference.
- *Identification, demonstration and verification of the effectiveness of restoration technologies.* For some species recovery times may not be achieved within the timeframe of the offset and losses may therefore be considered irreversible.
- *Determining (scientifically) the appropriate threshold of acceptance of conservation outcomes* to avoid the risk of inadvertently giving developers a 'license to trash'**.** This refers to the importance of strictly adhering to the mitigation hierarchy.
- *Enforcement of compliance.* This would require development of appropriate institutional structures and capacity.

REFERENCES

BBOP (Business and Biodiversity Offsets Programme). 2012. Standard on Biodiversity Offsets. Washington, D.C. *http://bbop.forest-trends.org/guidelines/Standard.pdf*.

Berndes, G., Abt, B., Asikainen, A., Cowie, A., Dale, V., Egnell, G., Lindner, M., Marelli, L., Paré, D., Pingoud, K., and Yeh, S. 2016. Forest Biomass, Carbon Neutrality and Climate Change Mitigation. From Science to Policy 3. European Forest Institute.

Bracmort, K. 2016. Is Biopower Carbon Neutral? Congressional Reserch Service. The United States.

Ceballos, G., Ehrlich P.R., Barnosky, A.D., García A., Pringle, R.M., and Palmer T.M. 2015. Accelerated Modern Human-Induced Species Losses: Entering the Sixth Mass Extinction. Sci Adv. 2015 Jun 19;1(5).

CIFOR (Center for International Forestry Research). 2012. Forests and Water: What Policymakers Should Know? Fact Sheet. No 6. November 2012.

Climate Bonds Initiative. 2016. Bonds and Climate Change: The State of the Market in 2016.

Commission on Climate and Tropical Forests. 2010. Protecting the Climate Forests: Why Reducing Tropical Deforestation is in America's Vital National Interest?

Costanza, R., de Grootb, R., Sutton, P., van der Ploegb, S., Anderson, S.J., Kubiszewskia, I., Farbere, S., and Turner, R.K. 2014. Changes in the Global Value of Ecosystem Services. Global Environmental Change. Volume 26, May 2014.

Costanza, R., d'Arge, R., de Groot,R.S., Farber, S., Grasso, M., Hannon, B., Limburg, K., Naeem, S., O'Neill, R.V., Paruelo, J., Raskin, R.G., Sutton, P., and van den Belt. M. 1997. The Value of the World's Ecosystem Services and Natural Capital. Nature 387:253–260.

Credit Suisse and McKinsey. 2016. Conservation Finance. From Niche to Mainstream: The Building of an Institutional Asset Class.

Credit Suisse, WWF, and McKinsey. 2014. Conservation Finance. Moving Beyond Donor Funding Toward an Investor-Driven Approach.

Dasos Capital Oy. 2016. Research report. Unpublished.

Dasos Capital Oy. 2017. Research report. Unpublished.

EC (European Commission). 2011. Estimating the Economic Value of the Benefits Provided by the Tourism/ Recreation and Employment Supported by Natura 2000. Final Report. DG Environment.

Ecosystem Marketplace. 2016a. View from the Understory. State of Forest Carbon Finance 2016. Forest Trends. Lead Author Allie Goldstein, Contributing Author Franziska Ruef.

Ecosystem Marketplace. 2016b. Alliances for Green Infrastructure: State of Watershed Investment 2016. Forest Trends. Lead Author Genevieve Bennett, Contributing Author Franziska Ruef.

EKO Asset Management Partners and NatureVest. 2014. Investing in Conservation: A Landscape Assessment of an Emerging Market.

EFTEC. 2012. Innovative Use of Financial Instruments and Approaches to Enhance Private Sector Finance of Biodiversity Final Summary Report to European Commission Directorate-General Environment.

Ellison, D., Futter, M.N., and Bishop, K. 2012. On the Forest Cover–Water Yield Debate: from Demand-to Supply-Side Thinking. Volume 18, Issue 3, March 2012.

The Environment Bank. 2016. International Examples. Information Sheet 8. *www.environmentbank.com/ library.php*.

EU Biodiversity Strategy. 2012. European Parliament Resolution of 20 April 2012 on Our Life Insurance, Our Natural Capital: an EU Biodiversity Strategy to 2020 (2011/2307(INI)).

EU Forest Strategy. 2013. A New EU Forest Strategy: for Forests and the Forest-Based Sector. COM (2013) 659 final.

EEA (European Environment Agency). 2015. The European Environment. State and Outlook 2015. Synthesis report.

EC (European Commission). 2016. Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and amending Regulation No 525/2013 of the European Parliament and the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change (COM (2016) 479 final. Brussels.

