WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Biodiversity and business risk

A Global Risks Network briefing

World Economic Forum
January 2010

A briefing paper for participants engaged in biodiversity related discussions at the World Economic Forum Davos-Klosters Annual Meeting

Prepared by PricewaterhouseCoopers for the World Economic Forum

This report was prepared by PricewaterhouseCoopers (PwC) for the specific use of the World Economic Forum and is not to be used, distributed or relied upon by any third party without PwC's prior written consent. The analysis and opinions contained in this presentation are based on publicly available sources and PwC has not independently verified this information and makes no representation or warranty, express or implied, that such information is accurate or complete. All recipients of this report must make their own independent assessment of the report, and neither PwC nor any of its affiliates, partners, officers, employees, agents or advisers shall be liable for any direct, indirect or consequential loss or damage suffered by any person as a result of relying on any statement in, or alleged omission from, this report.

The views expressed in this publication do not necessarily reflect those of the World Economic Forum, PricewaterhouseCoopers or the contributing companies or organizations.

World Economic Forum
91-93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0)22 869 1212
Fax: +41 (0)22 786 2744
E-mail: contact@weforum.org
www.weforum.org

© 2010 World Economic Forum. All rights reserved. No part of this publication may be reproduced or transmitted in any form or by any means, including photocopying and recording, or by any information storage and retrieval system.

Contents

"Biodiversity underpins ecosystem services. Bees can't pollinate, nor can trees store carbon, if they have all died. … Diverse systems are better at capturing carbon, storing water and preserving fisheries. Just how diverse an ecosystem has to be in order to supply the goods and services needed by man is a matter of debate - a debate made harder by the fact that many species may have uses that man has not yet found."

The Economist, 2008

Overview

"Global warming may dominate headlines today. Ecosystem degradation will do so tomorrow."

Corporate Ecosystem Services Review, World Resources Institute et al., 2008

To understand why this conclusion was reached consider the figures. Using the implied social cost of carbon from the Stern report ($85 per tonne CO_2), the long run economic cost of 2008 net greenhouse gas emissions could be in the region of $1.7trillion*. For the same year, the economic cost of biodiversity loss and ecosystem degradation was estimated to be between US$2 and US$4.5 trillion† (3.3 – 7.5% of global GDP). While these numbers are not directly comparable, the fact that they are in the same order of magnitude should give pause for thought.

To date discussions on biodiversity loss have focused on specifics such as coral reef degradation, deforestation or declining fish stocks. All of these are of concern to particular industries or regions. Recently, the broad systemic implications of biodiversity loss and ecosystem degradation linking to resource management, climate change and population growth have been more explicitly articulated. This briefing paper will explore both specific and broader systemic effects and the associated business risks.

This paper includes:

- A summary of the systemic nature of biodiversity loss and ecosystem degradation;
- Examples of biodiversity loss, ecosystem degradation and the associated value at risk;
- Current perceptions of biodiversity loss amongst business leaders and other decision makers;
- A typology of business risks related to biodiversity loss and ecosystem degradation including current examples and a case study looking at agricultural supply chains; and
- A high level guide for CEOs seeking to protect their businesses from the risks identified, pointing to a number of initiatives and resources that can help.

While this paper focuses on risk, it should be remembered that where there are risks there are also opportunities; with new trading mechanisms and markets, new technologies and design approaches, and improved land-use models, a new green economy presents a myriad of new areas for businesses to create value. In the summer of 2010, the international study The Economics of Ecosystems and Biodiversity (TEEB) will release a report aimed specifically at the business sector to help them understand and take advantage of this change.

Some key definitions

Biodiversity: the variability among living organisms within species, between species, and between ecosystems. Biodiversity underpins the proper functioning of ecosystems and ensures the delivery of ecosystem services.

Ecosystem: a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit. Examples of ecosystems include deserts, coral reefs, wetlands, rain forests, boreal forests, grasslands, urban parks and cultivated farmlands. Ecosystems can be relatively undisturbed by people, such as virgin rain forests, or can be modified by human activity, such as farms.

Ecosystem services: sometimes called 'environmental services' or 'ecological services' - are the benefits that people and economies obtain from ecosystems. Examples include fresh water, timber and fisheries, genetic resources, climate regulation, protection from natural hazards, erosion control and recreation.

Biodiversity risk: In this paper we use the term 'biodiversity risk' to refer to business risks related to biodiversity in the broadest sense. This includes risks as a result of direct impacts or dependencies on biodiversity and ecosystem services, as well as regulatory, financing, reputational and supply chain risks that arise due to business's relationships with biodiversity and ecosystems (page 8 includes a number of illustrative examples).

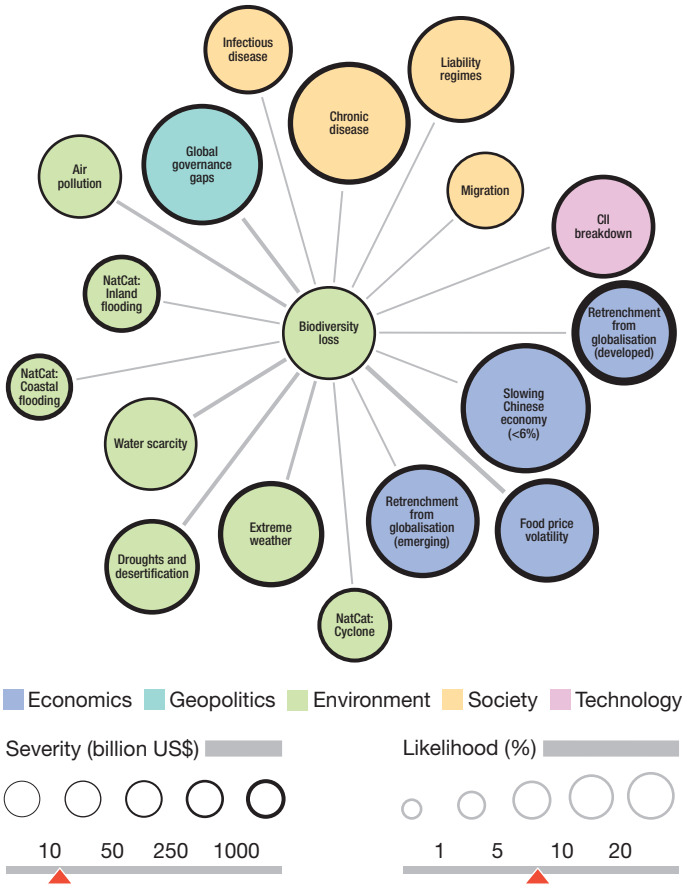
** Source: STERN REVIEW: The Economics of Climate Change and PwC analysis. $1.7 trillion is the lifetime cost of net CO_2 emissions from 2008 (20.09 Giga tonnes CO_2) using Stern's implied social cost of carbon ($85) which amongst other things assumes a business as usual emissions scenario and a discount rate of between 2 and 3%.*

