# A fresh look at the green economy

## Jobs that build resilience to climate change

Oxfam America

Approximately two million Americans are employed in sectors such as water management, agriculture, and disaster preparedness and response that contribute to building resilience to the impacts of climate change. Through investments in climate change resilience, we can proactively reduce the impact of natural disasters and drive economic growth. By spurring the development and deployment of new technologies and strategies such as efficient irrigation systems and early flood and storm warning systems we can save lives in the poor communities most vulnerable to climate change—and create jobs in the process.

Even with aggressive efforts to reduce emissions today, the consequences of climate change will be severe in many regions of the world. In fact, poor communities around the world already bear the brunt of its impacts.

We must go beyond cutting greenhouse gas emissions to also ensure that the most vulnerable communities in the US and abroad can build their resilience. Making these investments today will save money down the road as it becomes more expensive to respond to disasters, such as extreme storms, floods, and droughts.

Numerous reports have highlighted the potential for “green collar” jobs—jobs that seek to reduce harmful greenhouse gas pollution, such as those in the clean energy and building industries. But not much has been written about another kind of green jobs: those that build resilience to the existing and inevitable impacts of climate change. US companies can expand market share and create jobs as they develop and deploy technologies and services that enhance adaptive capacity in the US and abroad. And they can invest in climate resiliency in partnership with vulnerable communities, strengthening livelihoods and enabling sustainable development.

# US jobs in the adaptation marketplace

An analysis conducted for Oxfam using Bureau of Labor Statistics industry data identified approximately two million US jobs in seven economic sectors that contribute to building climate resilience.[1] These sectors are: Agriculture, Climate Change Information and Consulting, Coastal and Natural Resource Management, Disaster Preparedness and Response, Insurance, Water Management, and Health.[2] The jobs identified through our research apply to all skill levels, from farmworkers to civil engineers, and exist in every corner of the country in places as diverse as manufacturing plants and national forests. These jobs include both private and public entities.

While not all the jobs in these sectors are directly related to climate resilience, these sectors are ones in which climate resilience activities are most prevalent. Additional jobs in relevant industries, such as engineering services and remodeling construction of homes and buildings, are not included in this total because of the challenges involved in identifying the subset of specific climate resilience activities within those sectors.

