

2015 Stockholm Summit on Natural Capital: 9 Use Cases and the Natural Capital Science-Technology Platform

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SECURING INFRASTRUCTURE BENEFITS

The Inter-American Development Bank, through its Biodiversity and Ecosystem Services Program (BIO), is helping governments integrate the value of biodiversity and ecosystem services into infrastructure planning and loan decisions, with pilot projects in countries throughout Latin America and the Caribbean, including Colombia, Barbados, and the Bahamas.

“BETTER INFRASTRUCTURE IS KEY TO TACKLING POVERTY AND PROMOTING INCLUSIVE GROWTH. YET INFRASTRUCTURE PROJECTS THAT FAIL TO TAKE INTO ACCOUNT ENVIRONMENTAL AND SOCIAL OBJECTIVES CAN LEAD TO CONFLICTS AND ULTIMATELY FAIL TO DELIVER THE DEVELOPMENT BENEFITS ENVISIONED.”

- Luis Alberto Moreno,
President, Inter-American
Development Bank



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Trillions of dollars will be spent on development in the coming decades to meet the demands of a growing and urbanizing global population, with USD \$60 trillion projected for road and rail infrastructure alone by 2050.¹ As infrastructure networks expand, so too do opportunities for investing in biodiversity—the web of life that provides countless benefits to people and economies. Wisely managed, biodiversity and ecosystem services hold significant promise for securing long-term growth and prosperity.²

Until recently, governments lacked the ability to easily identify where ecosystem services originate. This has meant that valuable places that provide clean water, erosion control, and climate regulation have not been recognized within the process of siting infrastructure projects. Without this information, new roads, dams, and seawalls could cause unintended harm to local people. For example, a new road, built to spur trade and travel could also promote deforestation, creating a cascade of impacts, including local and downstream declines in water quality, release of stored carbon dioxide, and exacerbated flooding and

landslide risks from the loss of stabilizing vegetation. Unexpected loss of such ecosystem services can translate into unbudgeted costs for maintenance, water treatment, and disaster relief, as well as risks to businesses dependent on the infrastructure.

Awareness of these risks is growing, and governments and multi-lateral development funders such as the Inter-American Development Bank (IDB) are investing in efforts to map and preserve ecosystem services, recognizing their crucial support of long-term, sustainable growth.



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PROMISING ADVANCES

Advances in remote-sensing, software, and data processing technologies make it possible to map ecosystem services throughout a region or an entire country, so that infrastructure can be built away from sensitive areas. New tools allow stakeholders and decision-makers to easily compare cross-sector impacts and benefits of various development scenarios. The Colombian government is among the first worldwide to legally require the assessment of biodiversity and ecosystem service benefits to people in all development permitting decisions. The Colombia Ministry of the Environment and Sustainable Development is now using a simple spatial assessment tool to systematically evaluate the environmental impacts of all proposed infrastructure projects and offsets. This information can then be weighed explicitly in conjunction with cost and with human well-being benefits considered in standard permitting decisions.

IDB and other partners are extending the work in Colombia to create custom software for governments undertaking spatial planning processes that make trade-offs in development and environmental objectives more transparent, and cross-sector planning between transportation, forestry, fisheries, tourism, water, and energy faster and easier. These approaches have been co-developed with The Natural Capital Project for coastal planning in Belize, and work is underway for Andros Island in the Bahamas, and for Barbados as it launches a national coastal marine planning process.

SOLUTIONS SCIENCE AND TOOLS

The Natural Capital Project has co-developed a free, open source software tool that makes the localized consequences of development transparent by identifying for specific infrastructure projects where

ecosystem services are being provided, where they will be lost, and which communities will be affected. The software, Offset Portfolio Analyzer and Locator or OPAL, can also highlight mitigation and compensation options that benefit specific communities who will lose ecosystem benefits as a result of development. The OPAL software came out of an early partnership with the Colombian government and The Nature Conservancy to determine ways of compensating for development's damage to ecosystems and the benefits they provide. Similarly, for coastal and marine development planning, The Natural Capital Project's free, open source InVEST tool enables scenario analyses that can promote sustainable development while ensuring the long-term viability of coastal habitats that support economies and livelihoods.