FAO (Food and Agriculture Organisation of the United Nations). 2011. Payment for Environmental Services: First Global Inventory of Schemes Provisioning Water for Cities by Branka Buric and Jean Gault. FAO. Rome.
FAO. 2016a. State of the World's Forests 2016. Forests and Agriculture: Land-Use Challenges and Opportunities. Rome.
FAO. 2016b. The Global Forest Resources Assessment 2015: How Are the World's Forests Changing?
Fauna and Flora International. 2015. Biodiversity Offsets: Lessons Learnt from Policy and Practice Synthesis Report. Nicky Jenner and Pippa Howard. Supported by the Arcus Foundation.
FERN. 2016. Burning Trees for Energy is No Solution to Climate Change. Bioenergy Briefing Note.
Forest Trends. 2015. Ecosystem Markets and Finance: A Global Primer. Ecosystem Market Place.
Fu, Chung-Hong. 2009. Making Trees Greener: Opportunities in Ecosystem Services for Timberland Investors.
Global Canopy Programme. 2012. The Little Biodiversity Finance Book - 3rd edition.
Gold Standard. 2014. The Real Value of Robust Climate Action. Impact Investment Far Greater Than Previously Understood. A Net Balance Report for the Gold Standard Foundation.
Goldstein, A. 2016. Not So Niche: Co-benefits at the Intersection of Forest Carbon and Sustainable Development. Ecosystem Market Place and Forest Trends.
Hamrick, K. 2016. State of Private Investment in Conservation 2016. A Landscape Assessment of an Emerging Market. Ecosystem Marketplace.
Hanson, G., Ranganathan, J., Iceland, C., and Finisdore, J. 2012. The Corporate Ecosystem Services Review. Guidelines for Identifying Business Risks & Opportunities Arising from Ecosystem Change. WBCSD.
Hanski, I. 2005. The Shrinking World: Ecological Consequences of Habitat Loss. International Ecology Institute.
Hanski, I. 2015. Habitat Fragmentation and Species Richness. Journal of Biogeography. Volume 42, Issue 5 May 2015
Hetemäki, L. 2015. Metsien käytöllä voidaan leikata ilmastopäästöjä. Vieraskynä. Helsingin Sanomat 18.12. 2015.
IEEP. 2011a. Estimating the Overall Economic Value of the Benefits Provided by the Natura 2000 Network. Synthesis Report. Prepared by IEEP, Ecologic Institute, GHK, Metroeconomica, and Eftec.
IEEP. 2011b. Costing the Environmental Needs Related to Rural Land Management. Final Report. Project ENV.F.1/ETU/2010/0019r.
IEEP. 2014. Policy Options for an EU No Net Loss Initiative. Final Report ENV.B2/SER/2012/0028. The Institute for European Environmental Policy (IEEP) in collaboration with VU IVM, Eftec and GHK.
IINAS (International Institute for Sustainability Analysis and Strategy), EFI, and Joanneum Research. Forest Biomass for Energy in the EU: Current Trends, Carbon Balance and Sustainable Potential. For BirdLife Europe, EEB, and Transport & Environment. Final report.
IPPC 2007. IPP Fourth Assessment Report.
IUCN. 2007. Species Extinction – The Facts. The IUCN Red List of Threatened Species
ICMM (International Council on Mining and Metals) and IUCN. 2013. Independent Report on Biodiversity Offsets. Environmental Stewardship. by The Biodiversity Consultancy. w*ww.icmm.com/biodiversity-offsets*.
Jäppinen, J.-P. and Heliölä, J. (eds.). 2015. Towards a Sustainable and Genuinely Green Economy. The Value and Social Significance of Ecosystem Services in Finland (TEEB for Finland). Synthesis and Roadmap. The Finnish Environment 1en/2015. The Finnish Ministry of Environment, Helsinki
Kelly, E.R. and Schmitz, M.B. 2016. Forest offsets and the California Compliance Market: Bringing an Abstract Ecosystem Good to the Market. Geoforum. October 2016, Vol 75:99-109.
Kniivilä, M., Kosenius, A.-K. and Horne, P. 2014. Habitat Banking – the Pros and Cons and Applicability to Finland. PTT Working Papers 161.
Kormos, R., Mead, D., and Vinnedge, B. 2015. Biodiversity offsetting in the United States: Lessons Learned on Maximizing Their Ecological Contribution.
Krieger, D.J. 2001. Economic Value of Forest Ecosystem Services: A Review. The Wilderness Society.
Liang,J. et al. (83 other authors). Positive Biodiversity-Productivity Relationship Predominant in Global Forests. Science, 2016; 354 (6309).
Maaseudun tulevaisuus. 2016. Uudet metsäsodat uhkaavat, MTK ehdottaa suojelurahastoa. Article in the Maaseudun tulevaisuus journal. December 16, 2016.
Madsen, B., Carroll, N., Moore, B. 2010. State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Available at: *http://www.ecosystemmarketplace. com/documents/acrobat/sbdmr.pdf*.
Madsen, B., Carroll, N., Moore, B. 2011. State of Biodiversity Markets Report: Offset and Compensation Programs Worldwide. Updated version.