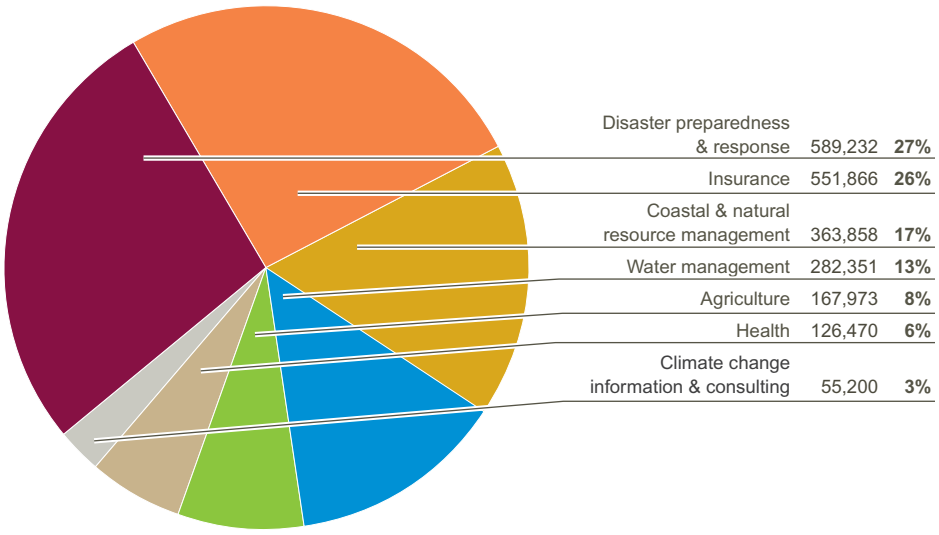


**Figure 1.**
Employment in sectors that contribute to building climate resilience

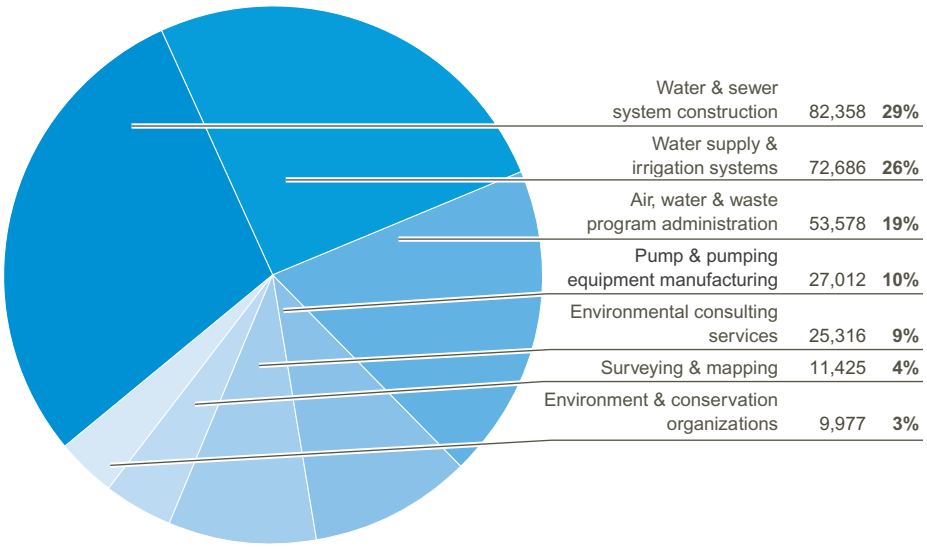


**Figure 2.**
Employment breakdown in the water management sector [3]

## US action can spur economic growth, build community resilience, and create jobs

Increased investment in international adaptation can demonstrate US leadership and catalyze opportunities for companies to invest in and partner with vulnerable communities globally.

Economic sectors that contribute to building climate change resilience have high potential for growth because vulnerable communities in the US and around the world are expected to experience more frequent and intense weather events as a result of climate change.

The US government must send a signal by establishing strong climate change adaptation policies and programs in the US and abroad. Long-term, guaranteed sources of funding for adaptation programs are essential to stimulate private investment, generate jobs, and help vulnerable communities build their resilience. If companies know that resources for building resilience to climate change are being provided, they will develop their capabilities accordingly, thus generating employment.

Increased investment in international adaptation can demonstrate US leadership and catalyze opportunities for companies to invest in and partner with vulnerable communities globally. Responsible investment in climate resilience will require listening to local communities to provide resources that people affected by climate change want and need. When US companies work in partnership with impacted communities, those communities will be better prepared to weather the challenges of a changing environment.

### What are the types of jobs that contribute to building climate resilience?

Activities most relevant to climate resilience are indicated in each sector. The number of jobs represents broad sector employment.

**282,351 jobs:** Water management
Development and manufacture of advanced water management technologies such as drinking water purification and desalination, water filtration, and reuse technologies; improvement of water use efficiency; and distribution of new technologies.

**167,973 jobs:** Agriculture
Development, distribution, and cultivation of drought-resistant seeds; manufacture, installation, and operation of irrigation and water supply systems; design and implementation of pest-control technologies; improvements in agricultural management and cultivation techniques; and improved forest fire early warning systems, suppression systems and practices, and forest management techniques.

**55,200 jobs:** Climate change information & consulting
Integrated modeling and climate risk assessment; sustainable development consulting services; development and distribution of mobile information technology; and improvement of strategic training services and programs.

**363,858 jobs:** Coastal & natural resource management
Integrated modeling and climate risk assessment; sustainable development consulting services; development and distribution of mobile information technology; and improvement of strategic training services and programs.