† Source: The Economics of Ecosystems and Biodiversity (TEEB), Cost of Policy Inaction Report, 2008. $2 - $4.5 trillion is the present value of net ecosystem service losses from land based ecosystems (e.g. forests, tundra, cultivated land) caused in 2008 and continuing for 50 years, based on discount rates ranging from 1 – 4%.

Biodiversity loss at the nexus of many risks

Figure 1

Biodiversity loss at the nexus of many risks



Source: World Economic Forum, Global Risks 2010 report

Figure 1 sets out some of the interconnections between biodiversity loss and other global risks as identified by the Global Risk Network of the World Economic Forum[1]. As the figure shows biodiversity loss is connected to a number of other risks with estimated severities in dollar terms ranging from tens of billions for inland flooding and infectious disease, to many hundreds of billions for food price volatility and chronic disease.

It is widely accepted that major social and economic trends contribute to biodiversity loss, but equally, as the examples below demonstrate, biodiversity loss and ecosystem degradation exacerbate and amplify other observed risks.

Coastal flooding

The removal of key costal ecosystems often increases the severity of coastal flooding. Coastal features such as coral reefs, inter-tidal mudflats, vegetated coastal dunes and mangrove forests create effective buffers against natural disasters, storms, and coastal erosion.

For example, a 28% reduction in mangrove cover between 1980 and 2000[2] in South East Asia to make way for commercial shrimp farming has contributed to a loss of natural protection against tsunamis and cyclones. This was tragically demonstrated during the 2004 South Asian Tsunami, when coastal areas still covered by mangroves were relatively less affected, with mangroves acting as a natural defence[3].

In addition to their vital role in coastal protection, these costal features are critical for many marine food chains, comprising vital nursery areas and habitats for commercially valuable fish and shellfish species. As we look to the future, with the prevalence of denser populations in coastal areas, the human and economic costs of damage to coastal ecosystems are set to grow.

Desertification

A process of ecosystem degradation, driven largely by population growth, and the industrialisation and intensification of agriculture, beginning with land conversion, and followed by overgrazing or soil degradation, has been a key driver of desertification, resulting in the widespread loss of once productive land. Increasing water scarcity, itself partly a result of deforestation or removal of vegetation, is compounding the problem in many regions.

For example, in Guangdong province in China, deforestation and land conversion have lead to encroaching desertification. Exacerbated by severe drought, this not only threatens further biodiversity loss but also agricultural productivity and community health.

Arid and semi-arid areas are most at risk and as they constitute around 30%[4] of land surfaces, this is a pressing risk for many regions. Some desertification may be inevitable as a result of climate change but slowing this trend relies on healthy and functioning ecosystems: continued degradation only serves to compound the problem.

Food security

The output of agricultural systems is highly dependant on biologically diverse soils and other key ecosystem services such as water regulation, pollination and climatic stability.

By 2050 these agricultural systems will be required to feed a forecasted population in excess of 9 billion, 50% higher than today. This population increase, coupled with dietary shifts towards higher meat consumption (much of it grain-fed), suggest a need to produce at least 70% more food[5]. This will place huge pressure on scarce land resources and will severely test the ability of ecosystems to deliver the services on which agriculture relies.

Further compounding these trends is the increasing use of land intensive crops to create biofuels. This not only contributes to biodiversity loss through land conversion but has also been identified as one of the causes of recent volatility in food prices.

The examples above describe just a few of the ways in which biodiversity loss and ecosystem degradation are inextricably linked to other major challenges facing society. The next section considers further the environmental and economic case for action.

Biodiversity loss and economic value

As illustrated in the previous section, the loss of biodiversity and degradation of ecosystems exacerbates many of the key challenges we face in the 21st century, from freshwater provision and sustainable agricultural production for 9 billion people, to catastrophic climate change, regional conflicts and migration due to resource shortages.

However, because biodiversity and ecosystem services often have unclear ownership and pricing, they are still frequently excluded from decision-making processes.

As a result, examples of biodiversity loss and ecosystem degradation abound.

- Half of wild marine fisheries are fully exploited, with a further quarter already overexploited. In 2006, it was estimated that all of the world's commercial fisheries are likely to collapse in less than 50 years[6] if we remain on the current consumption path.
- Severe soil degradation continues to increase globally at a rate of 5 million to 10 million hectares annually[7] (0.36 – 0.71% of global arable land).
- Warm-water coral cover has fallen by more than 30% since the beginning of the 1980s and projections suggest that due to climate change and other pressures little coral will remain by 2050[8].
- In the last 300 years, the global forest area has shrunk by 40%[9]. Deforestation in the tropics continues at an estimated rate of 13 million hectares, an area the size of England, every year[10].
- In the last 50 years, it is estimated that 60% of the Earth's examined ecosystem services have been degraded due to human impact[11].

This loss of biodiversity and degradation of ecosystems has dramatic consequences for business.

- The economic cost of soil erosion in Europe is estimated at €53 per hectare per year[12].
- Annual economic losses caused by introduced agricultural pests in the US, UK, Australia, South Africa, India and Brazil exceed US$100 billion[13].
- As highlighted at the start of this paper, the total annual economic cost of biodiversity loss and ecosystem degradation was estimated to be between US$2 and US$4.5 trillion[14] in 2008 (3.3 – 7.5% of global GDP).

Progressive approaches can be employed to manage risks, preserve biodiversity and enhance brand value.

