Complete results and the story behind PUMA's E P&L - the first ever attempt to measure, value and report the environmental externalities caused by a major corporation and its entire supply chain

PUMA's Environmental Profit and Loss Account for the year ended 31 December 2010

About PUMA

PUMA is one of the world's leading Sportlifestyle companies that designs and develops footwear, apparel and accessories. Through PUMAVision, the company's vision of a better world, PUMA is committed to working in ways that contribute to the world by supporting Creativity, Sustainability and Peace, and by staying true to the principles of being Fair, Honest, Positive and Creative in decisions made and actions taken. PUMA starts in Sport and ends in Fashion.

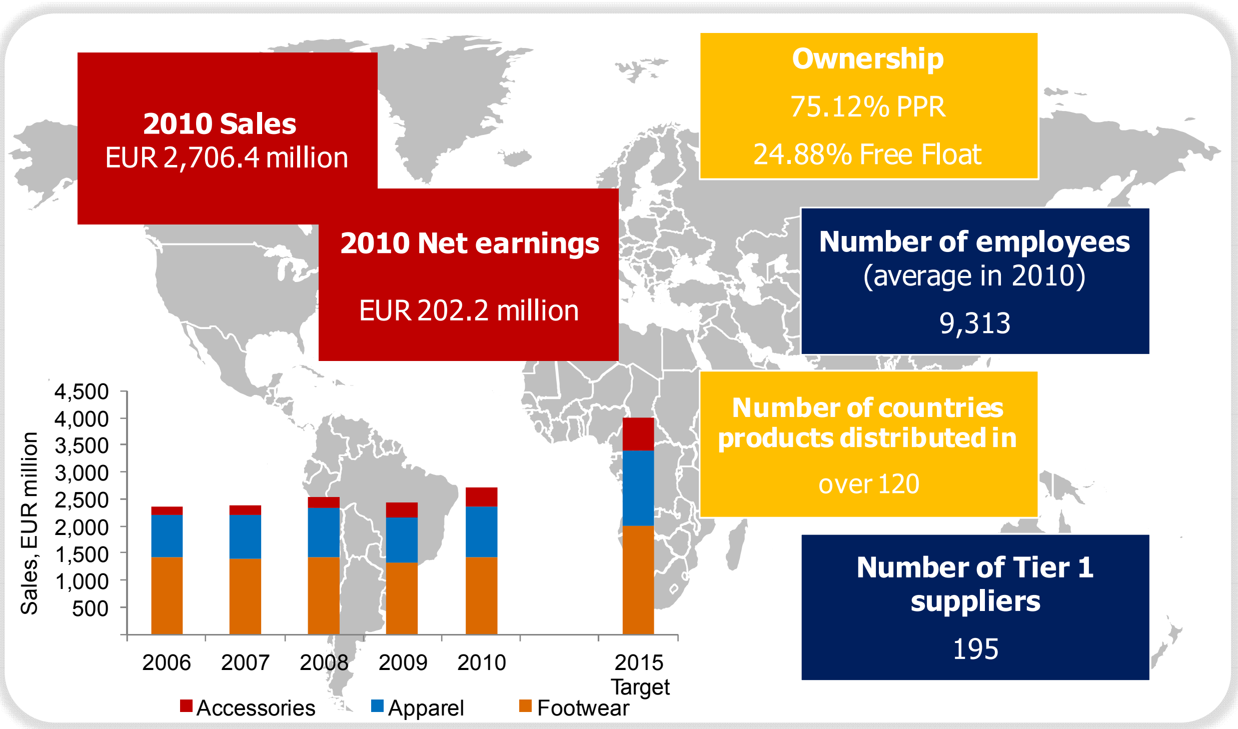
Our mission and principles

Our mission is to be the world's most desirable *and sustainable* Sportlifestyle company. PUMA is committed to living its principles and is focused on empowering employees and suppliers on all levels to take action towards our collective sustainability goals - ultimately helping to provide an authentic and informed customer experience.

PUMA Brands

The PUMA Group owns the brands PUMA, Cobra Golf and Tretorn. Its Sport Performance and Lifestyle labels include categories such as Football, Running, Motorsports, Golf and Sailing. Sport Fashion features collaborations with renowned designer labels such as Alexander McQueen, Mihara Yasuhiro and Sergio Rossi.

PUMA in numbers



Foreword by Jochen Zeitz

Executive Chairman of PUMA SE and Chief Sustainability Officer of PPR

> *"Once we know and are aware, we are responsible for our action and our inaction. We can do something about it or ignore it. Either way, we are still responsible."*
>
> Jean Paul Sartre

How did the idea come about to establish - for the first time ever - an Environmental Profit and Loss Account (E P&L)? This is a question that I have been frequently asked during the course of this project.

As an industry leader in sustainability, PUMA had already delivered on many sustainability initiatives since our journey started in 1999. At the end of 2009, we were setting ourselves ambitious targets to reduce CO_2 emissions, energy, waste and water in PUMA offices, stores, warehouses and direct supplier factories by 25% by 2015. In 2010, we launched our environmentally friendly product packaging - the Clever Little Bag.

Towards the end of 2009, in the midst of all these activities, it occurred to me that - while all these initiatives are crucially important to help reduce PUMA's negative environmental impact - we had to take the next step and demonstrate business as a force for better. Having been inspired by The Economics of Ecosystems and Biodiversity (TEEB) study which draws attention to the global economic benefits of biodiversity and valuing natural capital, I realized that in becoming a truly sustainable business we must address the cost of our business to nature and value it accordingly.

After searching for a solution and tool to implement at PUMA, and finding that there was nothing available, I realized that never before had a company accounted for and integrated the immense value - the true cost - of these services provided by nature such as fresh water, clean air, healthy biodiversity and productive land - which all businesses depend on. Obviously, we pay fees to local authorities for the treatment and supply of water but the true cost of the services water provides remains externalized and unaccounted for. I wanted to know how much we would need to pay for the services nature provides so that PUMA can produce, market and distribute footwear, apparel and accessories made of leather, cotton, rubber or plastic for the long run. I also wanted to know how much compensation we would have to provide if nature was asking to be paid for the impact done through PUMA's manufacturing process and operations. While nature is much more to us as humans than a mere "business", the simple question I put forward was - if our planet was a business, how much would it ask to be paid for the services it provides to a company in order to operate?

I then decided it only made sense to utilize the essence of our accounting framework when monetizing PUMA's environmental impacts so that it could be read like a traditional Profit and Loss Account. Two years down the road, after directing how this could be realized and determining who would support us in this process, we were able to present the initial results of the first ever Environmental Profit and Loss Account, focusing first on PUMA's greenhouse gas emissions and water usage. Later we added land use, air pollutants and waste throughout PUMA's operations and supply chain. The total results revealed, that if we treated our planet as we treat any other service provider, PUMA would have to pay EUR 8 million to nature for services rendered to our core operations such as PUMA offices, warehouses and stores in 2010, alone. An additional EUR 137 million would be owed to nature from PUMA's supply chain of external partners that we share with numerous other companies, and where we have less influence. So if PUMA is to successfully reduce its environmental impact, we have to address the activities of our supply chain partners that generate 94% of our total environmental impact. While we recognize that this is our responsibility, it is at the same time the responsibility of numerous other companies. In order to make a real change we, along with our industry peers, have to collaborate and work responsibly to help reduce the impacts of external supplier factories and raw material producers at least to a point where nature can recover rather than being depleted further, resulting in environmental damages that cannot be undone.

This economic valuation of PUMA's environmental impact does not affect our net earnings, but provides us with a wake-up call and the urgent need to act upon it. These findings transparently reveal where we have to direct our sustainability initiatives in order to make real improvements in reducing our footprint. At our annual stakeholder dialogue in Banz, we presented the PUMA E P&L, sought input from our stakeholders, listened to their ideas, modified some of our thinking and are now strategizing to find solutions for the best way forward.

These include identifying more sustainable materials, investigating the development of broadly accepted definitions of sustainable cotton and rubber and looking for additional opportunities to reduce greenhouse gas emissions and other environmental impacts.

Placing a monetary value on our impacts - on natural services - has helped to illustrate the potentially negative impact depleted ecosystems can have on a business' future performance. It is common practice in the corporate world that this 'inherent' value of nature is not defined and integrated into a company's accounting. Some corporations believe that businesses solely rely on financials and are driven by their "bottom lines". However, even those concerned only about bottom lines - and not the fate of nature - must now begin to realize that the sustainability of business itself depends on the long-term availability of natural capital.

Disappointingly, the negative impacts of business activity continue to grow and natural resources become more and more scarce. Governments will increasingly need to respond, businesses will need to be proactive and consumers will need to take a more active interest in and responsibility for their purchasing choices.

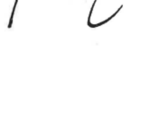
I was very pleased to see the interest generated by the release of the first results of the PUMA E P&L among national governments, sustainability experts, academics and other companies. One month after we released our results, the UK government featured our groundbreaking analysis as a best practices case study for sustainable business in the Department for Environment, Food and Rural Affairs (DEFRA) Natural Environment White Paper, a potential precursor to future policy and legislative action. By putting a monetary value on environmental impacts, PUMA is also diligently preparing for potential future policy or legislative changes, such as disclosure requirements or taxation on ecosystem services.

As a co-opted member of the German Council for Sustainable Development, which advises the German government on sustainability issues, I also presented the results and benefits of the PUMA E P&L to 15 Council members and a representative of the Federal Government in October 2011. As a result, the Council launched a project that aims to secure expert views on the possible development of new corporate reporting standards such as PUMA's environmental accounting statement and will promote the E P&L approach as an innovative practice in these discussions going forward. I continued to advocate our E P&L at influential meetings, such as speaking at the Prince of Wales' Accounting for Sustainability Forum (A4S) which brings organisations together to develop practical tools to enable environmental and social performance to be better connected with strategy and financial performance. In addition, I have been invited to be a member of the TEEB Advisory Board and we will help to contribute to their agenda.