**589,232 jobs**: Disaster preparedness & response
Advanced modeling to identify risks; development of early warning systems; improvement and implementation of emergency relief services; design of resilient buildings and construction materials; and landscape design that accounts for climate risk.

**551,866 jobs:** Insurance
Development and marketing of innovative insurance products; and design of risk mitigation techniques and financial protections.

**126,470 jobs**: Health
Administration of disease control measures; health consulting and education services; and implementation of response measures to public health crises.

## Case studies

US companies can grow, create jobs, and help communities in the US and around the world cope with the catastrophic consequences of a warmer world. The case studies highlighted in this report demonstrate concrete ways in which businesses are growing and creating jobs—at various skill levels and in diverse sectors—while partnering with vulnerable communities to build their resilience. Over the long run, communities must have access to skills and technologies that build climate resilience and promote sustaibable economic development.

Photo: Arni Vitale | Oxfam America

# Water management
# GE[4]

GE's Water & Process Technologies Division develops, installs, and maintains technologically advanced water equipment. Its business is centered on technologies for processing industrial and municipal wastewater and is evenly split between chemical treatment and the sales of equipment. Approximately 30 percent of its revenue comes from serving municipalities, while the remaining 70 percent stems from industry sectors such as wastewater treatment from steel mills and food and beverage plants.


*GE mobile water purification unit. Photo: GE*

**Employment profile and growth potential**

- 3,000 US employees
- More than 1,200 additional jobs are generated in domestic sales and mobile water system delivery

## Activities and technologies that build climate resilience

GE's water management technologies and services create high-quality jobs in the US while supporting vulnerable communities around the world as they respond to drought, water scarcity, and water quality issues.

**Water reuse for energy production** In India, GE is working with the government to address the country's growing energy requirements and water management problems. India needs to build 60,000 megawatts of generation capacity to meet rising energy demand, but lacks an adequate water supply for these facilities. GE is exploring the use of treated wastewater, which would help alleviate water shortages while mitigating the country's sewage treatment problem.

**Mobile water purification units** GE has engaged in a series of pilot projects to work with local businesses and municipalities to identify market needs and business models that will yield large-scale reach and impact while empowering partners on the ground. As part of this effort, GE is working in China to supply clean drinking water to communities. One concept utilizes GE-developed mobile water treatment plants, which are housed in large trucks and can purify water supplies for a large village or can be taken to multiple smaller villages where water is produced and stored in tanks. Water units are being evaluated by the Chinese government as part of its national development strategy. These mobile water filtration plants are also used for disaster relief situations and temporary outages.

**Village pure water kiosks** As part of the same initiative, GE worked successfully with an Indian manufacturer of water filtration technology to develop and disseminate water kiosks that supply drinking water for a small cost to consumers. Potential partners, such as the Safe Water Network, are working with banks and other organizations to structure a microfinance plan that will allow entrepreneurs to buy kiosks to serve as the "storefront." By creating new, innovative business models, as well as new treatment technologies, GE is developing sustainable solutions for this type of market that can be replicated in other parts of the world.

**Desalination in arid regions** GE recently finished construction of Hamma, a large desalination plant in Algeria that will provide 25 percent of drinking water for Algiers, the capital and largest city in Algeria. GE continues to invest in the next generation of desalination technology that will reduce the energy necessary to remove contaminants from water as well as reduce greenhouse gas emissions.

# Agriculture
# **John Deere**[5]

John Deere is a multinational corporation with three key divisions: Agriculture and Turf, Construction and Forestry, and Credit. The company sells products—including tractors, tillage, hill and forage equipment, and some precision irrigation technologies for high-value crops—in more than 130 countries and manufactures in 29. Its water business, which develops precision irrigation technologies that increase water use efficiency, is based in the Agriculture division.