- In the 1990's, Vittel (Nestlé Waters) chose to address groundwater contamination from local agricultural nitrates by compensating farmers and helping them to convert to more sustainable practices. In the first seven years Vittel spent US$32m[15] on this programme. A substantial sum, but small relative to the cost of plant closure, relocation, or brand damage which befell some competing brands.
- Recent declines in pollinating insect populations have been threatening agricultural yields. Syngenta, a company which supplies seeds and pesticides to farmers, responded by launching 'operation pollinator' which supports farmers to develop marginal land into habitats for wild pollinators, with the aim of optimising the productivity of the remaining land.

"A lot of our license not just to grow but, frankly, to continue operating, depends on how effectively we can demonstrate operational excellence in sensitive environments, so we have incorporated biodiversity thinking in our activities for some time."

Roxanne Decyk, Executive Vice President, Global Government Relations, Royal Dutch Shell

On a global scale however, biodiversity loss and ecosystem degradation continue at a dramatic rate.

The consequences will not just affect companies with direct reliance on natural resources but will also affect the supply chains and growth objectives of most industry sectors in the developed and developing world.

In light of the magnitude of the economic costs and business risks associated with biodiversity loss we might expect strong concern and action on the part of public and private sectors. The next section reviews whether this is in fact the case.

Current perceptions of biodiversity loss

The '13th Annual Global CEO Survey 2010' of 1,200 CEOs conducted by PwC and published in January 2010 sheds light on current perceptions of the risk to business posed by biodiversity loss.

Growth prospects

When asked to rate levels of concern about a range of threats to their business growth prospects, **27%** of CEOs were either 'extremely' or 'somewhat' concerned about 'biodiversity loss'.

Given the short term planning horizons still inherent in capital markets, exacerbated by the pressures of the global recession, it is notable that biodiversity loss remains a concern for some. Relative to other risks however, overall business concern was relatively low.

This may be because the effects of biodiversity loss are not, in most cases, dramatic one-off events, but rather they accumulate gradually, sapping the productive capacity of the economy, and so are less visible to business leaders and political decision-makers. It may also be caused by the fact (as outlined on page 3) that biodiversity loss and ecosystem degradation is an often unacknowledged but nonetheless significant underlying factor in other trends and risks which are widely known.

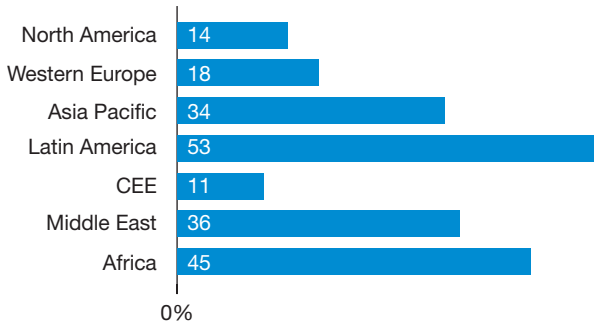
"I think that the issue of biodiversity loss is starting to gain some traction with business, but this is happening slowly, much more slowly than climate change and CO_2 for example"

Andrea Debbane, Vice President, Communications Strategy, Communication and Public Affairs, Airbus

Hidden within the headline figure of **27%** cited above there are stark regional variations. **53%** of CEOs in Latin America and **45%** in Africa are concerned that biodiversity loss will adversely impact their business growth prospects (Figure 2) compared to just **11%** in Central and Eastern Europe.

Figure 2

Respondents who were 'extremely' or 'somewhat concerned' about biodiversity loss as a threat to their business growth prospects.



Q: How concerned are you about the following potential threats to your business growth prospects?
Base: All respondents (139, 442, 289, 167, 93, 28, 40) Please note small base for Middle East

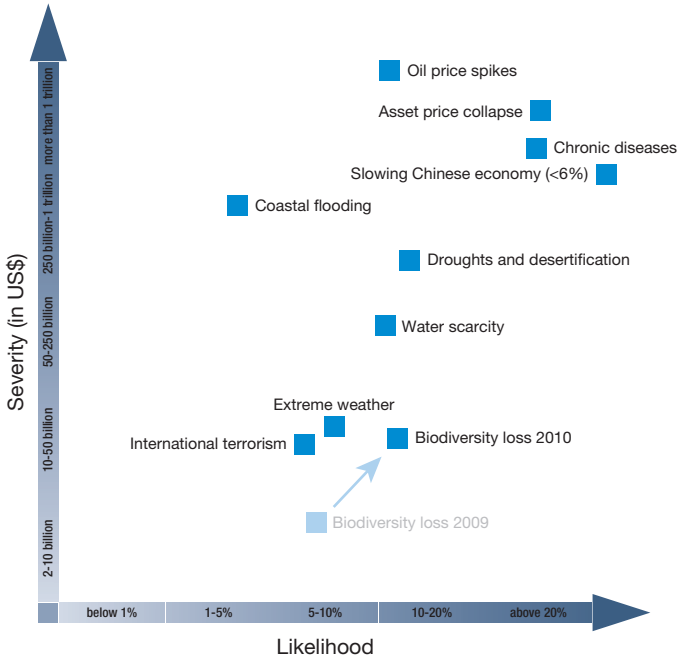
Source: PricewaterhouseCoopers 13th Annual Global CEO Survey 2010

Drawing on a somewhat different respondent profile‡, the World Economic Forum's Global Risks 2010 report finds that the perceived risk related to biodiversity loss, considered over the next ten years, has increased in both likelihood and severity in 2010 compared with 2009 (Figure 3). Set against a selection of other risks however, concern over the severity in economic terms remains relatively low.

‡ *The annual Global Risk Perception Survey is carried out between July and early October each year. Survey respondents are members of the World Economic Forum's Global Agenda Councils and its Global Risk Network (GRN). These groups are composed of practitioners and experts on a range of areas relating to the 36 risks covered by the Global Risks report and are drawn from business, academia, international organisations and governments.*

Figure 3

Biodiversity in the global risk landscape



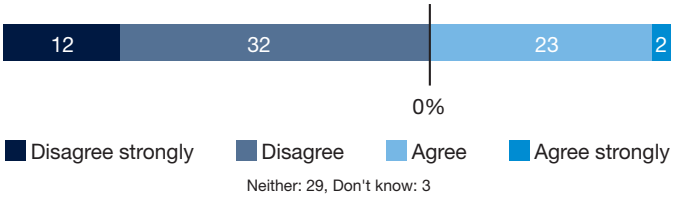
Source: World Economic Forum Global Risks 2010 report

Government action

Probing a little deeper we find that a high proportion of CEOs do not feel that their national government effectively protects biodiversity and ecosystems (Figure 4); recognising that government has an important role to play and implying a need for more direct government action to address biodiversity loss.