As a leader within our industry, PUMA has always explored a new way forward and our subsequent success has not only proved us right but also encouraged us to go further. Leadership is part of PUMA's mission to become the most desirable and sustainable Sportlifestyle company in the world. As the first company to attempt to transparently lay out our environmental footprint from cradle-to-gate, we have obviously caused some waves in the corporate world. Skeptics and critics will question the validity of our methodology and the veracity of our results but I believe we have made, and gone beyond, the first step. We are committed to this process and we will improve on it as we move forward. I am also excited that PPR, PUMA's majority shareholder and where I am also in charge of the Sport & Lifestyle Division as well as serving as Chief Sustainability Officer, will leverage the lessons learned and implement a Group E P&L across PPR's Luxury and Sport & Lifestyle brands by 2015 - a pioneering move and the first E P&L approach applied across multiple global brands.

I sincerely hope that the PUMA E P&L and its results will open eyes in the corporate world and make the point that the current economic model, which originated in the industrial revolution some 100 years ago, must be radically changed. A new business paradigm is necessary and a transformation of traditional corporate reporting will be central to this - one that works WITH nature, not AGAINST it. If the PUMA E P&L acts as a catalyst for change and other companies follow suit, by integrating their environmental footprint into their accounting processes, we will have succeeded in reaching an important milestone. As we respond boldly and decisively to the results of our E P&L, I am confident that PUMA is well on its way to becoming the most desirable and sustainable Sportlifestyle company in the world.

Yours



Contents

What is an E P&L?

At PUMA we understand the importance of healthy ecosystems to the future of our business and also recognize that we have to be accountable, ethical and responsible to our environment. Towards the end of 2009 we embarked on a journey to develop an enterprise and supply chain-wide view of our environmental impacts in monetary terms, so that we could take these impacts into account strategically and embed them in our business decision making processes.

All business operations and supply chains depend on nature for services such as fresh water, clean air, healthy biodiversity and productive land. PUMA's Environmental Profit and Loss Account (E P&L) is the first attempt to measure the immense value of these services to a business, and the true costs of a business's impacts on nature.

Definition

An Environmental Profit & Loss Account is a means of placing a monetary value on the environmental impacts along the entire supply chain of a given business.

The E P&L measures and values both reductions in ecosystem services and increases in environmental impacts which occur as a result of PUMA's operational and supply chain activities.[1]

Term	Definition
Profit	Activities that benefit the environment.
Loss	Activities that adversely impact the environment.
Environmental impact	A change in the make-up, functioning, or appearance of the environment. For example, greenhouse gases (GHGs) contribute to climate change which is associated with a range of environmental impacts such as reduced crop yields, changes in water availability and increases in extreme weather. Waste disposal results in GHG emissions as well as environmental impacts from leachate which can affect water courses and local disamenity impacts caused by dust, noise and odour.
Ecosystem services	Ecosystem services are the benefits that people and businesses derive from nature, like food, fibre, fuel, regulation of climate, assimilation of waste, opportunities for recreation, protection from extreme events, and cultural and spiritual enrichment.
Monetary value	The economic value to society of the profits / losses.
Entire supply chain	From production of raw materials to transport to stores, the total impact of bringing products to market.

Other key terms are defined in the annex on page 26.

[1] It is necessary to consider both because it is often more straightforward to value environmental impacts in terms of their direct effects on human wellbeing than to evaluate the complex ways in which they effect ecosystem services and natural capital, and then to value the consequences of those changes for society.

Though we pay fees to local authorities for services such as the treatment and supply of water, or the disposal of waste, the true costs of our environmental impacts remain externalized and unaccounted for. The E P&L represents how much we would need to pay for the impacts we cause and the services nature provides that enable PUMA to produce, market and distribute footwear, apparel and accessories made of leather, cotton, rubber or synthetics.

Providing goods and services will always have some impact on the environment. The challenge for us is to reduce our impact on the environment (the 'loss' in an E P&L) as far as possible while continuing to deliver value to our customers and investors, and at the same time look for ways to return value to the environment.

Why we developed the E P&L

Understanding the real cost of doing business - a new operating environment

In the year 2000, a team of more than 1,300 scientists and experts began work on the most comprehensive audit of the world's ecosystems ever undertaken, the Millennium Ecosystem Assessment. Five years later their findings confirmed that ecosystems around the world are in dramatic decline, with 63% of ecosystem services degraded.

A major international study was subsequently launched by the G8+5 environment ministers, The Economics of Ecosystems and Biodiversity (TEEB), to put an economic value on these losses and to recommend actions for a range of user groups. That study estimated annual economic impacts due to biodiversity loss and ecosystem degradation at between USD 2 and USD 4.5 trillion annually. TEEB's report for business and enterprise called on businesses to do more to evaluate and report on their interactions with ecosystems and to quantify their environmental externalities.

Inspired by the TEEB study we at PUMA began our own journey to quantify and monetise our environmental externalities. We also recognized the importance of developing a practical approach for businesses to integrate natural capital into accounting and decision making and to tackle the challenge of the economic invisibility of nature.

We believe that the current economic model, which originated in the industrial revolution some 100 years ago, is no longer viable and must give way to a new business paradigm, one that works with nature rather than against it.

As businesses, we should account for and, ultimately, pay for the cost to nature of doing business. These costs do not currently hit the financial bottom line, but could easily do so in the future, for example, as a result of new government policy, environmental activism, consumer demand, growing scarcity of raw materials, or as a direct consequence of escalating environmental degradation.

PUMA's Environmental Profit and Loss Account (E P&L) is designed to help identify and manage these risks, while simultaneously sharpening our focus in pursuit of new and sustainable business opportunities.

The benefits to our business

A challenge for all companies is to build an increasingly sustainable and resilient business model while also delivering multiple competitive advantages. PUMA aims to be the world's most desirable and sustainable Sportlifestyle company and the E P&L is one of the principal tools by which we hope to gain the information and insight required to set the strategy to achieve this.

The E P&L provides the following benefits to our business:

- Strategic tool

  The findings of the E P&L make transparent where we need to direct our sustainability initiatives in order to make real improvements in reducing our impacts. As a result we are looking into solutions to identify more sustainable materials, investigating the development of broadly-accepted definitions of sustainable cotton and rubber and have started to pursue opportunities to reduce greenhouse gas emissions.

- Risk management tool

  Understanding the value and nature of our environmental impacts in the supply chain provides an early view of emerging risks, enabling us to respond strategically to protect and enhance shareholder value. This is particularly relevant in an industry already facing increasing input costs as a result of a changing climate and availability of water.

- Transparency tool

By reporting the results of the E P&L we are being transparent about the extent of our environmental impacts. We believe this will provide a basis for more meaningful, evidence-based engagement with our stakeholders and enable us to demonstrate clearly the impact of our activities to reduce our impacts.

Ultimately, the E P&L will enable us to make better, more informed business decisions that take account of environmental impacts as well as more traditional financial and operational considerations.

Why put a monetary value on environmental impacts?

Through placing a monetary value on our environmental impacts we sought answers to several important questions:

- How can we help our employees, shareholders and our suppliers understand the magnitude and importance of our impacts on the environment?
- How can everyone in the business grasp the significance of the amount of CO_2 released, the impacts of land conversion required to provide raw materials, or the volume of water consumed and factor this into day to day decision making?
- Relative to one another, which are our most significant environmental impacts?
- Where in our supply chain should we focus our resources to reduce our environmental impacts?
- How can we help others understand the challenge of reducing our environmental impacts, and the work we are doing to manage them?

We recognise that we must account for the cost of nature in our day to day business decisions. Most people in the business and among our suppliers are not familiar with the language of sustainability and often struggle to put figures such as tonnes of GHG emissions and cubic meters of water into context.

We chose to convert our environmental impacts into monetary terms to make them digestible and meaningful to a much wider audience. In doing so we believe we have shed light on the true scale of our impacts, and enabled simpler communication of their implications.

We have seen by the response to our results in the media and the interest shown by governments, industry peers and international organisations that presenting our impacts in monetary terms is already having an effect. We hope that the E P&L will provide a new level of common understanding on which to base future stakeholder discussions around the need to internalise the true costs.

Comparing different environmental impacts is difficult as traditional ways of measuring them do not use a common metric. By assessing all environmental impacts using a common metric – the value to society, measured in monetary terms – the E P&L enables a far greater degree of comparability between very different types of impact. This is helping us better understand where we need to prioritise and focus attention on managing our environmental impacts.

PUMA's environmental impacts

The E P&L aims to cover all significant environmental impacts from the production of raw materials through to the point of sale. PUMA outsources the majority of its production and classifies its supply chain in four Tiers.

Area	Typical activities		
PUMA Operations	• Offices • Shops	• Warehouses • Business travel	• Logistics • IT
Tier 1 suppliers	• Shoe manufacturing	• Apparel manufacturing	• Accessory manufacturing
Tier 2 suppliers	• Outsole production • Insole production	• Textile embroidery and cutting • Adhesive and paint production	
Tier 3 Suppliers	• Leather tanning • Petroleum refining	• Cotton weaving and dyeing	
Tier 4 suppliers	• Cattle rearing • Rubber plantations	• Cotton farming • Petroleum production	• Other material production

Drivers of environmental impact

Through consultation in the expert community and reviews of current industry and academic publications we concluded that our most significant environmental impacts are greenhouse gas emissions (GHGs), water use, land use, air pollution and waste – it is these impacts which are therefore included in our E P&L. During 2011 we made a commitment to reduce and eliminate hazardous chemicals in waste water by 2020. In 2012 we will investigate if it is possible to develop a methodology to incorporate this impact into the E P&L.