SCALING UP

The Inter-American Development Bank funds USD \$1.8 billion for infrastructure projects annually throughout Latin America, and is a leader in supporting development that reduces poverty and inequality and achieves sustainable growth.³ The tools that are making cross-sector analyses fast and freely available have the potential to transform how development is pursued throughout the region, beginning with the Bahamas and Barbados, where IDB has been active in development planning for over 30 years. Additionally, this work is synergistic with the Latin American Conservation Council's⁴ "Smart Infrastructure" initiative, launched in 2015, with project pilots in Mexico, Colombia, Brazil and Peru.

As interest in including ecosystem services in infrastructure planning processes grows, software like OPAL and InVEST will help fulfill demand for on-the-ground information about trade-offs. The governments of Peru and Paraguay are implementing ambitious offset policies, and several governments in Asia and Africa are embarking on spatial planning to guide siting of infrastructure development by considering multiple aims for a region or country's environmental needs.

¹ Global Land Transport Infrastructure Requirements, International Energy Agency, 2013

² Biodiversity and Ecosystem Services Program Overview, IDB

³ Biodiversity and Ecosystem Services: A review of experience & strategic directions for the IDB, Gonzalo Castro de la Mata, May 18, 2012

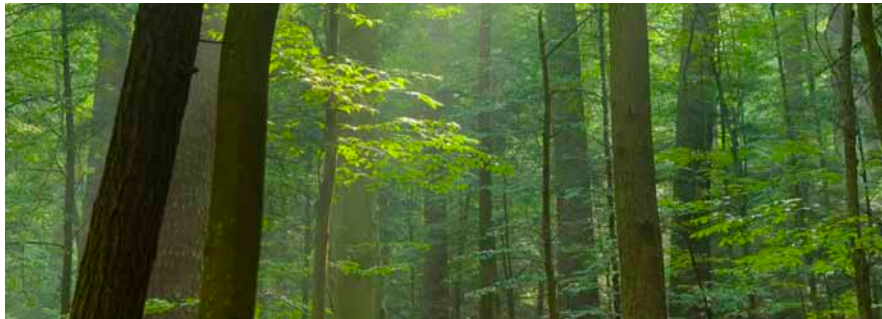
⁴ <http://www.nature.org/latin-america-conservation-council/index.htm>

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RESTORING FORESTS, ENHANCING LIVELIHOODS

The International Union for the Conservation of Nature (IUCN) and the World Resources Institute (WRI) have partnered with organizations around the world to translate broad forest restoration goals to on-the-ground action that can enhance food and water security, improve economic development, and reduce vulnerability to disasters. Innovations developed through this partnership include a tool that can rapidly screen regional restoration opportunities, quantify and compare potential outcomes, and prioritize investments to maximize a diverse suite of benefits at minimal cost.



“RESTORATION OF DEGRADED AND DEFORESTED LANDS IS NOT SIMPLY ABOUT PLANTING TREES. PEOPLE AND COMMUNITIES ARE AT THE HEART OF THE RESTORATION EFFORT, WHICH TRANSFORMS BARREN OR DEGRADED AREAS OF LAND INTO HEALTHY, FERTILE WORKING LANDSCAPES.”

- Bianca Jagger,
IUCN Ambassador for the Bonn
Challenge



Photo ©Stacie Wolny

Ecosystem degradation is a powerfully disruptive force, stymying long-term economic development and contributing to poverty, climate change, natural disaster risk, and reduced reserves of natural capital assets. Deforestation and other extractive land uses can provide local communities with increased revenue over the short-term, but lead to unintended consequences that affect long-term sustainability.