Figure 4

The government effectively protects biodiversity and ecosystems.



Q: Thinking about the role of Government in the country in which you operate, how much do you agree or disagree with the following statements?
Base: All respondents (1,198)

Source: PricewaterhouseCoopers 13th Annual Global CEO Survey 2010

"Some countries have very stringent environmental regulations that protect biodiversity and ecosystems; others don't. In most cases, it's related to the level of economic wealth in the country, and sadly, some of the places with the greatest exposure to ecosystem damage are either the least interested or have the weakest means to address them. And I think that is a problem. Educating governments in the value of their own ecosystems and the problems presented by biodiversity loss is probably as important as anything else"

Roxanne Decyk, Executive Vice President, Global Government Relations, Royal Dutch Shell

The analysis above suggests that, while dramatic short term risks continue to preoccupy the minds of decision makers, the risks posed by biodiversity loss are recognised by some in business.

In the following section we set out an indicative typology of these business risks relating to biodiversity loss and ecosystem degradation. We then consider global agricultural supply chains as a case study to contextualise some of the key issues and assess the potential value at risk.

A typology of biodiversity risks

Many in business are aware of the global problem of biodiversity loss and ecosystem degradation but this is often not perceived as an issue for business. However, as the table below illustrates, a wide range of risks related to declining biodiversity and loss of ecosystem services are already impacting on business. Primary industries such as extractives, forestry, farming and fishing are affected most broadly but no sector escapes untouched by some form of biodiversity risk.

		Sectors most likely to be affected[17]							
Category	**Risk**	**Primary Industries** (e.g. forestry, oil & gas, mining, farming and fishing)	**Utilities** (e.g. electricity, gas, water)	**Consumer Goods** (e.g. automobiles, food products, household products)	**Consumer Services** (e.g. retailers, media, travel and leisure)	**Health Care** (e.g. pharmaceuticals, biotechnology, healthcare providers)	**Industrials** (e.g. construction, aerospace, components)	**Financials** (e.g. banking, insurance, asset management)	**Technology and business services** (e.g. software, telcoms, consulting)
Physical risk	**Reduced productivity** Biodiversity loss, ecosystem degradation and consequent loss of ecosystem services can adversely impact productivity across a range of sectors.	✓	✓	✓					
	Scarcity and increased cost of resources For companies reliant on plant and animal commodities including genetic materials, scarcity and increasing costs pose a significant threat to on-going viability.	✓	✓	✓	✓	✓	✓		
	Disruption of operations Years of ecosystem degradation has left many areas vulnerable to what were once termed 'natural disasters'.	✓	✓	✓	✓	✓	✓	✓	✓
Regulatory and legal risk	**Restricted access to land and resources** Many business models rely on access to natural ecosystems and areas of high biodiversity and in a number of regions this access is becoming more difficult to obtain.	✓	✓						
	Litigation Companies are frequently subject to litigation as a result of their exploitation of biological resources or their adverse impacts on ecosystems and the associated human health consequences.	✓				✓			
	Reduced quotas A number of sectors are subject to quotas governing the extraction of biological resources. These quotas restrict business growth and when tightened they can have a dramatic effect on company prospects in the short term.	✓							
	Pricing and compensation regimes Governments around the world are introducing new compensation regimes and market based instruments to help address threats to ecosystems and biodiversity by putting a price on the environmental damage caused by companies. Such mechanisms will significantly increase costs for sectors and operators affected.	✓	✓				✓		
Market risk	**Changing consumer preferences** As consumers become increasingly aware of the environmental credentials of companies and their products there is evidence that buying habits are already changing. If this trend continues, sustainably extracted natural materials will eventually be a core requirement for market access in the sectors affected.	✓		✓	✓				
	Purchaser requirements A number of major purchasers are introducing or enhancing sustainable procurement guidelines which present significant risks for suppliers that will struggle to comply.	✓		✓					
Other risks	**Reputational risk** Association with adverse impacts on biodiversity and ecosystems can result in severe damage to a company's brand and restrict its 'social license to operate'.	✓	✓	✓	✓	✓	✓	✓	✓
	Financing risk Risks outlined above may have an adverse impact on a company's cash flows reducing its credit quality and consequently increasing the cost of accessing new finance. Major lenders are also tightening environmental requirements for access to corporate loans, particularly signatories to the Equator Principles, and insurers are increasingly sensitive to risks associated with biodiversity loss and ecosystem degradation.	✓	✓					✓	
	Supply chain risk Risks outlined above can have dramatic adverse consequences for downstream operators threatening security of supply chains or leading to increased costs.			✓	✓	✓			

"When we were developing the A380 assembly line, our obligations under the 'Natura 2000' environmental regulations in France resulted in a six month delay for one of the buildings while preservation of local biodiversity was addressed."

Andrea Debbane, Vice President, Communications Strategy, Communication and Public Affairs, Airbus

"We source extensively from the State of California. One of the items we source is almonds. The price of those almonds is determined by a number of factors, including availability, and it is our opinion that one circumstance that is contributing to a reduced level of availability is colony collapse disorder."