The figure overleaf illustrates how different operational processes along PUMA's supply chain result in impacts on the environment. These impacts are briefly described below:

Water use: Water plays a critical role in maintaining all natural systems which underpin life. In PUMA's supply chain water is used principally in the production of agricultural products such as cotton, but also to a lesser extent in industrial processes including leather tanning. The extraction of water by business from surface watercourses, groundwater, and collection of rainwater for consumption reduces the amount of water available to others and therefore reduces the benefits society derives from water. Specific impacts are highly location dependant but include reduced availability of water for domestic, industrial or agricultural use, loss of habitat for other species, changes to local climate, and impacts on recreation in and around watercourses.

Greenhouse gas emissions: Anthropogenic emissions of carbon dioxide and other greenhouse gases are resulting in changes in the global climate. PUMA's emissions arise from the burning of fossils fuels in electricity generation and transport, as well as emissions from land use conversion and cattle rearing (the livestock sector is responsible for 18% of global GHG emissions[2]).

In some parts of the world the impacts of climate change are already being felt, including increased flooding and drought, sea level rise, impacts on crop yields, and more frequent storms. Continuing climate change is expected to increase the severity of these impacts with diverse but significant consequences for societies around the world.

Land use conversion: Natural areas, rich with biodiversity, provide essential services to society which regulate our environment, provide goods and services that support livelihoods, offer opportunities for recreation, and provide cultural and spiritual enrichment. The conversion of land associated with the construction and use of

[2] http://www.fao.org/ag/magazine/0612sp1.htm

buildings and the production of raw materials affects society by making virgin land more scarce and increasingly fragmented, and hence reducing the services that land can provide to society.

Other air pollution: Air pollutants include particulates, sulphur dioxide, ammonia, nitrogen oxide, carbon monoxide, and volatile organic compounds (VOCs) and are emitted principally as a result of the burning of fossil fuels, as well as through the drying and processing of timber. These emissions can result in smog and acid rain, with associated impacts on health (particularly respiratory conditions), agricultural production, property, and the acidification of waterways and soils.

Waste: PUMA's operations and supply chain produces a variety of different hazardous (e.g. dyestuff, adhesives, petroleum products) and non-hazardous (e.g. paper and fabric) waste products. The impacts of waste disposal are dependent on the disposal method. Landfills result in visual disamenity for local populations, greenhouse gas emissions and, if the site is not well managed, the pollution of watercourses through leachate. Incineration also results in some greenhouse gas emissions, and disamenity, along with other types of air pollution.

Illustration of processes and impacts through PUMA's supply chain

PUMA's 2010 E P&L results

The table below sets out for the first time in monetary terms the changes in human welfare which result from PUMA's environmental impacts. Details on how these monetary values were derived are set out in 'How it was done' on pages 12-22.

The top half of the table splits the total impact of EUR 145 million between that attributable to our own operations and each tier of our supply chain. The latter half of the table shows where the impacts occur by our key regions and segments, including the impacts by segment normalised by sales.

The Environmental Profit and Loss

EUR million	Water use	GHGs	Land use	Other air pollution	Waste	TOTAL	% of total
	33%	33%	25%	7%	2%	100%	
TOTAL	**47**	**47**	**37**	**11**	**3**	**145**	100%
PUMA operations	<1	7	<1	1	<1	8	6%
Tier 1	1	9	<1	1	2	13	9%
Tier 2	4	7	<1	2	1	14	9%
Tier 3	17	7	<1	3	<1	27	19%
Tier 4	25	17	37	4	<1	83	57%
Regional analysis							
EMEA	4	8	1	1	<1	14	10%
Americas	2	10	20	3	<1	35	24%
Asia / Pacific	41	29	16	7	3	96	66%
Segments							
Footwear	25	28	34	7	2	96	66%
Apparel	18	14	3	3	1	39	27%
Accessories	4	5	<1	1	<1	10	7%

Intensity	Environmental impact (EUR) per EUR 100 of sales						
Footwear	1.8	2.0	2.4	0.5	0.1	6.7	
Apparel	1.9	1.5	0.3	0.3	0.1	4.1	
Accessories	1.2	1.5	0.00	0.3	0.00	2.9	

The drivers of environmental impacts

The table below sets out our environmental impacts in more traditional metrics. This data was used to generate the monetary values in the E P&L and shows for the first time our environmental impacts from our own operations and our entire supply chain.

	Water use	GHGs	Land use	Other air pollution	Waste
	Million cubic metres	Tonnes CO_2e ('000)	Hectares ('000)	Tonnes ('000)	Tonnes ('000)
TOTAL	**77.5**	**717.5**	**107.8**	**6.6**	**42.3**
PUMA operations	0.1	110.1	<0.1	0.4	6.5
Tier 1	5.3	131.4	0.3	1.1	21.2
Tier 2	20.3	108.8	0.2	1.0	8.3
Tier 3	18.4	112.7	0.2	1.2	3.3
Tier 4	33.4	254.5	107.1	2.9	3.0
Regional analysis					
EMEA	9.3	123.0	1.3	0.7	5.0
Americas	14.6	150.8	55.1	1.8	5.5
Asia / Pacific	53.6	443.7	51.4	4.1	31.8
Segments					
Footwear	8.2	72.9	0.4	0.7	3.9
Apparel	30.8	210.0	17.3	1.6	7.8
Accessories	38.5	434.6	90.1	4.3	30.6

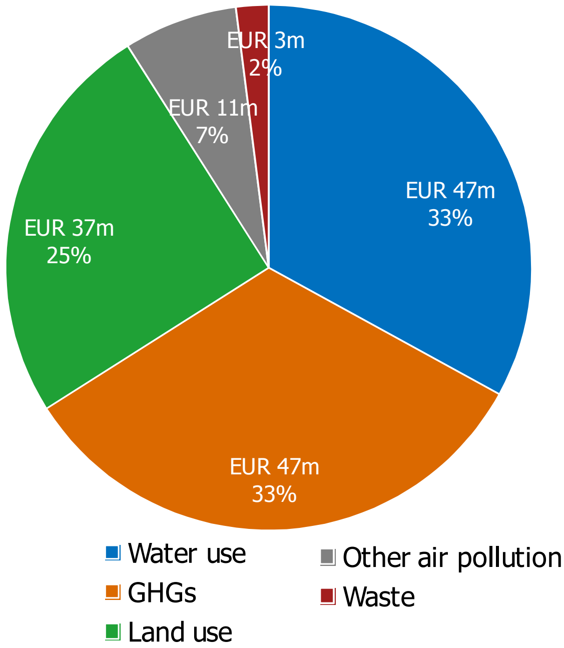
Discussion of results

PUMA E P&L results by environmental indicator

The 2010 E P&L provides for the first time a view of the environmental impact of producing and selling our products. It is difficult to place the overall impact of EUR 145 million in a broader context as no other business has yet publicly disclosed similar information. However, at EUR 145 million each year the scale of the impacts is undeniable.

By converting non-financial impacts into monetary values reflecting the impact on the environment and society the E P&L shows which of our environmental impacts are the greatest and where these impacts occur.

- At EUR 47 million each, our greatest impacts are from the use of water and the generation of greenhouse gas emissions.
- The conversion of land for agriculture for key raw materials such as leather, cotton and rubber is our third greatest impact at EUR 37 million.
- Other air pollution affecting acid rain and smog and the impacts of waste are less significant at EUR 11 million and EUR 3 million respectively.

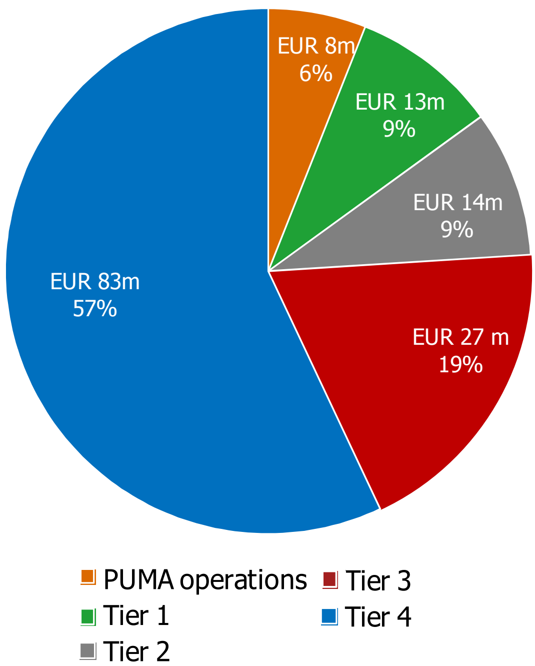


PUMA E P&L results by PUMA operations and tiers of the supply chain

In producing the E P&L we have reported our impacts from beyond the operations we control and see that our supply chain has a much greater environmental impact than our own operations.

The results show that just 6% (EUR 8 million) of the impact arise in our own operations, with a further 9% (EUR 13 million) caused by our direct suppliers (Tier 1). This leaves 85% of the impact outside what can be considered areas in which we have direct control or influence. As a result the full costs of the E P&L cannot be borne by PUMA alone and require a broader consultation. We will therefore need to work in collaboration with our suppliers and industry peers to address the impacts at all levels of the supply chain.