McKinsey. 2009. Charting Our Water Future: Economic Frameworks to Inform Decision-making. Report prepared with the support and active participation of each member of the 2030 Water Resources Group.
McNeil, D. and Rayment, M. 2015. Financing Opportunities and Needs: Biodiversity Offsetting and No Net Loss Measures. EU Business and Biodiversity Platform. Workstream: Access to Finance and Innovative Finance Mechanisms.
Merlo. M. and Croitoru, L. 2005. Valuing Mediterranean Forests: Towards Total Economic Value, CABI International, Wallingford UK/Cambridge MA.
Millennium Ecosystem Assessment. 2015. Ecosystems and Human Well-Being. Synthesis.
Nabuurs, G-J., Delacote, P., Ellison, D., Hanewinkel, M., Lindner, M., Nesbit, M., Ollikainen, M., and Savaresi, A. 2015. A New role for Forests and the Forest Sector in the EU Post-2020 Climate Targets. From Science to Policy 2. European Forest Institute.
Nabuurs, G-J., Delacote, P., Ellison, D., Hanewinkel, M., Lindner, M., Ollikainen, M., and Hetemäki, L. 2017. EU Climate Smart Forestry. Manuscript submitted for publication.
Natural Capital Declaration (NCD). 2015. Towards Including Natural Resource Risks in Cost of Capital. State of Play and the Way Forward.
OECD (Organisation for Economic Cooperation and Development). 2016. Biodiversity Offsets: Effective Design and Implementation, OECD Publishing, Paris. *http://dx.doi.org/10.1787/9789264222519-en*.
Paloniemi, R. and Varho, V. 2009. Changing Ecological and Cultural States and Preferences of Nature Conservation Policy: The Case of Nature Values Trade in South-Western Finland (Journal of Rural Studies 25:1, 87-97).
Primmer, E., Kangas, H-L., Liski, J., Rekola, A., Seppälä, J., Kettunen, M., Allen, B., Nesbit, M., and Paquel, K. 2016. Sustainable Forestry in Finland: ENVI Delegation in May 2016. A study for the Committee on the Environment, Public Health and Food Safety. Policy Department: Economic and Scientific Policy. Brussels.
Prokofieva, I., Wunder, S., and Vidale, E. 2012. Payments for Environmental Services: A Way Forward for Mediterranean Forests?
Rockefeller Foundation. 2015. Incentive-Based Instruments for Water Management. The Rockefeller Foundation, evaluation Office.
Schoukens, H., and Cliquet, A. 2016. Biodiversity Offsetting and Restoration under the European Union Habitats Directive: Balancing between No Net loss and Deathbed Conservation? Ecology and Society 21(4):10. *http://dx.doi.org/10.5751/ES-08456-210410*.
Secretariat of the Convention on Biological Diversity. 2014. Global Biodiversity Outlook 4. Montréal.
Science for Environment Policy. 2015. Ecosystem Services and the Environment. In-depth Report 11 produced for the European Commission, DG Environment by the Science Communication Unit, UWE, Bristol. Available at: *http://ec.europa.eu/science-environment-policy*.
Southwick Associates. 2011. The Economics Associated with Outdoor Recreation, Natural Resources Conservation and Historic Preservation in the United States. For the National Fish and Wildlife Foundation.
State of Europe's Forests 2015. Forest Europe. Full report.
Suomen ympäristökeskus. 2008. Suomen luontotyyppien uhanalaisuus – Osa 1: Tulokset ja arvioinnin perusteet. Suomen ympäristö 8/2008.
TBC. 2016. Government Policies on Biodiversity Offsets. Industry Briefing Note of The Biodiversity Consultancy, Cambridge, UK.
TEEB. 2010. The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and recommendations of TEEB.
Tittensor, D.P., Walpole, M., Hill, S.L.L., Boyce, D.G., Britten, G.L., Burgess, N.D., Butchart, S.H.M., Leadley, P.W., Regan, E.C., Alkemade, R., Baumung, R., Bellard, C., Bouwman, L., Bowles-Newark, N.J., Chenery, A.M., Cheung, W.W.L., Christensen, V., Cooper, H.D., Crowther, A.R., Dixon, M.J.R., Galli, A., Gaveau, V., Gregory, A.D., Gutierrez, N.L., Hirsch, T.L., Höft, R., Januchowski-Hartley, S.R., Karmann, M., Krug, C.B., Leverington, F.J., Loh J., Lojenga, R.K., Malsch, K., Marques, A., Morgan, D.H.W., Newbold, T., Noonan-Mooney, K., Pagad, S.N., Parks, B.C., Pereira, H.M., Robertson, T., Rondinini, C., Santini, L., Schindler, S., Sumaila, U.R., Teh, L.S.L., van Kolck, J., Visconti, P., and Ye, Y. 2014. A Mid-term Analysis of Progress towards International Biodiversity. Science 346(6206):241-4.
UNECE. 2014. The Value of Forests. Payments for Ecosystem Services in a Green Economy.
UNECE/FAO. 2016. Forest Products Annual Market Review, 2015-2016. Geneva.
UNEP. 2011. Towards a Green Economy: Pathways to Sustainable Development and Poverty Reduction.
UNFCCC (The United Nations Framework Convention on Climate Change). 2015. Paris Agreement. FCCC/CP/2015/L.9/Rev.1. Adopted on 12 December 2015, not yet into force. Paris.

