Levi Strauss & Co. Life Cycle Approach to Examine the Environmental Performance of its Products

Levi Strauss & Co. (LS&Co.) is focused on building sustainability into everything we do. In 2007 LS&Co. commissioned a life cycle assessment (LCA) study to find out more about the environmental impact of a pair of Levi's® 501 Jeans and Dockers® Original Khaki from cotton seed to landfill. At the heart of these LCA's was a significant data collection effort to ensure that primary data would drive our LCA results. This study taught us a great deal about the environmental impacts caused by our products outside the bounds of our direct sphere of influence. From this work, an idea was borne in 2008 to develop a life cycle based product environmental impact assessment method ("E-valuate") that relied heavily on primary data making it both actionable and dynamic. This method would be created in the hopes that key stakeholders could be informed about how their business decisions impact the environmental attributes of the products they design, merchandise and sell.

The greatest opportunity to reduce the environmental impact of a new or existing product occurs during the design phase of its life cycle. Therefore, the primary objective of our life cycle evaluation approach is to provide our designers and developers the information they need to help them make more sustainable products. A secondary objective is to provide a science-based method to support any claims of environmental improvement of our products. Although not an initial objective of this effort, it was later realized that the methodology also provides a rigorous means to communicate environmental performance to suppliers. Results are presented in actionable statistical measures of performance to let them know how they measure up against peers and where to focus on improving.

The first version of E-valuate was finalized in 2009 and reviewed by a panel of experts convened by Ceres at their headquarters in Boston. Ceres is an internationally recognized network of investors and environmental organizations. Acting on the important input from this expert review panel, E-valuate was revised in 2010. Recently, a pilot using the latest version of E-valuate was completed. The pilot assessed forty (40) fabrics from raw material production or extraction up to and including the dyeing and weaving of a fabric. This pilot also included the assessment of eleven (11) full products from cradle (raw material production such as cotton cultivation) to gate (garment manufacturing). The results of the product level life cycle assessments can be found at the end of this document.

A key aspect of the methodology is to provide readily understood results to non-LCA experts such as designers and material suppliers. As such the methodology includes a collection of impact assessment metrics and additional indicators. The metrics and indicators were selected to be comprehensive and in alignment with LS&Co.'s corporate sustainability goals yet not be duplicative, minimizing bias by including several overlapping criteria as well as increasing the effort to interpret results.

The methodology includes measures of:

- Contribution to climate change
    - A measure of the carbon dioxide equivalent for all green house gas emissions that are attributable a product.[1]
- Energy use[2]
    - A measure of energy consumed to produce a product.
- Percent renewable energy[3]
    - Percent of total energy use from renewable resources to produce a product.
- Water consumption[4]

[1] The E-valuate methodology adheres to the Publicly Available Specification (PAS) 2050:2008 for goods and services (BSi 2008). Global warming potentials are based on the Intergovernmental Panel on Climate Change (IPCC) Fourth Advisory Report (IPCC 2007) for 100-year time horizon. Measure of impact is in kg CO2-e.

Intergovernmental Panel on Climate Change (2007) IPCC Fourth Assessment Report. The Physical Science Basis, Geneva, CH.

British Standards Institute (2008) Publicly Available Specification PAS 2050:2008 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services, London, UK

[2] Energy use is based on the Cumulative Energy Demand (CED) method published in ecoinvent version 1.0 and expanded by Pre Consultants (Goedkoop et al., 2009). Data categories include non renewable fossil, nuclear and biomass sources, and renewable biomass, wind, solar, geothermal and water sources. Measure of impact is in MJ-e.

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.

[3] The percent renewable energy is an indicator of the proportion of the total energy consumed that is sourced from renewable resources. Renewable and non-renewable energy classification is based on the Cumulative Energy Demand (CED) method published in ecoinvent version 1.0 and expanded by Pre Consultants (Goedkoop et al., 2009). Data categories include non-renewable fossil, nuclear and biomass sources, and renewable biomass, wind, solar, geothermal and water sources. The measure of impact is a percentage derived from the ratio of renewable energy to total energy (renewable and non-renewable energy sources).