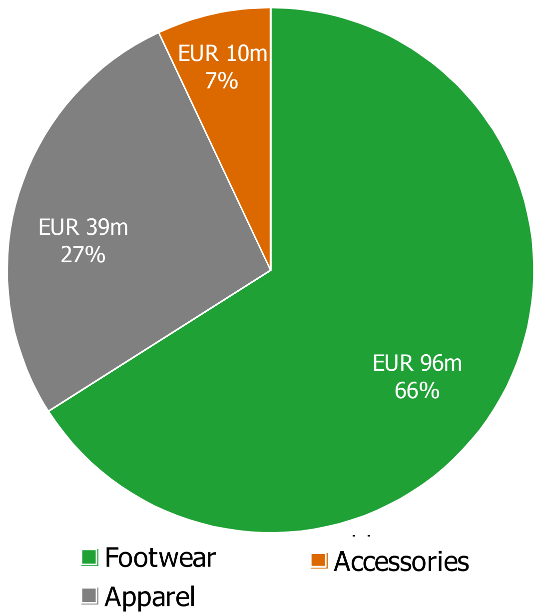
Tier 4 (impacts from the production of raw materials) in itself accounts for 57% (EUR 83 million) of our total impacts. This stage of production is a hugely important determinant of the quality and desirability of our products but also the aspect most distant from our own operations and influence.



PUMA E P&L results by business line

Analysing the results by line of business provides further insight into the drivers of our environmental impact. Our Footwear lines generate the greatest environmental impact indicated by the impact per EUR 100 of sales. The monetised environmental impacts from footwear are EUR 6.7 per EUR 100 of sales, Apparel EUR 4.1 and Accessories EUR 2.9 per EUR 100 of sales. The high impact of Footwear is caused by the materials and processes involved in creating our products.

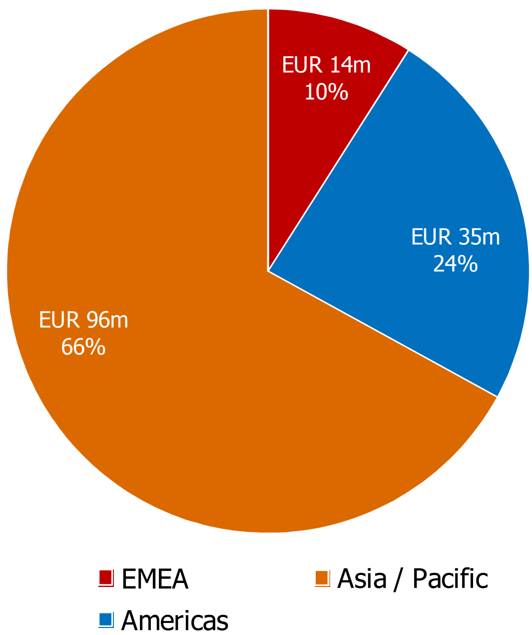
The intensity of the environmental impact of Footwear is driven to a large extent by the amount of leather used. Cattle farming and leather tanning and finishing are the most energy intensive process and some of the most water intensive processes of all the processes in the supply chain. In addition, cattle farming is the most land extensive material used in our products.



PUMA E P&L results by region

Our environmental impacts occur mostly in the Asia / Pacific region (66%, EUR 96 million) where the majority of our supply chain is based. More than 40% of the environmental impact in Asia / Pacific is from water use which is driven by the concentration of cotton farming and fibre, yarn, thread and fabric mills in the region. In addition, our high concentration of supplier factories in the Asia / Pacific region means that more than 60% of GHG emissions and other air pollution, and almost all of our waste is generated here. A significant proportion of raw materials are also sourced from the region with Australia providing leather, India and China providing the majority of cotton and Vietnam most of the natural rubber.

The impacts of land use from the sourcing of leather from the Americas accounts for more than half the impacts in this region with the majority of leather coming from Argentina, Canada and the US, and some cotton coming also from the US.



How it was done

PUMA's E P&L is the first attempt to measure, value and report the significant environmental externalities associated with our business and its entire supply chain. It aims to cover all significant environmental impacts from the production of raw materials right through to the point of sale – a scope sometimes referred to as 'cradle to gate'.

The process of developing the E P&L methodology

A comprehensive international search for an existing methodology revealed significant progress in the academic field of environmental economics and ecosystem valuation, many applications in the public sector, and some promising work in the private sector. However, no single methodology was found which could deliver the enterprise and supply chain-wide view of environmental externalities that we sought.

Following a rigorous selection process, we appointed PricewaterhouseCoopers (PwC) and Trucost to support the development of such a methodology, drawing specifically on the environmental economists, non-market valuation specialists and sustainability reporting experts in PwC's Sustainability and Climate Change team, and experts in supply chain metrics and environmental valuation from Trucost.

Scope and boundary of the E P&L

The task for the E P&L project team was to provide a high level view of the most significant environmental externalities across PUMA's operations and supply chain. The chosen scope was therefore 'cradle to gate'; from the production of raw materials, through the manufacturing process, and up until the point of sale. The impacts covered in the E P&L represent PUMA's most significant global environmental impacts, where PUMA contributes to the following:

Impact	Measurement
Climate change	Tonnes of GHG emissions
Water scarcity	Volume of water used
Loss of biodiversity and ecosystem services	Area of ecosystem converted
Smog and acid rain	Tonnes of particulates, ammonia, sulphur dioxide, nitrogen oxide, volatile organic compounds (VOCs) and carbon monoxide
Leachate and disamenity affects from landfill and incineration of waste	Tonnes of waste to landfill and incineration

Measuring the drivers of environmental impact

To measure the drivers of each of the chosen impacts, data were sourced from PUMA's operations and suppliers where available and supplemented with modelled data to complete the picture. This process is described in more detail in the table below.

Driver	Sources of data and calculation approach
• Tonnes of GHG emissions • Volume of water used (cubic meters of direct water consumption) • Tonnes of particulates, ammonia, sulphur dioxide, nitrogen oxide, volatile organic compounds (VOCs) and carbon monoxide • Tonnes of waste to landfill and incineration (hazardous and non-hazardous)	*PUMA's own operations and selected first Tier suppliers* • For PUMA's own operations data on offices, retail, warehouses, business travel and logistics came from PUMA's internal environmental management system. • A number of PUMA's most significant first Tier suppliers have been providing data to PUMA on these drivers. Other significant Tier 1 suppliers were engaged to collect further primary data. • Significant GHG emissions other than carbon dioxide (CO_2) (methane, CH_4 and nitrous oxide, N_2O) and air pollutants including carbon monoxide (CO), sulphur dioxide (SO_2), nitrogen oxide (NO_x) and particulate matter were incorporated into the analysis based on fuel consumption data also collected in PUMA's environmental management system. The latest fuel conversion factors from the International Energy Agency were used. • Actual data collected represents 30% of total greenhouse gas emissions, 11% of total air pollution emissions, 1% of total water abstraction quantities and 55% of total waste generation quantities. The remaining data are modelled. *Remaining first Tier suppliers and suppliers in Tiers two to four* • For the remaining suppliers (representing 84% of the impact), the measurement of the drivers of environmental impacts were modelled using Trucost's econometric input-output (I-O) model.
Area of ecosystem converted (hectares)	The land use valuation note below provides detail on how areas of ecosystem converted for the production of raw materials and footprint of factories and offices in PUMA's supply chain were estimated.

Modelling of drivers of environmental impacts

Trucost's econometric input-output model was used to generate much of the supply chain environmental impacts. This econometric model applies government collected industry census data to analyse the products used and produced by 464 business sectors. By understanding the economic interactions between each business sector, the model integrates the use and emissions of more than 250 environmental resources. Using information on the expenditure and sectors of operation for 195 of PUMA's first-Tier suppliers in the 2010 financial year, volumes of GHGs and other air pollution, water abstraction and waste generation were estimated for each supplier's own operations and those of its own supply chain.

Primary GHG, air pollution emissions, water consumption and waste generation data were validated against the modelled data to help enhance data integrity across the supply chain.

Assumptions and limitations

Measuring and valuing environmental externalities on the scale required is not a precise exercise and requires significant assumptions in a number of areas. However, the key business value lies in understanding the scale, scope and trajectory of PUMA's impacts on the environment; we believe our analysis is ultimately sufficient to deliver this value. As a result of limited data availability for the underlying environmental drivers, 88%[3] of the total E P&L impact is derived from modelled data. The econometric input-output (I-O) model assumes that PUMA's suppliers are typical within their industrial sector, with an average level of economic and environmental performance for each unit of output.

Other than for GHGs, the location of emissions or resource use is significant because the ensuing environmental impacts depend on geographical location and context. However, while the precise location of Tier 1 suppliers was known, for many other suppliers only national level locations were available.[4] As a result, the valuation approaches employed in the E P&L generate national level averages for specific environmental impacts. Making decisions at a local level may require additional research and analysis.

The valuation approaches also involve important assumptions related to the applicability of the results from previous studies but set in new contexts[5] and also to the likelihood of uncertain events.

We have been mindful of differences in underlying study boundaries and approaches, potential double counting between studies and between impact categories in the analysis, and the need for an appropriate level of completeness. We have taken a conservative approach to selecting the assumptions used in the methodology, erring on the side of the environment, endeavouring not to underestimate our impacts.

Significantly more detail on the key assumptions in the analysis is included in the methodological notes later in this section.

---

[3] For GHG emissions, water use, other air emissions and waste the economic input-output model results accounted for 84% of the total impacts for these metrics. The area of land converted is based on productivity modelling. Together the proportion of the E P&L that is based on modelled data is 88%.

[4] Engagement with suppliers in Tiers 2 and 3 provided information on their locations and the geographical sourcing of raw materials (by production quantity) within each product category (Apparel, Footwear, and Accessories), which was used to infer the geographical breakdown for Tier 4.

[5] Values from pre-existing studies often need to be 'transferred' from alternative comparable locations and adjusted as appropriate using recognised economic techniques.

BOX: What do we mean by environmental valuation in the E P&L?

The E P&L approach

The environmental valuation approaches used in the E P&L attempt to quantify in monetary terms the changes in human welfare[6] which result from PUMA's environmental impacts. The E P&L therefore presents the estimated cost to society of PUMA's environmental impacts.