*Precision irrigation technology is used to cultivate crops in the US and globally. Photo: Liliana Rodriguez / Oxfam America*

### Employment profile and growth potential

Related to precision irrigation:

- Two factories located in the US, in California and Georgia, manufacture drip irrigation products; each factory employs several hundred workers
- As the company expands its drip irrigation business, it will likely locate manufacturing and distribution centers within the regions served; John Deere currently has drip irrigation manufacturing facilities in India and Israel

### Activities and technologies that build climate resilience

John Deere creates vital jobs in the US by manufacturing products and services designed to increase crop yield and improve water use efficiency in farming communities globally. Some of these technologies and services are now being developed and redesigned for small-scale use in developing countries.

**Drip irrigation systems to increase efficiency and productivity** Drip, or precision, irrigation systems increase crop productivity and water use efficiency. These systems have predominantly been used to support large-scale agriculture because of the need to access electricity; however, systems are now being designed and implemented for small-scale use, an urgent need as community farmers face more frequent and severe droughts. In 2006, John Deere entered the precision irrigation business by purchasing three companies, two in California and one in Israel. The company now sells precision irrigation parts, packages, and systems in approximately 25 countries and is one of the top three companies in the precision irrigation market.

**Products and services for small-scale farmers** John Deere is working to create products and services more suitable for small-scale farmers, and has made a commitment to provide advisory services coordinated with technology sales in the developing world. The company has also developed a single-axle tractor for Africa and Asia, and engineers in India have designed a fuel-efficient and relatively inexpensive tractor for farmers in the developing world.[6] Manufacturing of this product will take place in India and China, and parts will be widely available. In Zambia, John Deere is exploring a partnership with the World Bank to test innovative microfinance options, such providing loans through cooperatives, to support local farmers in developing countries.

## Climate change information and consulting
# Riverside Technology[7]

Riverside assists organizations with collecting, analyzing, managing, and disseminating environmental information so managers and policy makers can formulate strategic and knowledgeable decisions related to critical water resources. Riverside has been working in the fields of water resource management and disaster risk reduction in the US and globally for 25 years.

*Flood warning systems help Bangladeshi communities prepare for heavy rains. Photo: Abir Abdullah / EPA*

### Employment profile and growth potential

- Approximately 100 employees located in Silver Spring, MD, and Fort Collins, CO
- Named one of northern Colorado's fastest-growing businesses
- Largest proportion of revenues from engineering and technical support for National Oceanic Atmospheric Administration satellite and environmental programs

### Projects that build climate resilience

Riverside is a rapidly growing company in the US with expertise in hydrologic forecasting, environmental and natural hazard monitoring, information technology, vulnerability assessments, and climate change analysis. These services assist communities to assess and prepare for the impact of climate change on water supplies, natural streamflows, and timing and volume of hydrologic runoff. Riverside typically includes local partners and communities—from both the private and public sectors—during project design and implementation, ensuring that these local engineering, consulting, and planning entities build their own capacity and resilience to respond to climate change scenarios.

**Disaster preparedness, local capacity building, and planning** In Ethiopia and Sudan, Riverside has partnered with local consulting firms to identify and map the flood-related vulnerabilities and hazards of communities along flood-prone stretches of the eastern Nile River. The company is also helping governments along the Nile develop a framework for working together around water resource planning.

**Water user associations** Riverside worked with local communities in Romania to establish and develop more than 90 water user associations. Through intensive hands-on training sessions, Riverside helped build the capacity of these groups of water users to manage their organization, finances, and irrigation water effectively.

**Flood warning systems** Working with local partners in Bangladesh, Riverside adapted the latest flood warning technologies (remote sensing, hydrologic models, and geographic information systems) to the Bangladeshi context. In order to generate and disseminate accurate and timely flood warning messages to the village level, Riverside used a text message-based model for flood warning dissemination that gave vulnerable communities access to expert science.

**Evapotranspiration mapping and reservoir impact analysis** In arid and semi-arid places such as Morocco and northeastern Brazil, Riverside used innovative technologies and methods to assist water resource planners and decision makers. In Morocco, Riverside developed evapotranspiration estimates using remote sensing techniques to assess irrigation performance. In Brazil, Riverside quantified water losses through evaporation utilizing satellite imagery, mapping numerous small reservoirs, and then evaluating the impact of the water loss.