UNU-IHDP and UNEP. 2014. Inclusive Wealth Report 2014. Measuring Progress Towards Sustainability. Cambridge: Cambridge University Press.
WBCSD (World Business Council for Sustainable Development). 2015. Recommendations on Biomass Carbon Neutrality. Business solutions for a sustainable world.
World Economic Forum. 2015. Global Risks report. Davos.
WRI (World Resources Institute). 2016. Protecting Drinking Water at the Source: Lessons from Watershed Investment Programs in the United States.
WTTC (World Travel and Tourism Council). 2016. 2016 Economic Impact Annual Update Summary. World Travel and Tourism Council.
WWF (Worldwide Fund for Natures). 2016. Living Planet Report 2016. Risk and Resilience in a New Era. WWF International, Gland, Switzerland.

LIST OF WEB PAGES VISITED

climate-standards.org/ccb-standards
climate-standards.org/ccb-standards
eib.org/ncff
forces.fsc.org
forest500.org
global.nature.org/content/water-share-report
goldstandard.org
habitabank.com
water.globalforestwatch.org

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GLOSSARY

Biodiversity offset. Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. In some circumstances, biodiversity offsets are designed to result in an overall biodiversity gain. Offsetting is the final stage in a mitigation hierarchy (see definition below). It can take place onsite or off-site.

Biological diversity or biodiversity means "the variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems". (Article 2, convention on Biological Diversity (CBD)). It encompasses three levels: (i) ecosystem (habitat) diversity; (ii) species diversity; and (iii) genetic diversity.

Carbon offset. The use of carbon credits to enable businesses to compensate for their emissions, meet their carbon reduction goals and support the move to a low carbon economy. Carbon offsetting delivers finance to essential renewable energy, forestry and resource conservation projects which generate reductions in greenhouse gas emissions.

Carbon sink. Natural (e.g. a forest) or artificial reservoir that accumulates and stores some carbon-containing chemical compound for an indefinite period. The process by which carbon sinks remove CO_2 from the atmosphere is known as carbon sequestration.

Compensatory mitigation. The restoration, creation, enhancement, and/or in certain circumstances preservation of natural resources for the purposes of offsetting adverse impacts which remain after all appropriate and practicable avoidance and minimization has been achieved. Compensatory mitigation represents a spectrum of practices that range from rigorous and measurable biodiversity offsets to less direct efforts to compensate for impacts through assessed fees or penalties for adverse land impacts, financial donations and land protection.

Compliance carbon markets. Marketplaces through which regulated entities obtain and surrender emissions permits (allowances) or offsets to meet predetermined regulatory targets. In the case of cap-and-trade programs, participants – often including both emitters and financial intermediaries – can trade allowances or offsets to make a profit from unused allowances or to meet regulatory requirements.

Conservation Bank. A parcel of land containing natural resource values that are conserved and managed in perpetuity, through a conservation easement held by an entity responsible for enforcing the terms of the easement, for specified listed species and used to offset impacts occurring elsewhere to the same resource values on non-bank lands.

Conservation easement (a.k.a. land easement). The most traditional tool for conserving private land in the US. An easement is a legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land to protect its conservation values. It allows landowners to continue to own and use their land – if the use does not violate the conservation terms set out in the easement. It also allows them to sell or pass it on to heirs.