Environmental valuation employs a wide range of techniques to estimate changes in human welfare, sometimes eliciting estimates directly from affected parties (for example, by asking how much they would be willing to pay to achieve a particular environmental outcome), or indirectly, by using estimated willingness to pay or accept compensation for changes known to be caused by environmental factors (for example, particular health outcomes). Welfare estimates can also sometimes be inferred based on costs incurred to avoid or mitigate particular environmental outcomes, or revealed in the prices paid for marketed products and services.[7]

Other possible approaches

Two alternative approaches to valuing environmental issues were considered, but were deemed inappropriate for this analysis. They are described below:

Market prices: Market transactions are associated with the management of many environmental impacts and can be used to measure environmental impacts. For example, the cost of disposing of waste, charges paid for water abstraction and use, or the traded price of carbon (e.g. in the European Union Emissions Trading Scheme). However, these prices reflect the supply and demand conditions in imperfect markets and are not generally a good approximation of the costs to society of the impacts associated.

Abatement costs: The cost of reducing emissions or impacts, for example through adopting different manufacturing practices, is termed the abatement cost. For example, the social cost of carbon applied to every tonne of CO_2e in the E P&L is EUR 66. However, the cost of abatement varies across different technologies, each offering a given potential for emission reductions at a different cost. It is therefore not the case that reducing PUMA's environmental impacts to zero would cost EUR 145 million. Abatement costs are not a measure of social impact but rather one of technological change and are therefore inappropriate for the E P&L.

Valuing the environmental impacts

GHGs

The analysis of GHG impacts applies an estimate of the 'Social Cost of Carbon'[8] (SCC) to PUMA's 2010 operational and supply chain emissions, to provide an estimate of the potential welfare impacts of those emissions. Estimates of the SCC look to value the damage resulting from current and future climate change (e.g. reduced crop yields, damage to infrastructure, increased incidence of extreme weather) attributable to each tonne of carbon dioxide equivalent (CO_2e) released in a given year.

The SCC used in the analysis is derived from a subset of the SCC estimates reported by the economist Richard Tol in his 2009 paper "The Economic Effects of Climate Change". The 232 estimates of the Social Cost of Carbon (SCC) included in Tol's paper are based on a wide range of models and assumptions and range in USD from below-zero to four-figure estimates.

---

[6] Human welfare (or human well-being) is a measure of how 'well off', 'satisfied' or 'happy' people are, or consider themselves to be.
[7] For some impacts a variety of methods are possible and in all cases care must be taken in the choice and subsequent application of an approach to achieve the closest possible proxy for likely changes in human welfare given a particular environmental change.
[8] The phrase 'social cost' is used here because it is widely used in the literature on the potential welfare impacts of climate change. Social cost is an accurate description and consistent with the approaches taken for PUMA's other environmental impacts but easily misunderstood in a context where the impacts being valued are environmental. For clarity therefore it is worth re-iterating that the E P&L estimates the change in human welfare (i.e. social cost) of changes in environmental quality that result from PUMA's activities. These costs should not be confused with the costs and benefits associated with what are more typically classified as social impacts – for example; working conditions, employee access to healthcare, or education and training.

The approach considers five principle uncertainties which have a significant impact on the resulting SCC estimate. These factors, along with PUMA's approach, are summarised below.

Discounting future damages resulting from 2010 emissions: PUMA opted to use a social discount rate (SDR) rather than a commercial discount rate to estimate the SCC. The SDR comprises two elements – the 'Pure Rate of Time Preference' (PRTP) and assumptions on future economic growth. The PRTP selected by PUMA is 0%, based on the philosophy that no generation should prioritize its welfare over another's. The approach averages future economic growth in the studies which disclose it. The overall SDR applied in the analysis was 3.4%.

Normalising SCC estimates in 2010 USD: As well as adjusting for price inflation, older SCC estimates were increased by 3% per annum to account for growth in the SCC as a result of the increased stock of GHGs in the atmosphere (the mid-point of the IPCC's 2-4% range).

Valuing damages: Studies use a range of methods to value damages from climate change but no formal consensus exists. PUMA's approach was therefore to average across studies.

Accounting for catastrophic risks: High estimates of the SCC are often driven by extreme climate scenarios while lower estimates are generally based on more moderate scenarios. When averaging across many SCC estimates, choosing the median value reduces the impact of more extreme scenarios on the result because most estimates are clustered towards the lower end of the distribution of values. To take account of more extreme climate scenarios, PUMA used the mean of the distribution of SCC estimates.

Equity weighting across countries based on income levels: Many SCC studies make adjustments to damage values to reflect differences in incomes and material wealth between countries – so called 'equity weighting'. There is currently no consensus on how or if equity weighting should be applied. Therefore PUMA has chosen to take an average across studies.

Valuation results

Applying the criteria and approaches outlined above resulted in a global estimate for the 2010 Social Cost of Carbon, expressed in 2010 Euros of: EUR 66 t/CO_2e (USD 87).

This estimate is highly sensitive to the assumptions outlined above and PUMA recognises that there is significant uncertainty around the true SCC. The estimate will be revisited in future years and revised as appropriate depending on developments in the science and economics of climate change.

Other air pollution

The impacts of six air pollutants are included in the valuation: particulates; sulphur dioxide; nitrogen oxide; ammonia; volatile organic compounds (VOCs) (considering their outdoor environmental impacts only at this stage); and carbon monoxide. These pollutants are associated with various, sometimes overlapping, external costs. Five types of external cost were included in the valuation: negative health effects; reduced crop yields; corrosion of materials; effects on timber; and acidification of waterways. Some of the effects are caused directly by the pollutant emitted (e.g. the health impacts of particulates) and some effects are caused by secondary pollutants formed as a result of chemical reactions in the atmosphere (e.g. sulphur dioxide forming sulphuric acid as well as sulphate compounds which contribute to smog).

Literature reviews were carried out for each pollutant to derive the average level of each type of effect associated with a tonne of that pollutant (e.g. the reduction in crop yield from a tonne of nitrogen oxide emission). Local market values were applied to impacts on market goods such as crops, materials and timber. For largely non-market costs such as health impacts, values were based on averages derived from 'willingness to pay' and 'willingness to accept' compensation studies in the literature. Where necessary, these averages were then adjusted based on relevant local factors (e.g. purchasing power parity for willingness to pay analyses, population density for health impacts).

Particulates' impacts on human health are local and the location and height of the emissions has a significant impact. The number of effects associated with each tonne of particulate emissions was adjusted based on which type of sector was emitting the pollutant – a technique used in the literature. For example, emissions of particulates from electricity generation generally cause less harm to human health than emissions from, for example, the transport sector because of the average height at which the emissions occur (high stacks of a power station, compared to ground level emissions from transport) and the average local population density. For the other pollutants, local factors are somewhat less important and in these cases, average impacts from the literature were adjusted based on regional population densities. The size of the particles is directly linked to their potential to cause health problems. Particles that are 10 micrometers (μm) in diameter or smaller (PM_{10}) cause serious health effects because they can be passed through the throat and nose and enter lungs.

Carbon monoxide effects were found to be small, accounting for less than 0.5% of the total cost of air pollution and an average global external value was derived from the literature.

Ammonia (NH_3) and Sulphur dioxide (SO_2) both disrupt nutrient cycling within forests through acid deposition and the acidification of soils. Ozone from Nitrogen oxides (NO_x) and Volatile Organic Compounds (VOCs) emissions effect crop yields and tree growth by reducing the efficiency of photosynthesis and entering stomatal leaf openings. The reduction in timber outputs and crop yields due to acid rain and ozone are dependent on local factors such as soil type and meteorological conditions. However, they can be valued using global market prices and adjustments based on the regional forest cover and crop type. The depreciation cost of man-made materials resulting from the corrosive effects of acid rain are calculated using local maintenance costs. The valuation of acidification effects on waterways uses observed clean-up costs as a proxy for the value placed on non-acidified water; transferring these from site to site where necessary. It is common practice to use such cost based approaches in the absence of welfare derived alternatives but it is worth noting that the approach does not therefore explicitly value reduced fish catches, reduced eutrophication of estuaries, lost recreational value or other impacts of acid rain. The literature suggests, however, that the value of these indirect impacts on humans is dwarfed by the value of the more direct impacts captured in this analysis.

The dispersion of air pollutants is unpredictable and non-uniform and modelling this dispersion was beyond the scope of this study. This made estimation of costs associated with geographical location difficult. Taking averages from existing regional studies, each of which modelled air dispersion, should help to counteract any element of uncertainty. There are also significant non-linearities associated with some of the chemical reactions that the pollutants undergo in the atmosphere, which could have unpredictable effects on costs and may not be fully captured in an analysis based on average values.

Valuation results

The table below shows the weighted average values (per tonne) for each pollutant according to the locations of PUMA's operations and that of its global supply chain. The table also shows the range of values across the locations (values vary according to location and sector as described above).