Steve Yucknut, Vice President, Sustainability, Kraft

Example
"Deforestation in the Agno River basin in the Philippines has led to such extensive river and reservoir siltation that the 100-megawatt Binga hydroelectric facility can only operate intermittently"[17].
Measures to control deforestation and conversion to soy and palm oil production may significantly increase the prices of these commodities which form key inputs for many producers of food and household goods.
Studies have shown that the total economic impact of Hurricane Katrina (approximately US$150 billion), was significantly higher than would have been the case if costal wetlands in the region had been preserved[18].
The share price of Associated British Ports dropped by 12% following the refused planning permission for their port at Dibden Bay, UK, due to its proximity to protected areas. The company was forced to write off £44.9 million in sunk costs[19]. The Transneft project in Russia incurred severe delays due to its proximity to the pristine Baikal Lake and potential impacts on the critically endangered Amur Leopard, and cost Transneft a reported USD 1 billion to shift the pipeline's route[20].
"In 2003, indigenous Ecuadorians filed a suit against ChevronTexaco in an Ecuadorian court, charging the company with dumping toxic oil wastewater into 350 open pits as well as into Amazon basin wetlands and rivers that the tribes rely upon for drinking, bathing, and fishing"[21]. The company is currently involved in a $27 billion court battle relating to alleged toxic contamination of local rainforests and rivers[22].
Commercial fishing operations in the European Union have been impacted over the past decade by the tightening of fishing quotas on cod, hake, plaice, and other species in an effort to curb the depletion of wild fish stocks. Operators who exceed quotas can face substantial fines and suspension of licences.
Driven by the Endangered Species Act, landowners in the US are obliged to mitigate their impact on endangered species, and must purchase 'credits' to offset unavoidable impacts from a 'Biodiversity Banking' scheme. Similarly in Australia, where companies clear vegetation, they are required to purchase 'offsets' of similar habitat elsewhere which can be sourced through the 'Bushbroker System'. Average credit prices range from AUD $42,000 to $157,000 per hectare[23].
The gradual proliferation of ecologically certified materials such as Marine Stewardship Council (MSC), Forest Stewardship Council (FSC) and Rainforest Alliance are indicative of the changing consumer demand for 'biodiversity-friendly' products. Consumer sales of these certified products are growing rapidly; sales of MSC-labelled products worldwide grew by 67% from April 2008 to March 2009[24].
Walmart will now only purchase farmed shrimp certified to Global Aquaculture Alliance standards and has recently pledged to source only wild-caught fresh and frozen fish for North American stores from fisheries certified by the Marine Stewardship Council.
"The forestry company MacMillan Bloedel suffered reputational damage when Greenpeace and others protested against the firm for clear-cutting forests. In response, Scott Paper and Kimberly-Clark in the United Kingdom stopped sourcing from MacMillan Bloedel, causing the company to lose five percent of its revenue almost overnight"[25].
In 2008, the Norwegian Pension Fund withdrew its £500 million stake in the mining giant Rio Tinto and excluded the company from its funds. The decision to withdraw was based on the activities of Rio Tinto's mining operations in Indonesia[26].

A case study of biodiversity loss and agricultural supply chains

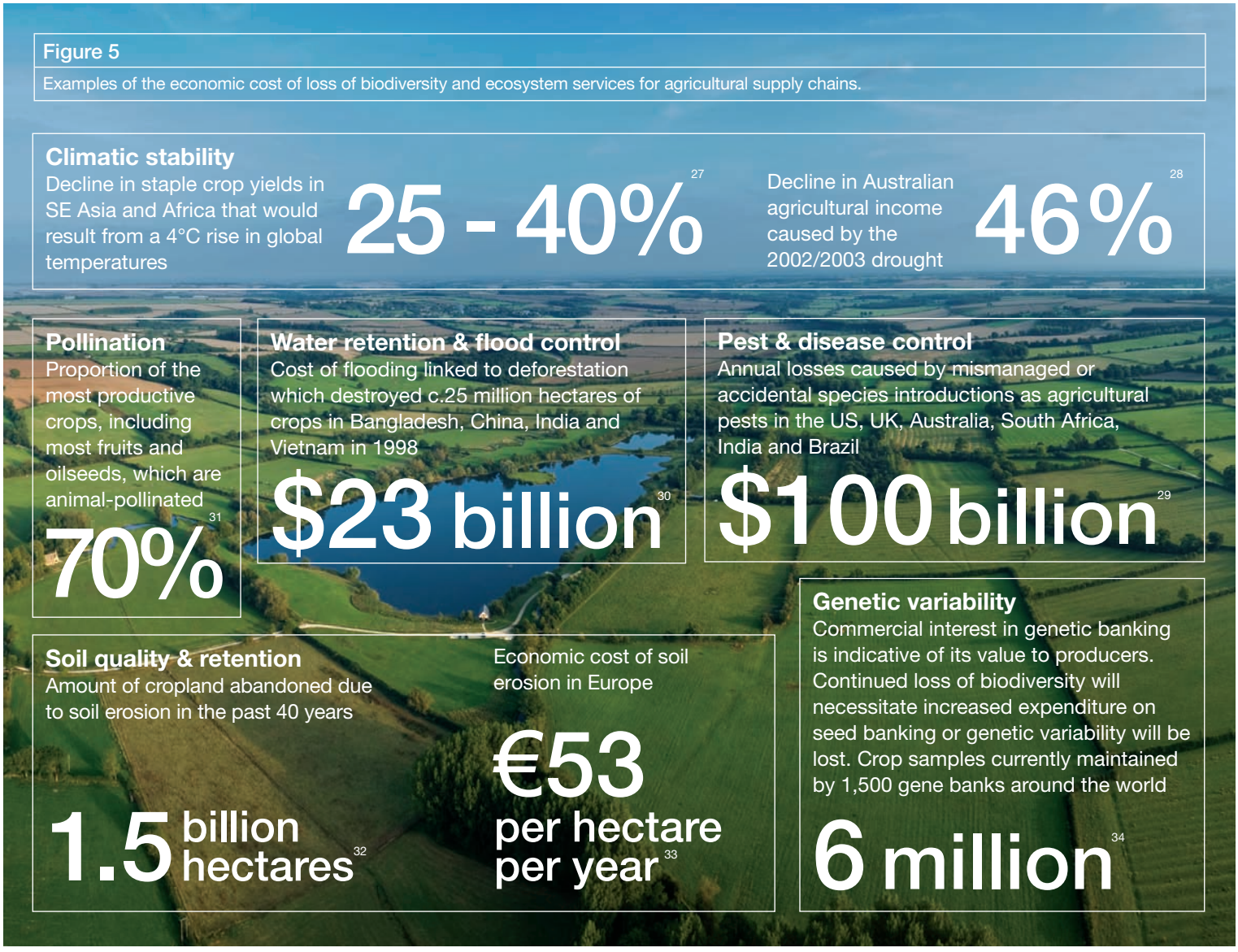
Agricultural production is reliant on biodiversity and ecosystem services. Dependencies include water retaining features of the landscape, soil nutrient cycling by micro-organisms, local and global climatic stability, genetic variability in crops and pollination and pest control services provided by insects and other animals. However, modern agriculture also requires highly modified ecosystem states and the on-going relationships between biodiversity, ecosystems and agricultural production are complex and subject to instability. The figure below illustrates a few of the real costs borne as a result of these instabilities.