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.

- A measure of water consumed to produce a product.

- Land occupation[5]
  - Area of land occupied to produce a product.
- Qualified sustainably grown (QSG) fibers content[6]
  - Percentage of fibers grown under a recognized cultivation program to address areas of sustainability. Examples of such programs include certified organic programs and the Better Cotton Initiative.
- Waste generated[7]
  - A measure of the primary solid waste generated during spinning, dyeing, weaving, cut/sew, and finishing of a product.
- Materials efficiency[8]

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[4] The Water Depletion impact category includes a minimal set of resource sources representative of water use following guidance of the ReCiPe impact assessment methodology (Goedkoop et al., 2009). Water categories include consumption from lakes, rivers, unspecified natural origin, and in ground well. Additional water categories have been included in the Water Depletion impact category, those generally related to any fresh water, barrage water, process water, and cooling water. Consumption is measured in m^3 water. Details of the resources included in the Water Depletion midpoint methodology can be found in Table 11.1 of the ReCiPe impact assessment method report (Goedkoop et al., 2009)

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.

[5] Land occupation is a measure of the amount of land occupied and the time of occupation for both agricultural land and urban land occupation. Methodology is based on the ReCiPe hierarchical midpoint characterization approach. To calculate this midpoint methodology, only the amount of area occupied and time of occupation is needed. Measure of impact is in area x time (m^2 x yr). Details of the characterization can be found in the Table 10.12 Midpoint characterization factors for impacts of land occupation, ReCiPe impact assessment method report (Goedkoop et al., 2009)

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.

[6] Qualified sustainably grown (QSG) fibers indicator is a measure of the amount of QSG fiber used to make a product as a proportion of total fibers. The measure of impact is a percentage derived from the ratio QSG material in the product to total materials in the product by weight.

[7] Primary waste generation is a measure of the amount of waste generated from primary materials to make the products. Ancillary materials (e.g., process chemicals) are not included. Measure of impact is in kg of primary waste produced.
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[8] Materials efficiency is an indicator of the efficiency of primary material used in the product as a proportion of the total material required to produce the product. The measure of impact is a percentage derived from the ratio primary material in the product to total materials used.

- A measure of the efficiency of primary material use (materials that end up in the product).

- Recycled content[9]
  - Percentage of materials used from post consumer recycled sources.
- Land transformation[10]
  - A measure of land transformed from its original state as a result of product production.
- Eutrophication[11]
  - A measure of the discharge of harmful nutrients to freshwater bodies that cause algal growth as a result of product production.