## Coastal and natural resource management
# Royal Engineers and Consultants[8]

Royal Engineers and Consultants is a small company headquartered in New Orleans that operates in communities along the Gulf Coast in Louisiana, Alabama, and Texas. The company works in the areas of civil engineering, construction and construction management, coastal and environmental engineering, and project management. Its annual revenues of between $10 million and 15 million are generated mostly from government agencies. The company is part of the Small Business Administration's Emerging 200 Program, which targets promising inner-city small businesses that are poised to create jobs and economic growth.

*Dredging to support marsh restoration in the Gulf Coast. Photo: Royal Engineers and Consultants*

### Employment profile and growth potential

- Grew from 5 employees to more than 150 immediately following Hurricane Katrina
- Directly employs 55 people; hires additional labor for projects through partners and subcontractors

### Projects that build climate resilience

Royal creates jobs for a range of skill levels in the Gulf Coast region, jobs that help to strengthen communities' ability to prepare for and respond to intense storms and sea level rise.

**Marsh restoration** In designing marsh restoration projects, such as a project in the northern shoreline of Lake Mechant in Louisiana, engineers employed by Royal have considered long-term sea level rise rates and account for these rates in choosing ecosystem management practices that support marine life and natural vegetation.

**Management of a community recovery program** In Cameron Parish, Royal led and coordinated the workflow for a large Hurricane Rita reconstruction program consisting of approximately 60 individual projects. Royal helped the parish select and prioritize projects based on a set of sustainability-related criteria and incorporated retrofits to protect against future flood and storm damage. The program created about 1,800 jobs with construction contractors, architecture firms, and engineering firms.

**Climate resilient reconstruction** Royal Engineers performed geotechnical inspections of New Orleans city buildings that were damaged during Hurrican Katrina to determine whether they were structurally safe enough to rebuild. Buildings for the city's Office of Recovery Management were then rebuilt to be more likely to withstand future hurricanes. In the rebuilding process, the company utilized green building materials and technologies when possible.

# Insurance
# **Swiss Re**[9]

Swiss Re is one of the largest reinsurance companies in the world, providing reinsurance and insurance products that help manage disaster-related risks, among other things. Recognizing that climate change could significantly increase insurance losses, the company has worked for 20 years to promote a better understanding of climate risk. Swiss Re is developing and deploying specific insurance products to help clients transfer climate risk, including weather risk insurance.

*Drought microinsurance in Ethiopia. Photo: Eva-Lotta Jansson / Oxfam America*

### Employment profile and growth potential

- Swiss Re's total US-based workforce amounts to more than 2,000 employees operating from 24 offices
- Approximately 40 percent of Swiss Re's 2009 net premiums and fee income is derived from the US, its major market

### Projects and activities that build climate resilience

**Weather-based insurance in developing countries** Using an index as a basis, weather insurance can provide a payout to a farmer, organization, or government when, for example, rainfall levels fall below an agreed point on an index for an agreed period of time. Swiss Re has pioneered weather risk transfer instruments in developing countries, starting in India in 2004 with a program reaching more than 350,000 smallholder farmers. In partnership with the World Bank and the government of Malawi, Swiss Re developed a derivative product to help protect Malawi against drought-related shortfalls in maize production. More recently, Swiss Re entered into collaboration with Oxfam America, the Relief Society of Tigray (REST), and the International Research Institute for Climate and Society (IRI) to launch an innovative weather index insurance product for smallholder rain-fed farmers in Ethiopia.

**Index-based weather insurance in the US** In 2010, Swiss Re entered into an agreement with the Alabama State Insurance Fund to offset the economic impacts of catastrophic hurricanes. In the case of a severe hurricane hitting the state of Alabama, wind speed is measured to determine whether the insurance contract has been triggered. The insurance payouts could be used to cover costs such as emergency response and lost tax revenues.