Air Pollutant	Weighted Average Value per tonne (EUR)	Range (EUR)
Particulates	14,983	1,285 – 191,743
Ammonia	1,673	1,133 – 5,670
Sulphur dioxide	2,077	783 – 6,422
Nitrogen oxides	1,186	664 – 3,179
Volatile Organic Compounds	836	425 – 1,998

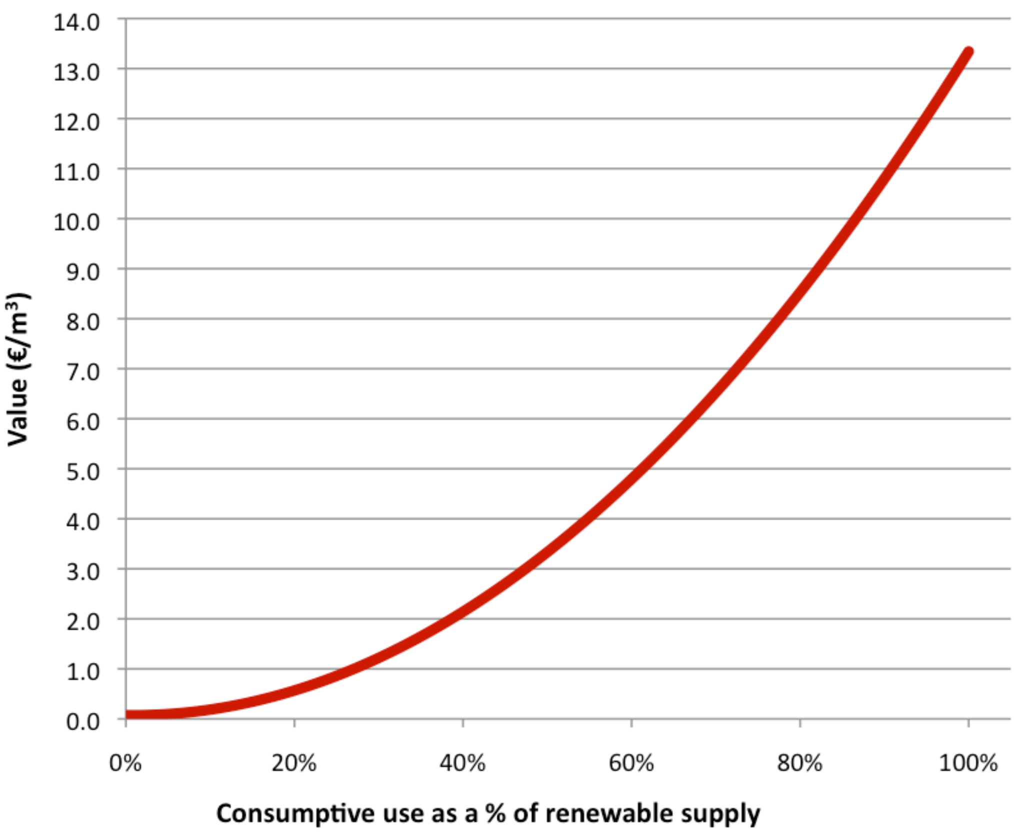
Water use

The water use value coefficients were derived from an extensive review of the available water valuation literature adjusted for local incomes and water scarcity. The analysis values the loss of ecosystem services that depend on water for their provision (other than direct provision of freshwater) - often termed the 'indirect use value' of water. The lost value associated with reduced water availability for direct consumption (the opportunity cost of water) is not included because this is assumed to be accounted for in the price PUMA and its suppliers pay for water extraction and use. This is a significant assumption since water prices are often observed which either exceed or do not cover local opportunity costs. The overall approach along with key adjustments are summarised below.

The values for water represent the reduction in the indirect use value of water accruing to third parties (e.g. via ecosystem goods and services, such as freshwater replenishment, ecosystem maintenance, water nutrient cycling) as a result of water consumption in PUMA's operations and supply chain. Consumptive use of water means that the water withdrawn is not returned to the source from which it is withdrawn, and therefore reduces the water available to other water users and users of water ecosystem services, who derive value from the presence of water.

The indirect use value of water is considered to be principally driven by its scarcity. A wide literature search was conducted to estimate the relationship between scarcity and value. The search showed that many of the water valuation studies used methods that were difficult to compare. As such, a sample of 18 US studies were selected as these used comparable approaches and spanned a wide range of local water environments from arid regions to areas where water was relatively abundant. The relationship between water scarcity and value was established and applied to the locations where PUMA operates or sources goods from.

Relationship between value and scarcity



The level of water scarcity (withdrawal (surface + groundwater) as a percentage of actual renewable freshwater resources)[9] in PUMA's operations and supply chain was obtained at a basin-level where location-specific information was available and otherwise considered at a national-level. The observed relationship between water scarcity and value (based on the US studies) was calibrated to regional valuation estimates obtained from the literature review and applied across sites and countries in PUMA's own operations and supply chain to estimate the water use externality. Estimates were adjusted for purchasing power parity where appropriate to better reflect the local value of lost services.

[9] FAO Aquastat

Valuation results

The weighted average value according to the locations of PUMA's operations and that of its global supply chain is EUR 0.81/m^3 with a range of EUR 0.03 to EUR 18.45/m^3 depending on the scarcity in each location (as described above).

Land use conversion

Natural areas, rich with biodiversity, provide essential services to society which regulate our environment, provide goods and services that support livelihoods, offer opportunities for recreation, and provide cultural and spiritual enrichment. The flow of ecosystem services from natural areas accrues to society every year and, as the extent of natural areas decreases as a result of land conversion, so the annual flow of public ecosystem services is reduced.[10]

This analysis values the environmental externality represented by the loss of biodiversity and ecosystem services associated with the conversion of natural ecosystems to provide land for agriculture and buildings[11] in PUMA's operations and supply chain.

The greatest land use conversion in PUMA's supply chain is associated with the farming of cotton, rubber and cattle ranching for leather which occur in Tier 4 of PUMA's supply chain.[12] For these land-intensive activities a detailed analysis of the value of ecosystems converted was carried out. For PUMA's own operations and Tiers 1 to 3, a more simplified methodology was applied. As information on the specific land areas used in the production of PUMA's raw materials is not currently known, the analysis for cotton, rubber and cattle ranching considers PUMA's impact as a share of the total industry impact within each source country. Government statistics were used to identify the area occupied by the production of cattle, cotton and rubber at a sub-national level. The area required for producing PUMA's leather, cotton and rubber is based on its share of this production.

For cotton and rubber the full land use impact is attributed to PUMA. For leather, an adjustment must be made to account for the fact that leather is only one of the economic outputs of cattle production, the principle other output being meat. Some commentators argue that leather is a pure by-product of cattle rearing for meat. PUMA takes the more conservative view that since the value of the hide adds up to 15% to the value of the cow, demand for leather forms part of the economic case for cattle-rearing and therefore part of the case for land conversion. Land use is attributed to leather production in proportion to its share of the value of a cow in each country.

To identify the ecosystem conversion associated with PUMA's production, the historic ecoregions in each source country[13] were first examined. The analysis draws on the 867 ecoregions identified by WWF's Terrestrial Eco-regions analysis.[14] Due to the number of valuation studies, for valuation purposes it is not appropriate to differentiate ecoregions in the level of detail reported by WWF in their biophysical analysis. For the purposes of this analysis, WWF's eco-regions are therefore mapped to aggregated eco-regions using classifications closely aligned with those adopted by The Economics of Ecosystems Biodiversity (TEEB).

---

[10] The principle cause of on-going losses of biodiversity and declines in ecosystem service provision is the conversion of natural ecosystems to agricultural land. Cultivated systems now cover one-quarter of the Earth's terrestrial surface, and it is predicted that a further 10% to 20% of natural grassland and forestland may be converted by 2050 (Millennium Ecosystem Assessment Reports).

[11] A simplified methodology was used to estimate the impacts associated with land conversion for factories and offices in Tier 1 to 3 and PUMA's operations, representing less than 1% of the total impact, as such the methodology is not elaborated on here.

[12] Other causes of land use conversion were excluded: wool, linen, palm oil, bamboo and other agricultural products are used in small quantities and are therefore considered immaterial; the land footprint associated with the production of petroleum derivatives used in synthetics is low relative to the share of production consumed by PUMA through the lifetime of the production facility and is therefore considered immaterial.

[13] The analysis was done at a sub-national resolution, typically state or regional (e.g. Australian territory, Argentinean Province, US State etc.)

[14] WWF's Conservation Science Program (CSP) define ecoregions as relatively large units of land containing a distinct assemblage of natural communities and species, with boundaries that approximate the original extent of natural communities prior to major land use conversion.

Areas of land use across different ecosystem types

Historic ecoregion	Area (thousand hectares)
Grassland	53
Temperate forest	39
Sub-tropical forest and woodland	10
Tropical forest	6
Inland wetland	1
Coastal wetland	<1
All	**110**

To assign a per hectare value to these ecosystems the analysis draws on the significant body of existing ecosystem valuation literature. A large number of studies were compiled by TEEB which were supplemented by additional research. This was used to generate values for each relevant ecoregion (e.g. tropical forest, grassland, inland wetland) in each country, drawing on the approach employed by TEEB.

Most underlying ecosystem valuation studies were performed recently and consider the cost of losing an additional hectare 'today'. However, the land that PUMA's production occupies was converted at some time in the past, when natural areas were more abundant. The values from existing studies have therefore been adjusted to take into account the fact that ecosystem value (per hectare) increases as the extent of remaining natural areas diminishes. PUMA makes the conservative assumption that ecosystem value is directly proportional to scarcity of the given ecosystem (rather than increasing more rapidly as scarcity increases which would give a lower average value over time). An average value over time (for each ecoregion in each country) is developed based on this assumption.[15]

A second conservative assumption, implicit in the analysis, is that all public ecosystem services are lost following land conversion. Since producing the materials that PUMA relies on generally involves intensive agricultural techniques which prioritise private financial returns over the provision of public ecosystem services, this assumption is likely to be reasonable in most cases.

Valuation results

A total of 156 different values were derived according to this approach, specific to each ecosystem type in each country from which PUMA sources raw materials or has operations. The per hectare values for the various ecosystem types range from EUR 63 (arid grasslands in Pakistan) to EUR 18,653 (coastal wetlands in the US). The weighted average ecosystem value across the entire analysis was EUR 347, indicating that most of PUMA's land use is at the lower end of this range. Coefficients were multiplied by the identified production areas to give the total cost of land use associated with PUMA's operations and supply chain in 2010.