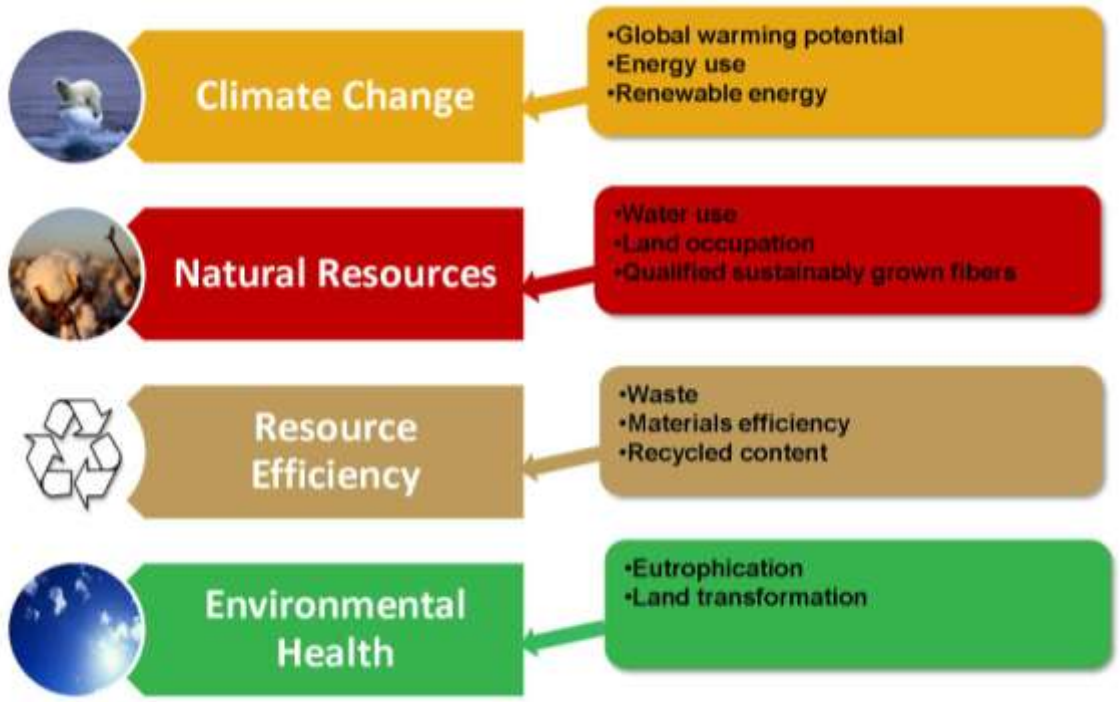
[9] The proportion of materials in the product that are sourced from verified post consumer recycled materials. The measure of impact is a percentage derived from the ratio primary material in the product to total materials used.

[10] Land transformation is a measure of the amount of land area that is transformed to a different use. Methodology is based on the ReCiPe hierarchical midpoint characterization approach whereby mean restoration times are considered. To calculate this midpoint methodology, the amount of area occupied is required. Measure of impact is in area (m^2). Details of the characterization can be found in the Table 10.14 Midpoint characterization factors for impacts of land transformation, ReCiPe impact assessment method report (Goedkoop et al., 2009)

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.

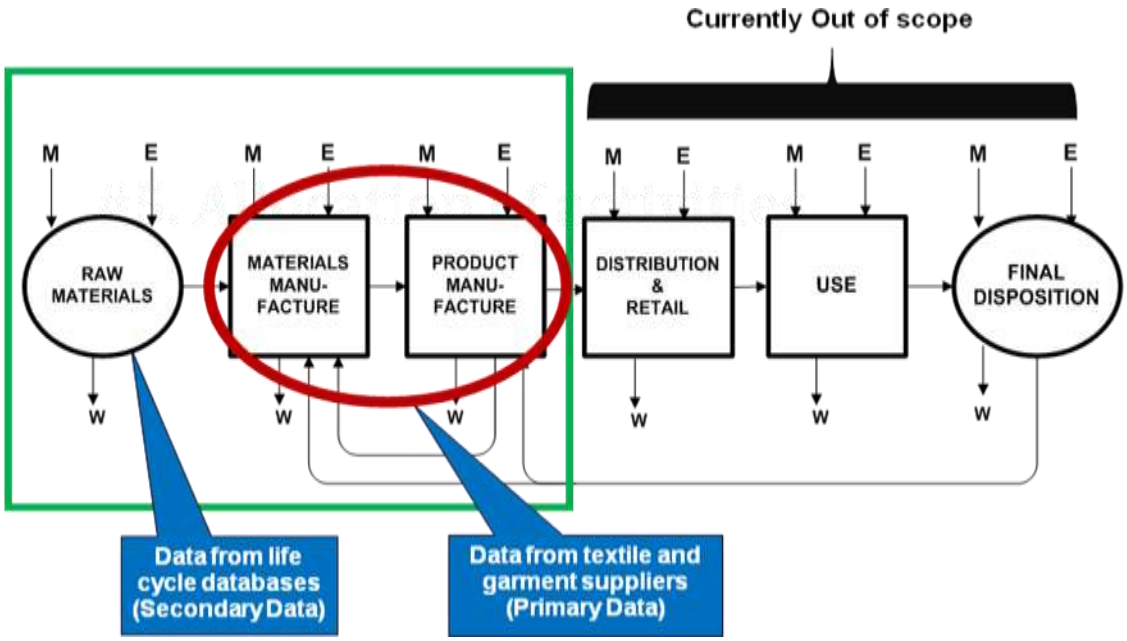
[11] Eutrophication is a measure of impacts associated with eutrophying effects. For this methodology was select only eutrophying effects to freshwater environments. Measure of impact is in kg phosphorus-equivalents (P-e). Details of the characterization can be found in Table 6.4 Midpoint characterization factors for impacts of land occupation ReCiPe impact assessment method report (Goedkoop et al., 2009)