"Biodiversity is the foundation of our business. Agriculture depends on biodiversity as the adaptation of agriculture to new environmental conditions depends on the inherent diversity within plants. Essentially, biodiversity is the foundation of agriculture."

Juan Gonzalez-Valero, Head of Corporate Responsibility, Syngenta

Figure 5

Examples of the economic cost of loss of biodiversity and ecosystem services for agricultural supply chains.



These costs affect the entire value chain:

- Producers – through reduced crop income;
- Processing companies – with supply interruptions and increased input prices;
- Retailers – who increasingly need to invest in assessing supplier and product related biodiversity risks, and devote resources to responding to NGO campaigns on specific product ranges.

"The loss of biodiversity impacts our raw material supply chain. We're highly dependent upon the earth and its ability to produce the natural resources we use to make food."

Steve Yucknut, Vice President, Sustainability, Kraft

Further, the pressure for new agricultural land accounts for 60 to 80% of global forest conversion activity.[35] New climate change related measures aim to dramatically reduce deforestation related emissions by 2050. If successful, along with other pressures on land, this will significantly reduce new agriculture-related conversion.

This analysis focusing just on agricultural production systems demonstrates trends in risk which are relevant to a number of other value chains:

1. Costs relating to biodiversity loss and ecosystem degradation can be numerous and varied;

2. Some of the risks are foreseeable and can potentially be monitored, and even hedged through insurance and other financial instruments;

3. Certain risks and costs will be unpredictable – the complexities of interactions between ecosystems and economic activity present invisible threats;

4. Costs are likely to increase – the impacts of ecosystem degradation, compensation expectations, legislation, and pressure group activities are all increasing; and

5. Continued and severe ecosystem degradation can lead to a collapse of commercially valuable stocks (e.g. of certain fish, tree species and food crops) or a failure in specific ecosystem services (e.g. commercially valuable pollination services due to Colony Collapse Disorder or disrupted rainfall patterns).

Opportunities

Where there are risks there are also opportunities. A range of initiatives are underway to encourage sustainable agriculture, and the need to meet future demand whilst protecting biodiversity presents many opportunities along the value chain.

- Public agencies and others are providing increased funding for biodiversity conservation in cultivated landscapes, recognising the need to work beyond protected areas.
- Agricultural practices such as integrated crop management and conservation agriculture provide opportunities for farmers and agri-businesses to increase production more sustainably.
- Suppliers to the agricultural sector can benefit from sales of products which help producers to conserve biodiversity whilst increasing production.
- Multiple initiatives are being sponsored by the food and agriculture industries to promote sustainable agriculture including 'roundtables' on sustainable palm oil, soy, coffee, sugar and cocoa.

"We believe that our products work well with natural systems by reducing the amount of pesticides needed to grow crops, by allowing greater use of conservation tillage which builds topsoil and provides cover for foraging birds and small mammals, and by allowing greater yields on currently used farmland, relieving pressure on forests and marginal lands."

Natalie Dinicola, Director, Sustainable Agriculture Development Partnerships, Monsanto

- Processors and retailers can take advantage of rapid growth in demand for certified sustainable agricultural products to enhance brand value and differentiate their products with consumers. In so doing, they provide financial incentives to help producers protect ecosystems and biodiversity.

If these and other practices sympathetic with biodiversity and ecosystems can be scaled up there is still hope that increasing demand for agricultural output can be met without causing irrevocable damage to the future productive capacity of ecosystems.

Thinking more broadly than agriculture, a range of comparable opportunities exist in other sectors, for businesses that are attuned to the biodiversity agenda.

Biodiversity and business over the next decade

Will biodiversity risk become 'material' for mainstream businesses, or alternatively, will biodiversity related opportunities capture the imagination and attention of business leaders?

The 10th Conference of the Parties to the Convention on Biological Diversity (CoP 10) in Nagoya, the publishing of a major international study on The Economics of Ecosystems and Biodiversity (TEEB), and the United Nations 'International Year of Biodiversity' all converge in 2010. As a result, at least in this year, companies are likely to hear and use the word 'biodiversity' more frequently. It remains to be seen whether, in the face of so many other immediate challenges, momentum will continue to build for serious and sustained private sector engagement in the biodiversity agenda post-2010.

"With the population at 6.7 billion today, growing to 9 billion by 2048, and continued and accelerating biodiversity loss, it's hard to imagine that pressures on space aren't going to lead to more impacts on business."

Steve Yucknut, Vice President, Sustainability, Kraft

The Economics of Ecosystems and Biodiversity (TEEB) – a game changer?

The economic analysis on the cost of biodiversity loss and ecosystem degradation already coming out of the TEEB initiative is providing leaders in both business and government with much needed information on which to base key decisions, at corporate and national level.

For example, the analysis exposes the skewed logic behind decisions to allow conversion of mangroves to commercial shrimp farming, by setting the short term and narrow private sector returns on which conversion decisions were based, against the far greater societal benefits of mangrove protection (including storm protection, fish nursery, timber and other forest products). In this analysis, net private sector returns after mangrove conversion were estimated at US$1,220 per hectare per year, less than one tenth of the societal benefits provided by intact mangroves which were valued at US$12,392 per ha per year.[36/37]

What does this mean for business? Several scenarios are plausible, and indeed already observable in specific cases and countries:

1. Significant growth in **compensation regimes and regulatory controls** on businesses and projects with high impacts on biodiversity and ecosystems;
2. **Consumer preference trends and choice editing** by retailers undermines markets for high biodiversity impact **products and services**;
3. **Habitat banking, biodiversity offsets,** and other **'ecosystem markets' flourish**;
4. Significant **tax and subsidy reform** occurs to better reflect biodiversity values; and
5. Control of **biocarbon-related GHG emissions results in global financing mechanisms** (Reducing Emissions from Deforestation and Degradation (REDD) or similar) to promote 'pro biocarbon, pro biodiversity' co-benefit activities.

International Finance Corporation review of Performance Standard Six – increased financing risk?

The International Finance Corporation is currently reviewing its Performance Standards, including Performance Standard Six (PS6) on Biodiversity Conservation and Natural Resources Management. The process will clarify definitions such as what is meant by a 'critical natural habitat' in order to improve consistency of application of the standards.