Credit. A unit of measure representing the environmental commodity that can be traded (this can be functional, e.g. a ton of carbon equivalent, or a measure of area), based on the environmental activity.

Credits are units of exchange defined as the ecological value associated with converting to other economic uses a naturally occurring wetland or other specific habitat type. Conservation credits is the quantification of a species' or habitat's conservation values within a conservation bank.

Ecosystem means "a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Each ecosystem contains complex relationships between living (biotic) and non-living (abiotic) components (resources), sunlight, air, water, minerals and nutrients. These biotic and abiotic components are regarded as linked together through nutrient cycles and energy flows. The quantity, quality and diversity of species each play an important role in a given ecosystem.

Ecosystem services refer to the benefits that people obtain from ecosystems. These include: provisioning services: regulating services; cultural services; and supporting services that are necessary to produce all other ecosystem services.

Ecosystem goods are portions of the natural capital itself - such as timber or fish - that are harvested from ecosystems. Often, for simplicity and following standard terminology both ecosystem goods and ecosystem services are referred to as ecosystem services.

Impact investing. Impact investments are investments made into companies, organizations, and funds with the intention to generate social and environmental impact alongside a financial return.

Mitigation bank/banking. The restoration, creation, enhancement, or preservation of a wetland, stream, or other wildlife habitat area that is undertaken for offsetting the anticipated loss of comparable resources due to development. Mitigation bank is a site, or suite of sites, where resources (e.g., wetlands, streams, habitat, species) are restored, established, enhanced and/or preserved to provide compensatory mitigation for impacts. In general, a mitigation bank sells compensatory mitigation credits to developers whose obligation to provide compensatory mitigation is then transferred to the mitigation bank sponsor.

Mitigation hierarchy. The mitigation hierarchy is the logical, sequential framework in which impacts are avoided, minimized, remediated and any residual impacts offset. Adherence to the mitigation hierarchy is central to biodiversity offsetting. The mitigation hierarchy serves to meet the environmental policy principle of "No Net Loss" of biodiversity alongside development

Natural capital can be defined as the world's stocks of natural assets which include geology, soil, air, water and all living things in the ecosystem. It is the stock of ecosystems that yields a renewable flow of goods and services that underpin the economy and provide inputs and direct and indirect benefits to businesses and society.

No Net Loss. "No Net Loss" policy can be defined as a principle by which counties, agencies, and governments strive to balance unavoidable habitat, environmental and resource losses with replacement of those items on a project-by-project basis so that further reductions to resources may be prevented. No Net Loss is conceptualized and implemented within the mitigation hierarchy.

Non-profit investors. For this study, this group includes not only foundations and nongovernmental organizations but also DFIs as well as one state-owned corporation.

Offset. Measures taken to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and / or rehabilitated or restored, to achieve No Net Loss or a net gain of biodiversity. Offsets can take the form of positive management interventions such as restoration of degraded habitat, arrested degradation or averted risk (restoration offset), or protecting areas where there is imminent or projected loss of biodiversity (protection/conservation offset). Offsetting is a market-based tool.

Payments for Ecosystem Services (PES) refers to a voluntary transaction in which the generation of a clearly defined ecosystem services is being paid for by a buyer from a seller, only if the seller secures the provisioning of that service.

Rehabilitation/restoration. Measures taken to rehabilitate degraded ecosystems or restore cleared ecosystems following exposure to impacts that cannot be completely avoided and/ or minimized. Forest restoration is applied for degraded forest (ecosystems) and rehabilitation is applied for degraded lands which have no forest cover. This may include not only planting etc. but also hydraulic and other works.

Socially responsible investing (SRI). Refers to investments that are considered socially responsible based on environmental, social, and corporate governance criteria.

Voluntary carbon offset markets. Marketplaces through which companies, organizations and individuals voluntarily obtain and retire emissions offset credits to meet internal carbon footprint or emission reduction goals.

Water banking. The practice of forgoing water deliveries during certain periods and "banking" the right to, in the future, use the forgone water or sell it to another party. Water banking generally depends on the availability of significant storage capacity to facilitate such transfers.

Water quality trading. Trading programs allow facilities facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or superior) pollution reductions from another source at lower cost, thus achieving the same water quality improvement at lower overall cost.

Watershed investment (in this report). Watershed investment as any transaction between a *buyer* and a *seller* where financial value is exchanged for activities or outcomes associated with the maintenance, restoration, or enhancement of watershed services or natural areas considered important for watershed services.

Watershed services. The benefits to society provided by healthy natural systems (like forests or wetlands), such as aquifer recharge, flow regulation, erosion control, and water purification.


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