Goedkoop et al. (2009). ReCiPe 2008: A life cycle impact method which comprises harmonized category indicators at the midpoint and the endpoint level, Pré Consultants, Centre for Milieukunde (CML) Leiden University, RUN Radboud University, RIVM, Biltoven, Netherlands.



While the method is designed to capture environmental impact throughout all product lifecycle phases, at present, the scope of the assessment is from cotton seed through production of final product. The methodology strives to incorporate primary data wherever possible, allowing for greater understanding and insight by stakeholders along the supply chain. The method is supported by an extensive cooperative data collection effort with our suppliers. Primary data is collected for processes that include yarn spinning, dyeing yarn, weaving fabric, cutting fabric, and sewing and finishing product ready for distribution to retail outlets. We currently use secondary industry average data sources for yarn spinning when fabric producers are not vertically integrated, sundry production (e.g., zippers, rivets, packaging) and cotton growing, and look to incorporate primary data where ever possible[12].

[12] Secondary datasets used are sourced from Pré Consultants accessible from their SimaPro v7.2.4 LCA software: Swiss Ecoinvent v 2.2, US electricity grid modified Ecoinvent database, US Life Cycle Inventory (LCI) database, the DK Input Output database, and the US Input Output database.



The current methodology is not intended to address nor evaluate social or economic considerations; hence social LCA impact assessment criteria are not included. Further, the methodology is intended to be used as one part of several inputs to the decision-making process to make more sustainable products. For example, LS&Co. has developed an extensive Terms of Engagement (TOE) program for suppliers that outlines a set of fundamental worker rights, safety, health and environment criteria in order to be a supplier in good standing.[13] LS&Co. has also implemented a comprehensive Restricted Substance List (RSL) throughout its supply chain. The RSL integrates health, safety, dermatology, toxicology and eco toxicology measures.[14]

[13] Levi Strauss & Co. (2010) Global Sourcing and Operating Guidelines. Retrieved 20 December, 2010, from http://www.levistrauss.com/library/levi-strauss-co-global-sourcing-and-operating-guidelines-0

[14] Levi Strauss & Co. Restricted Substance List. http://www.levistrauss.com/sustainability/planet/chemicals

Product Assessment Results using LS&Co.'s E-valuate method

501® Original Jeans – Rinse Run (PC9 00501-0115)

Impact Category	Quantity	Units
Global Warming Potential	15	Kilograms CO2- equivalents
Energy Use	197	Megajoules
Renewable Energy	13%	Percent
Water Use	6.3	Cubic meters
Land Occupation	6.8	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.18	kilograms
Materials Efficiency	75%	Percent
Recycled Content	1%	Percent
Eutrophication	0.003	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

501® Original Jeans – Dark Stonewash (PC9 00501-0194)

Impact Category	Quantity	Units
Global Warming Potential	16	Kilograms CO2- equivalents
Energy Use	220	Megajoules
Renewable Energy	15%	Percent
Water Use	6.3	Cubic meters
Land Occupation	7.1	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.18	kilograms
Materials Efficiency	75%	Percent
Recycled Content	1%	Percent
Eutrophication	0.003	Kilograms Phosphorous-equivalents
Land Transformation	0.005	Square meters