PS6 underpins the Equator Principles which govern project finance provided by signatory banks, so the IFC is developing a guidance note and new tools for identifying critical habitats and related client requirements more effectively.

This may present new challenges for developers seeking to raise finance for projects in sensitive areas.

Will biodiversity become a material risk for my operations?

How real and close to home biodiversity risk is to specific companies and value chains will vary substantially in the medium term. In the absence of a coordinated global approach to governance in this area, local policy makers and capital markets may ultimately determine what is protected and what is lost, which sectors have to change behaviours and which continue largely with business as usual.

Just two years ago, REDD and TEEB were entirely academic concepts. In late 2009, they featured in mainstream press as part of the Copenhagen summit agenda and were acknowledged as crucial focus areas in tackling climate change and biodiversity loss and promoting social welfare.

Given the complexity of the often fundamental risks which biodiversity loss presents, more work is undoubtedly needed to fully understand the risks to business and impacts on value. Nonetheless, much research has already been done and more is under way. Deeper analysis and growing awareness of the implications of biodiversity loss are likely to drive it to the fore of the economic and environmental agenda over the coming years, in much the same way that climate change has moved to centre stage over the past decade.

Perhaps the most unpredictable aspect we face in the debate on biodiversity is the pace of change.

"We have worked with a variety of different partners, including IUCN and others, trying to promote this idea of a system for motivating companies to avoid biodiversity damage. For us, I think this would be very positive, and we would look to be a leader in this area."

Roxanne Decyk, Executive Vice President, Global Government Relations, Royal Dutch Shell

"Biodiversity risks are captured within our risk assessment procedures. These include direct or indirect risks and benefits of our products on biodiversity."

Juan Gonzalez-Valero, Head of Corporate Responsibility, Syngenta

Managing biodiversity risk

Whether biodiversity risk is addressed as an issue in its own right, or tackled as part of a wider enterprise risk management programme[38], will depend on the nature of the business in question. Notwithstanding this, there are a series of practical steps which businesses can take to evaluate and manage their exposure.

By acting early to manage risk, companies can also benefit from a leadership position in addressing biodiversity loss and can use their refined understanding to exploit new business opportunities which are sympathetic to biodiversity and ecosystems.

Activity		Guidance
1	Assess your current processes and capacity	• Determine if there is sufficient technical expertise within your organisation to understand relevant biodiversity risks or whether external support is required. • Review the processes currently in place to manage biodiversity risks and identify the teams or individuals responsible. • Review how your competitors and other leading companies are responding to biodiversity risk.

2	Evaluate potential biodiversity risk for your business	• With the help of external organisations and tools as appropriate, identify your business's direct impacts and dependencies on biodiversity and ecosystem services and potential material risks.
		• Referencing the typology on page 8 assess your exposure to other biodiversity related risks, for example:
		  • **Regulatory:** Might your business be affected by regulatory responses to biodiversity loss? e.g. extraction quotas, ecosystem pricing regimes, permitting requirements.
		  • **Physical:** Will ecosystem degradation expose your operations to increased disruption? e.g. flooding, desertification.
		  • **Company brand:** What negative impacts on biodiversity are 'hidden in the closet' in your operations or supply chains? E.g. unsustainable sourcing, impacts on endangered species, pollutants.
		  • **Supply chain:** Could biodiversity risks threaten the operations of your key suppliers?

3	Develop and implement a strategy to prepare and protect the business	• Consider establishing a working group or similar to manage the strategic response. • Create a framework to track and manage the risk which is commensurate with the potential scale of the risk, appropriately governed, integrated with internal management systems and importantly encompasses supply chains and potential downstream impacts. • Engage with industry initiatives which can help to manage risk and provide reputational advantage.
4	Communicate your position to stakeholders and positively influence policy	• Communicate your performance, initiatives and successes to your stakeholders. • Use your progressive position and alignment with industry initiatives to reach out to other organisations and develop strategic alliances. • Engage early in policy consultations to help shape pending national and international ecosystem related regulations and ensure that you are well placed to deal with the implications. • Consider leveraging media interest in biodiversity to strengthen your position.

"Biodiversity is an important topic that we focus on across the company at Monsanto. Rather than look at it from one point of view through one team, our company elects to have numerous teams look at specific aspects of biodiversity to bring broader focus and a variety of points of view."

Natalie Dinicola, Director, Sustainable Agriculture Development Partnerships, Monsanto

Relevant initiatives and resources

Detailed background information on biodiversity and ecosystems;

The **Millennium Ecosystem Assessment (MA)** was a major global study providing a state-of-the-art scientific appraisal of the condition and trends in the world's ecosystems, the services they provide and the options to restore, conserve or enhance the sustainable use of ecosystems.

The Economics of Ecosystems and Biodiversity (TEEB) is a major international study to draw attention to the global economic benefits of biodiversity, to highlight the growing costs of biodiversity loss and ecosystem degradation, and to draw together expertise from the fields of science, economics and policy to enable practical actions moving forward.

Tools for evaluating biodiversity risks;

Ecosystem Services Review (ESR) includes a sequence of questions that helps managers develop strategies to manage risks and opportunities arising from a company's dependence on ecosystems.

Natural Value Initiative (NVI) includes the **Ecosystem Services Benchmark**, a methodology for assessing biodiversity and ecosystem services-related risks and opportunities in the food, beverage and tobacco sectors.

Integrated Biodiversity Assessment Tool (IBAT) is a screening tool which draws information from the **World Database of Protected Areas (WDPA)** and other sources to help companies incorporate biodiversity into their risk analysis, decision-making and planning processes.

Business and Biodiversity Offsets Program (BBOP) toolkit assesses whether biodiversity offsets are appropriate and provides guidance on offset design.

Initiatives and resources to support implementation, decision making and communication;

Ecosystem Valuation Initiative (EVI) builds on the ESR, enabling companies to value their impacts and dependencies on ecosystem services to feed into better business decision making.

Multi-scale Integrated Models of Ecosystem Services (MIMES) is an integrated suite of models that assess the true value of ecosystem services and how their function and value may change under various management scenarios.

Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) is a decision-making aid to assess how distinct scenarios may lead to different ecosystem services in particular geographic areas.

Business and biodiversity initiative aims to increase the engagement of the private sector in achieving the objectives of the **Convention on Biological Diversity (CBD)**.