[15] Estimates of the value of ecosystem services (per hectare) today reflect today's acute levels of ecosystem scarcity, whereas the value of ecosystem services (per hectare) when natural ecosystems were more plentiful would have been much lower. In order to apply these values to historical conversions, it is therefore necessary to adjust today's marginal value estimates according to the relationship between marginal value and scarcity. In practice the actual relationship will vary for different ecosystems. In some cases a positive convex exponential relationship is likely due to damage thresholds above which ecosystems cease to function. However, given the lack of data we chose to use a directly proportional relationship as a strongly conservative assumption. An average value through time was calculated for each ecosystem type in each country and applied to all areas irrespective of the time of conversion. Using the average is the most appropriate approach because today each converted plot contributes equally to the prevailing scarcity of ecosystem services, such that it would be inappropriate to assign them different values.

Weighted average cost of using one hectare of different types of ecoregion[16]

Historic ecoregion	Weighted average value (EUR per hectare)
Grassland	229
Temperate forest	283
Sub-tropical forest and woodland	251
Tropical forest	1,352
Inland wetland	5,792
Coastal wetland	18,653
Average for all	**347**

Box: Case study example – the land use impact of PUMA's leather sourced from Australia

In 2010, PUMA used 4.8 million square feet of leather from Australia. This is equivalent to 1.1% of Australia's total production (252,000 tonnes or 423 million square feet at 1.679 ft^2/kg). Australia's cattle industry occupied 38 million hectares of modified pastures in 2010 (excluding grazing of unconverted natural grasslands). Assuming constant productivity, 420,000 hectares were required to produce the leather used by PUMA.

However, it would be inappropriate to allocate all the impacts associated with this area to PUMA because the cattle industry also produces meat. The average value of the meat from an Australian head of cattle was USD 653 in 2010, and the average hide price USD 57, representing 8% of the value. Apportioning 8% of land use impacts to PUMA gives an area of 34,000 hectares.

The precise locations of this production are unknown. We assume, therefore, that it is drawn equally from all in-country producers. The spatial distribution of cattle production in Australia allows us to identify the types of ecosystems that have been converted to make way for cattle production. The Australian cattle industry is concentrated in New South Wales, Victoria and South Australia where converted grassland and temperate forest make up most of the area, along with some sub-tropical forest and woodland, and some tropical forest in Queensland.

Per hectare values for each ecosystem were drawn from the academic literature and adjusted for income, and environmental context, and converted to account for the time of conversion. The resultant values range from EUR 343 per hectare for grassland to EUR 2,973 per hectare for tropical forest. Tropical forests have a higher value because they are more productive, have a greater biological diversity, offer valuable recreation opportunities, store more carbon, and are relatively scarcer. Multiplication of the per hectare values by the land area for each ecosystem type where conversion took place gives a total value of EUR 11.7 million for the land use impacts associated with PUMA's leather demand from Australia.

[16] These values are weighted across all countries in the analysis and are also 'time weighted' based on the adjustment described in note 14.

Solid waste

The valuation of solid waste generated by PUMA and its supply chain are based on two types of disposal method: landfill; incineration. Each disposal method has a different external cost associated with it.

Landfill

Waste sent to landfill (basic landfill or sanitary landfill) has three main external costs: greenhouse gas (methane) emissions from the decomposing waste; leachate emissions (liquid run-off that passes into the surrounding area); and the disamenity effects of the site (noise, dust, litter, odour, the presence of vermin, visual intrusion and enhanced perceptions of risk).

Methane emissions were quantified based on the IPCC emission factors for waste, with national methane capture rates taken into account. The Social Cost of Carbon was then applied to each tonne of methane (measured in CO_2-equivalent). As the waste decomposes over many years, the temporal profile of methane emissions was calculated using the US EPA's landfill life-cycle data tool and a discount rate of 3.4% (as used in the GHG valuation methodology) was applied to the cost of future emissions associated with waste deposited in 2010.

Leachate costs are based on the cost of clean-up to remediate the affected area. Leachate costs depend heavily on the quality of the landfill site. High-quality, well-managed landfill sites will have negligible leachate costs. By contrast, basic landfill sites with no liner can have very high leachate costs. A leachate scale was developed based on best and worst case scenarios from the literature. Leachate costs were then derived based on the quality of waste management in each country in PUMA's value chain (using the percentage of waste going to a formal disposal method as a proxy for waste management quality).

Disamenity effects are principally non-market effects and hedonic pricing methods[17] are commonly used in the literature to infer the associated external costs. Average disamenity costs were derived from the literature and adjusted for different countries at purchasing power parity.

Valuation results

The weighted average value according to the locations of PUMA's operations and its global supply chain is EUR 73 per tonne of waste sent to landfill (ranging from EUR 36 to EUR 87 depending on location – as location influences the three factors described above).

Incineration

Waste incineration has two main types of external cost – emissions to air (GHGs, air pollutants, polyhalogenated organic compounds and heavy metals) and disamenity. An environmental 'benefit' can also be obtained through energy recovery (as this avoids the use of fossil fuel derived energy).

Quantities of emissions to air were estimated using national incineration emissions limits for countries included in PUMA's supply chain (using average emissions limits for those where no data was available). Studies from the literature take this approach and assume that incinerator emissions are equal to the limit values of the study country or region. GHG emissions were valued based on the Social Cost of Carbon. Valuation of air pollutants (sulphur dioxide, nitrogen oxide and particulates) follows the methodology described in the Air Pollution valuation note above. The cost of Polychlorinated-p-Dibenzodioxins and Polychlorinated Dibenzofurans as well as heavy metal emissions was derived from the 2009 EU study "Waste Management Externalities in EU25".

Where energy recovery was present, conversion factors for energy recovery from waste and national grid electricity conversion factors were used to derive the GHG emissions avoided per tonne of waste incinerated.

Valuation results

The weighted average value according to the locations of PUMA's operations and that of its global supply chain is EUR 51 per tonne of waste incinerated (ranging from EUR 35 to EUR 63 depending on location).

---

[17] Hedonic pricing is an example of a 'revealed preference' valuation technique whereby preferences for non-market aspects of environmental quality are revealed in market transactions. For example, variations in house prices may reveal a preference for houses away from a dump site allowing an estimate of the value of the disamenity effects of the dump site to be derived.

The journey ahead

The development of the E P&L supports our vision of becoming the world's most desirable and sustainable Sportlifestyle company by helping to fully understand the scale of our impacts on the environment. We will use these results to help us manage our environmental impacts in both a more targeted and a more holistic way. We believe that managing and ultimately mitigating these impacts will not only result in a reduced impact on the environment but will also provide multiple competitive advantages.

Using the overall findings to inform corporate strategy

The E P&L is a powerful informational tool to help focus corporate strategy. When trying to calculate our environmental losses, monetising environmental impacts enables different impacts to be compared on a consistent basis, enabling us to focus our strategy and prioritise our efforts on the most significant impacts. Understanding that 85% of the environmental impacts occur in Tiers 2 – 4 of the supply chain prompts a focus on the management challenges related to these impacts, which have to date received less attention than the impacts of our own operations and those of our direct suppliers. We are currently analysing opportunities to influence the environmental impacts of Tiers 2 - 4 through the choice of raw and synthetic materials that are used in products, the selection of suppliers, and by working with suppliers to reduce the impact of their current sourcing practices.

Using the detailed results to inform operational decisions

The E P&L has produced a wealth of detailed information beyond the headline results which will be used internally to enhance decision making across a variety of business areas. For example, when looking at product design and material specification, the potential water and land-use implications can be evaluated upfront and alongside cost, performance and aesthetic considerations and included in procurement criteria. Information on the environmental performance of specific suppliers will help provide benchmarks for their performance targets and provide a basis for sharing best practices.

Collaborating to drive change

The world's biggest and most intractable environmental challenges - such as the on-going degradation of biodiversity and ecosystems - cannot be addressed by one company acting alone. We recognise that in order to make a real change we, along with our industry peers, have to work responsibly to help reduce the impacts of external supplier factories and raw material producers. In addition to driving innovation in various areas within our own supply chain and with our consumers, we also need the support of policy makers and the engagement of the whole industry to implement a new model for businesses that works with nature rather than against it and ultimately supports social and economic sustainability.

To tackle this challenge, PUMA has already started to gain support from national governments, environmental organizations, and representatives of science and industry to push for a shift in the current business paradigm towards a more sustainable approach; one that acknowledges the indispensible services provided by healthy ecosystems and respects their limits. One of the first steps to achieving this change requires the services to be given monetary values in order to account for them when doing business. We hope other companies will follow suit.

Risk management

Our results highlight the significance of environmental impacts currently not accounted for, in fact, actively externalised in the current business model. We anticipate as environmental consciousness grows and resource scarcity increases so the likelihood that the true value of the environmental externalities will be internalised, whether through regulation, consumer pressure, or changing supply and demand dynamics.

The PUMA E P&L provides insights into which of the prevailing environmental trends has the greatest potential effect on our future business. Tackling our own impacts and those of our supply chain, head-on, will help us begin to reduce our exposure to such risks. By improving our understanding of these risks, our ability to more effectively manage exposure to potentially growing challenges such as those driving the volatility of cotton prices in recent times, will be greatly enhanced.

New opportunities

Tackling the impacts presented in the E P&L in any significant way will require revisiting the fundamental elements of the current business model. This provides great opportunity to develop radically new innovation in the design, production and marketing of our products to achieve demonstrably smaller impacts on the environment. We believe that by more deliberately tackling environmental impacts we will help drive sustainability and differentiate our brand, while providing a distinct competitive advantage.