501® Original Jeans – Medium Stonewash (PC9 00501-0193)

Impact Category	Quantity	Units
Global Warming Potential	16	Kilograms CO2- equivalents
Energy Use	200	Megajoules
Renewable Energy	13%	Percent
Water Use	6.3	Cubic meters
Land Occupation	6.9	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.18	kilograms
Materials Efficiency	75%	Percent
Recycled Content	1%	Percent
Eutrophication	0.003	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

501® Original Jeans – Light Stonewash (PC9 00501-0134)

Impact Category	Quantity	Units
Global Warming Potential	15	Kilograms CO2- equivalents
Energy Use	180	Megajoules
Renewable Energy	13%	Percent
Water Use	6.2	Cubic meters
Land Occupation	6.7	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.18	kilograms
Materials Efficiency	75%	Percent
Recycled Content	1%	Percent
Eutrophication	0.003	Kilograms Phosphorous-equivalents
Land Transformation	0.003	Square meters

Slim Straight 514™ Jeans – Indigo Wash (PC9 00514-4177)

Impact Category	Quantity	Units
Global Warming Potential	8.6	Kilograms CO2- equivalents
Energy Use	140	Megajoules
Renewable Energy	14%	Percent
Water Use	6.3	Cubic meters
Land Occupation	6.3	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.10	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.003	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

Slim Straight 514™ Jeans – Tumbled Rigid (PC9 00514-0164)

Impact Category	Quantity	Units
Global Warming Potential	16	Kilograms CO2- equivalents
Energy Use	190	Megajoules
Renewable Energy	13%	Percent
Water Use	5.7	Cubic meters
Land Occupation	6.3	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.1	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

Regular Straight 505® Jeans – Range (less water) (PC9 00505-2765)

Impact Category	Quantity	Units
Global Warming Potential	16	Kilograms CO2- equivalents
Energy Use	190	Megajoules
Renewable Energy	13%	Percent
Water Use	5.9	Cubic meters
Land Occupation	6.6	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.10	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

Regular Straight 505® Jeans – Range (PC9 00505-2765)

Impact Category	Quantity	Units
Global Warming Potential	16	Kilograms CO2- equivalents
Energy Use	200	Megajoules
Renewable Energy	13%	Percent
Water Use	6.0	Cubic meters
Land Occupation	6.6	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.10	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

Slim Straight 514™ Jeans – Rigid Tank (PC9 00514-0206)

Impact Category	Quantity	Units
Global Warming Potential	7.7	Kilograms CO2- equivalents
Energy Use	110	Megajoules
Renewable Energy	18%	Percent
Water Use	5.8	Cubic meters
Land Occupation	6.2	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.14	kilograms
Materials Efficiency	81%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.001	Square meters

Regular Straight 505® Jeans – House Cat (PC9 00505-0250)

Impact Category	Quantity	Units
Global Warming Potential	15	Kilograms CO2- equivalents
Energy Use	180	Megajoules
Renewable Energy	14%	Percent
Water Use	5.7	Cubic meters
Land Occupation	6.3	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.09	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters

Regular Straight 505® Jeans – Steel (less water) (PC9 00505-0352)

Impact Category	Quantity	Units
Global Warming Potential	15	Kilograms CO2- equivalents
Energy Use	170	Megajoules
Renewable Energy	15%	Percent
Water Use	5.9	Cubic meters
Land Occupation	6.6	Square meter x year
Qualified Sustainably Grown Fibers	0%	Percent
Primary Waste	0.09	kilograms
Materials Efficiency	87%	Percent
Recycled Content	1%	Percent
Eutrophication	0.004	Kilograms Phosphorous-equivalents
Land Transformation	0.002	Square meters