In summer 2010 **TEEB** will release a report aimed specifically at business which will provide practical guidance on the issues and the opportunities created by the inclusion in mainstream business practices of ecosystem- and biodiversity-related considerations.

Companies should consider engagement with sector or issue specific initiatives and organisations such as the Round Table on Sustainable Palm Oil (RSPO), the Forest Stewardship Council (FSC) and the Marine Stewardship Council (MSC). The **International Social and Environmental Accreditation and Labelling Alliance (ISEAL)** provides a useful gateway to a number of relevant environmental standards systems.

Leaders in the field have also benefited from collaboration and strategic alliances with major conservation NGOs.

Acronyms

CBD	Convention on Biological Diversity
CCD	Colony Collapse Disorder
CoP 10	The 10th Conference of the Parties (to the CBD) to be held in Nagoya, Japan in October 2010
FSC	Forest Stewardship Council
GHG	Greenhouse Gas
NGO	Non-Governmental Organisation
REDD	Reduced Emissions through Deforestation and Degradation
RSPO	Round Table on Sustainable Palm Oil
TEEB	The Economics of Ecosystems and Biodiversity

Acknowledgements

Authors

William Evison, Senior Associate, Sustainability and Climate Change, PricewaterhouseCoopers LLP UK

Christopher Knight, Assistant Director, Sustainability and Climate Change, PricewaterhouseCoopers LLP UK

This paper has been prepared with the support of PricewaterhouseCoopers Global Thought Leadership Group (www.pwc.com/researchandinsights).

With input from:

Sheana Tambourgi, Director, Head of the Global Risk Network, World Economic Forum

Jason Shellaby, Research Analyst, Global Agenda Councils, World Economic Forum

PricewaterhouseCoopers and the World Economic Forum would also like to thank the following people who kindly took part in interviews which helped to inform this paper:

Andrea Debbane, Vice President, Communications Strategy, Communication and Public Affairs, Airbus

Juan Gonzalez-Valero, Head of Corporate Responsibility, Syngenta

Natalie Dinicola, Director, Sustainable Agriculture Development Partnerships, Monsanto

Roxanne Decyk, Executive Vice President, Global Government Relations, Royal Dutch Shell

Steve Yucknut, Vice President, Sustainability, Kraft

References

1. *World Economic Forum, Global Risks Report 2010. www.weforum.org/en/initiatives/globalrisk/Reports/index.html*
2. *FAO, State of the Worlds Forest, Rome (2003).*
3. *Dahdouhguebas et al. (2005). How effective were mangroves as a defence against the recent tsunami?*
4. *Huang, J. (2008). An Overview of the Semi-arid Climate and Environment Research Observatory over the Loess Plateau.*
5. *Food and Agricultural Organisation, How to feed the world in 2050, October 2009.*
6. *Worm, B. et al. (2006). Impacts of Biodiversity Loss on Ocean Ecosystem Services.*
7. *The International Soil Reference and Information Centre (ISRIC).*
8. *IPCC, 2007: Climate Change 2007: Impacts, Adaptation, and Vulnerability.*
9. *Food and Agriculture Organization of the United Nations (2001).*
10. *Eliash, J., (2008) Eliash Review; Climate Change; Financing Global Forests. UK.*
11. *Millenium Ecosystem Assessment (2005).*
12. *García-Torres, L. et al., (2001). Conservation agriculture in Europe: Current status and perspectives.*
13. *Convention on Biological Diversity, "business.2010", magazine on business & biodiversity. June 2009. Volume 4 - Issue 1.*
14. *TEEB Cost of Policy Inaction Study, (2008).*
15. *Daniele Perrot-Maitre, (2006). The Vittel payments for ecosystem services: a "perfect" PES case?*
16. *Sectors adapted from FTSE / DJ International Classification Benchmark.*
17. *Corporate Ecosystem Services Review, World Resources Institute et al. 2008.*
18. *UNEP FI, Bloom or Bust, 2008.*
19. *UNEP FI, Bloom or Bust, 2008.*
20. *The Economist, Where the wild things are, October, 2008.*
21. *Corporate Ecosystem Services Review, World Resources Institute et al. 2008.*
22. *The Sunday Times Magazine, The Amazon's Dirty War, November 2009.*
23. *Victoria Department of Sustainability and Environment, 2006.*
24. *Marine Stewardship Council, Annual Report 2008/2009.*
25. *Corporate Ecosystem Services Review, World Resources Institute et al. 2008.*
26. *The Times, Norwegian wealth fund sells stake in Rio Tinto, September 2010.*
27. *www.actoncopenhagen.decc.gov.uk/en/ambition/evidence/4-degrees-map/*
28. *www.treasury.gov.au/documents/817/HTML/docshell.asp?URL=03_article_2.asp*
29. *Convention on Biological Diversity, "business.2010", magazine on business & biodiversity. June 2009. Volume 4 - Issue 1. www.pwc.com/gx/en/research-publications/exploring-emerging-risks.jhtml*
30. *United Nations Economic and Social Commission for Asia and the Pacific (ESCAP).*
31. *www.fao.org/DOCREP/005/Y4586E/y4586e11.htm*
32. *www.grida.no/news/press/2185.aspx*
33. *García-Torres, L. et al., (2001). Conservation agriculture in Europe: Current status and perspectives.*
34. *The Global Crop Diversity Trust website 2008: www.croptrust.org/main/trust.php?itemid=84*
35. *www.grida.no/news/press/2185.aspx*
36. *TEEB – The Economics of Ecosystems and Biodiversity for National and International Policy Makers - Summary: Responding to the Value of Nature 2009.*
37. *Barbier, E. B. (2007). Valuing Ecosystem Services as Productive Inputs. Economic Policy 22 (49): 177-229.*
38. *PricewaterhouseCoopers, Exploring Emerging Risks, Extending Enterprise Risk Management (ERM) to address emerging risks, 2009.*

The World Economic Forum is an independent international organization committed to improving the state of the world. The Forum provides a collaborative framework for the world's leaders to address global issues, engaging particularly its corporate members in global citizenship. Incorporated as a foundation, and based in Geneva, Switzerland, the World Economic Forum is impartial and not-for-profit; it is tied to no political, partisan or national interests. The Forum has NGO consultative status with the Economic and Social Council of the United Nations. (www.weforum.org)