**Catastrophe bonds (also known as "cat bonds")** Cat bonds are a type of risk-linked security that transfer a specified risk (or set of risks) from a "sponsor" (for example, a primary insurance company or government) to qualified institutional investors. Cat bonds are variable-rate bonds whose principal could potentially be partially or entirely lost if specified trigger conditions are met. The triggers are linked to major natural catastrophes. The majority of cat bonds are underwritten for the most potentially destructive risks, which include US windstorms, European windstorms, California earthquakes, and Japanese earthquakes.

## Conclusion

The case studies included in this report demonstrate the ways in which US businesses and workers can partner with communities in developing countries, and with vulnerable communities in the US, to provide goods and services for building climate resilience. Policies and programs must be established by the US government that build community resilience to climate change and provide long-term investment to stimulate economic growth and create jobs.

# Notes

**Methodology**

Oxfam contracted with the consulting firm ECONorthwest to identify industry groups within economic sectors where adaptation-related jobs are most likely to exist. The analysis in this report is based on 2009 employment data from the Bureau of Labor Statistics (BLS) sorted by industry using the North American Industrial Classification System. The BLS data originate from the Quarterly Census of Employment and Wages, and includes all jobs covered under unemployment insurance. It was beyond the scope of this analysis to determine the percentage of activities or employment within identified industries.

ECONorthwest (ECONW) is an economics consulting firm that has more than 30 years of experience providing analysis for business, government, non-governmental organizations, and other private parties across a broad array of economic issues. ECONW has extensive experience analyzing the costs and benefits of public policies and measuring their impacts on US jobs and incomes.

This analysis serves as a companion to "The New Adaptation Marketplace" report released by Oxfam in 2009.

1 The selection of BLS sectors was made based on the adaptation-related activities described in the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment report, particularly Chapter 3 on "Fresh Water Resources and Their Management," Chapter 5 on "Food, Fibre, and Forest Products" (which includes agriculture), Chapter 6 on "Coastal Systems and Low-Lying Areas," Chapter 7 on "Industry, Settlement and Society" (which includes disasters and insurance), and Chapter 8 on "Human Health."

2 The Energy Supply sector also includes adaptation-related jobs in the manufacture and distribution of small-scale energy technologies overseas, but this sector was not included in the total analysis because of difficulty obtaining accurate data.

3 Job totals slightly higher due to round up.

4 The content of this case study is based on information gathered in interviews conducted in August 2010 with Jeffrey Fulgham, chief marketing officer, GE Water & Process Technologies.

5 The content of this case study is based on information gathered in interviews conducted in August and September 2010 with the following John Deere employees: John Bustle, VP of John Deere Foundation; JB Penn, chief economist; Sarah Dean, program manager; Vanessa Stifle-Claus, government relations.

6 John Deere engineers have designed a tractor that they report is appropriate and marketable in the developing world. This low-horsepower tractor will be available in 2011 and is highly fuel efficient. In addition, according to interviews, John Deere understands that climate change will have a sustained impact on the agricultural sector, especially in regard to water use, and the company has worked through coalitions and task forces like the Council on Foreign Relations, the Tropical Forest Commission, and the US Climate Action Partnership to advocate for funding of adaptation and for increased international funding in climate change legislation.

7 The content of this case study is based on information gathered in interviews conducted in August 2010 with Larry Brazil, president and CEO of Riverdale Technology, and Robert Laitos, senior development specialist.

8 The content of this case study is based on information gathered in interviews conducted in August and September 2010 with Mitch Andrus, vice president, Royal Engineer's South Division. Mr. Andrus noted that Royal Engineers advocates for sustainable coastal restoration and protection plans through associations like the Coast Builders Coalition.

9 The content of this case study is based on information gathered in interviews conducted with Mark Way, directo, Sustainable Development of Swiss Re, and Reto Schnarwiler, director, Insurance & Specialty


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COVER: Workers in a desalination plant in Yuma, AZ install one of 9,360 desalting membranes, part of an irrigation project.
*Photo: Jim Richardson / National Geographic*