Communication with stakeholders

The E P&L also enables us to conduct more informed discussions with stakeholders. It supports PUMA's commitment to develop a more sustainable business, focuses discussions on the issues that have been identified as being the most significant, and provides a context for PUMA's sustainability strategies and targets. As the E P&L looks beyond our own direct operations to the impacts across the entire supply chain, it also acts as a useful reference tool in discussions with stakeholders about responsibility for and attribution of environmental impacts at each tier of the supply chain.

As corporate reporting evolves to meet the changing needs of investors, consumers and the wider stakeholder community, companies will be under increasing pressure to produce annual reports that include more forward looking and strategic information to provide greater and more accurate insights into current and future performance. The E P&L provides information that will enable PUMA to provide stakeholders with a greater understanding of the current challenges, the overall environmental performance of the business, areas for improvement and the potential implications of trends and challenges in future.

Communicating the results of the E P&L in a way that makes sense for our consumers will be an essential part of including them in our journey to be the most desirable and sustainable Sportlifestyle company. We will continue to look for new ways to inspire our consumers to be more responsible in their purchasing and lifestyle choices.

Future developments of the E P&L

- Plans for publication of the next E P&L: we have already started to implement solutions within our own operations and at our Tier 1 suppliers, such as capacity building projects and efficiency improvement programs to reduce the ecological footprint. We are also currently developing solutions to help address impacts occurring further down in the supply chain, where the challenges are much greater and where PUMA has far less influence because individual suppliers may be shared by many companies.

  To give these actions time to deliver tangible reductions, we have decided to focus on these mitigating actions and publish our next E P&L at the beginning of 2013.

- Refining the raw data and methodologies: economic valuation of ecosystem services and environmental impacts is a fast developing field. The E P&L takes advantage of many recent advances and we will continue to pursue our own innovations in this area while monitoring, contributing to and drawing on the latest academic and public sector research. We hope this first attempt will encourage and stimulate others sectors and actors to contribute.

  Data collection of the type needed for the full E P&L will be improved. We are working to increase the proportion of E P&L data collected directly from suppliers in order to improve the accuracy and robustness of results in future. Currently, the majority of primary data comes from PUMA's own operations and Tier 1 suppliers but the company will examine existing methods and create new ways of obtaining data from other tiers.

- Cradle-to-grave: considering the full product lifecycle: The current scope of the project is a 'cradle to gate' analysis. For products like footwear which has relatively limited impacts associated with its use phase, this truncation may be a reasonable estimation. But for apparel, which may demand frequent washing and perhaps also ironing, significant impacts are not covered under the current scope. Recycling waste is also currently excluded and could warrant further attention in a cradle-to-grave analysis.

A call for support

Valuing environmental externalities is an inexact science at present and requires assumptions to be made. The results presented in this document reflect what we believe to be sensible and conservative assumptions. We recognise that others may have different views on the most appropriate assumptions. In publishing these results we hope to stimulate debate and we welcome support from others to continually evolve and refine the methodology for valuing corporate environmental externalities.

Annex - Key terms defined

Biodiversity

Biodiversity describes the variety of life on earth, within and between species, genes and ecosystems. Biodiversity is known to underpin the provision of ecosystem services (see below).

Ecosystem

Ecosystems are the natural and semi-natural systems that make up the environment around us, like forests, wetlands, deserts, grasslands, urban parks and farmland.

Natural capital

Natural capital is a modern term used to describe the stock of biodiversity and other valuable natural resources which underpin the delivery of ecosystem services.

(Environmental) externality

An externality is a cost (or benefit) to a third party resulting from an activity, for which the third party is not adequately compensated (or does not pay). For example, an environmental externality arises when an unregulated shoe factory pollutes the air thus reducing local environmental quality and negatively affecting the well-being of local communities.

In the future it is possible that these communities will object and demand compensation, or that the government will impose a cost of pollution, thus increasing the factory's costs of production and effectively internalising the externality.

Bibliography

DEFRA, (2003) "A study to estimate the disamenity costs of landfill in Great Britain" *DEFRA Publications, February, 2003.*

DEFRA, (2008) "Damage Cost Guidance, Interdepartmental Group on Costs and Benefits" *Air Quality subgroup* : (November)

Eftec, (2010) "Scoping Study on the Economic (or Non-Market) Valuation Issues and the Implementation of the Water Framework Directive – Final Report" *Prepared for the European Commission Directorate- General Environment, September 2010*

Environmental Protection Agency, (2011) "The Benefits and Costs of the Clean Air Act 1990 – 2020" *US EPA*

EXIOPOL, (2009) "Waste Management Externalities in EU25 and disamenity impacts in the UK" *Exiopol Deliverable DII.5.B-2.*

ExternE, (2003) "External Costs - Research result on socio-environmental damages due to electricity and transports" *Euro Study 20198.*

FAO, (2004) "Economic valuation of water resources in agriculture" P*roduced by National Resources Management and Environment Department*

Food and Agriculture Organisation of the United Nations, Statistics Database. http://faostat.fao.org/default.aspx (Accessed July 2011)

Hammitt, J.K. and Y. Zhou, (2006) "The Economic Value of Air-Pollution-Related Health Risks in China: A Contingent Valuation Study" *Environmental and Resource Economics* Vol 33 : (3)

Holland, M. et al., (2005) "Damages per tonne emission of PM, NH3, SO2, NOX and VOC from each EU25 Member State" *AEA Technology Environment plc* : (March)

Hope, C., (2008), "Discount rates, equity weights and the social cost of carbon". Energy Economics Vol 30 : (3)

Kumar, P. (ed), (2010), "The economics of ecosystems and biodiversity", *Earthscan publishing*

Lamoreux, J. F., J. C. Morrison, T. H. Ricketts, D. M. Olson, E. Dinerstein, M. W. McKnight, and H. H. Shugart (2006), Global tests of biodiversity concordance and the importance of endemism. Nature 440:212-214

Loomis, J.B., (1987) "The Economic Value of Instream Flow: Methodology and Benefit Estimates for Optimum Flows" *Journal of Environmental Management, Vol. 24, 169-179*

Lvovsky, et al., (2000) "Environmental Costs of Fossil Fuels - A Rapid Assessment Method with Application to Six Cities" *The World Bank*, Paper no. 78 : (October)

Matus et al., (2011) "Health Damages from Air Pollution in China" *MIT* : Joint Program on the Science and Policy of Global Change Report No. 196

Millennium Ecosystem Assessment Reports, (2005). Ecosystems and Human Well-Being Synthesis

Nahman A., (2011) "Pricing landfill externalities - emissions and disamenity costs in Cape Town, South Africa" *Environmental and Resource Economics Group, Council for Scientific and Industrial Research South Africa.*

Ngoc U., & Schitzer H., (2009) "Sustainable Solutions for solid waste management in Southeast Asian countries" *Institute for Process Engineering (IPE), Graz University of Technology.*

Nolan ITU Pty Ltd & Merz, S. K., (2001) "Independent Assessment of Kerbside Recycling in Australia" *Revised Final Report - Volume I, January, 2001.*

OECD, (2010) "Pricing Water Resources and Water and Sanitation Services" *March, 2010*

Olson, D. M., E. Dinerstein, E. D. Wikramanayake, N. D. Burgess, G. V. N. Powell, E. C. Underwood, J. A. D'Amico, I. Itoua, H. E. Strand, J. C. Morrison, C. J. Loucks, T. F. Allnutt, T. H. Ricketts, Y. Kura, J.

F. Lamoreux, W. W. Wettengel, P. Hedao, and K. R. Kassem (2001), Terrestrial ecoregions of the world: a new map of life on Earth. BioScience 51:933-938

Ramsey F., (1928) "A Mathematical Theory of Saving," Economic Journal, Vol 38 : (152)

Rogers, Bhatia & Huber, (1998) "Water as a Social and Economic Good: How to Put the Principle into Practice" *Global Water Partnership, Published by the Global Water Partnership, August, 1998*

Stern N., (2007), The Economics of Climate Change: The Stern Review. Cambridge, UK: Cambridge University Press

The Saurer Report, http://www.thesauerreport.com (Accessed July 2011)

The World Bank, (2011) "GNI, PPP (current international $)" *<http://data.worldbank.org/indicator/NY.GNP.MKTP.PP.CD> (Accessed 09.03.11).*

Themelis N. J., Ulloa P. A., (2006) "Methane Generation in Landfills" *Earth Engineering Center and Department of Earth and Environmental Engineering, Columbia University, August, 2006.*

Tol R. (2008), "The Social Cost of Carbon: Trends, Outliers and Catastrophes." Economics—the Open-Access, Open-Assessment E-Journal Vol 2 : (25)

Tol R. (2009), "The Economic Effects of Climate Change" Journal of Economic Perspectives Vol 23 : (2)

United Nations Statistics Division, (2007) "System of Environmental-Economic Account for Water" *Prepared by United Nations Statistics Division upon recommendation by the UN Committee of Experts on Environmental-Economic Accounting*

United Nations, (2005). Millennium Ecosystem Assessment Reports Ecosystems and Human Well-Being Synthesis

Van der Ploeg, S., R.S. De Groot and Y. Wang (2010) The TEEB Valuation Database: overview of structure, data and results. Foundation for Sustainable Development, Wageningen, the Netherlands

Van der Ploeg, S., Y. Wang, T. Gebre Weldmichael and R.S. de Groot (2010) The TEEB Valuation Database – a searchable database of 1310 estimates of monetary values of ecosystem services. Foundation for Sustainable Development, Wageningen, The Netherlands

Weitzman M., (2009), "The Extreme Uncertainty of Extreme Climate Change: An Overview and Some Implications" Harvard University Preliminary Note, Oct 2009

WWF Wildfinder, http://www.worldwildlife.org/science/wildfinder/ (Accessed July 2011)

Young, R. (2005), "Determining the economic value of water: concepts and methods" *Resources for the Future Press, Washington, D.C.*