The Bonn Challenge was born out of a growing international awareness of the interde-

pendency of social, economic, and ecological systems. Named after the German city in which it was launched in 2011, the Bonn Challenge is the largest and most ambitious global restoration effort ever undertaken, with goals to restore 150 million hectares of degraded land worldwide by 2020, and an additional 200 million hectares (greater than the size of India) by 2030. This unprecedented effort has dual goals of enhancing ecosystems and the benefits they provide to people while improving economic opportunities for local communities.

Achieving the Bonn Challenge could contribute an additional USD \$200 billion¹ to local and national economies and sequester enough carbon to reduce global emissions by 17

percent.² To date, thirty countries are participating in the Challenge, along with dozens of private companies and NGOs.

After commitments are made comes the difficult task of figuring out how to implement a restoration plan. Limited resources, scarce data, and insufficient local capacity often hamper the translation of goals to action. Critical questions include: What type of restoration will be most effective at addressing environmental concerns while securing livelihoods? What are the potential benefits and costs of restoration? And how can countries strategically target restoration to get the best returns for people and nature?



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PROMISING ADVANCES

IUCN and WRI developed a framework called the Restoration Opportunities Assessment Methodology (ROAM) for integrating science and stakeholder-driven approaches to achieve restoration goals. ROAM is strengthened by a network of partnerships that provides expertise ranging from economics to remote sensing and from ecosystem services modeling and valuation to local knowledge and capacity building. These partnerships, united by the ROAM framework, significantly enhance the ability of countries to diagnose barriers, strategically target restoration, and secure financing for implementation.

Although each country has a unique set of challenges, common across all applications is the need to evaluate how restoration can enhance food and water security, improve economic development, and reduce vulnerability to disasters and further ecosystem degradation. These are grand challenges. However, partnerships coupling science and data expertise with on-the-ground implementation networks are building local capacity, identifying opportunities for innovation and entrepreneurship, and enhancing the resilience of local communities and ecosystems.

The ROAM approach is already paying off. In Rwanda, ROAM assessments and stakeholder workshops identified a lack of tree species suitable for agroforestry. In response, local nurseries are now sourcing and growing native varieties that will be planted by

farmers to improve soil retention, crop productivity, and other products such as fuel wood. In Uganda, the Ministry of Water and Environment and Makerere University are using ROAM and tools from The Natural Capital Project to compare the benefits of restoring degraded forest reserves versus investing in tree plantings in agricultural lands to promote agroforestry. The analysis will identify Ugandan districts that have the greatest potential to meet clean water, climate, and biodiversity targets through restoration or agroforestry while improving crop production and minimizing costs.

SOLUTIONS SCIENCE AND TOOLS

The Natural Capital Project's optimization tool within the ROAM framework analyzes existing GIS data on slope, soil type, and forest cover, and overlays these with social and economic data to identify restoration opportunities with the greatest potential to improve water quality, reduce sediment loss, and improve biodiversity, while minimizing impacts to agriculture or other land uses. The goal of the tool is to highlight co-benefits and trade-offs associated with alternative restoration strategies, depending on the specific objectives most important to stakeholders in different regions or countries.

SCALING UP

Smart, strategic restoration enabled by the best available data and science will increase carbon sequestration, enhance biodiversity, reduce vulnerability to disasters, and improve the delivery of clean water to communities. There are more than two billion hectares of degraded lands in need of restoration, including millions of hectares of abandoned agricultural land, low productivity lands, and former mining and drilling sites. If its restoration goals are met, the Bonn Challenge will not only restore lands and livelihoods, but the resulting social movement will also help build capacity, international and corporate partnerships, and the political will to further restore vast portions of the planet.

¹ www.iucn.org

² www.bonnchallenge.org

SUGGESTED CITATION:

Solie, S., B. Keeler, P. Hawthorne, M. Verdone, M. Ruckelshaus, and A. Guerry. 2015. Restoring Forests, Enhancing Livelihoods: International Union for the Conservation of Nature. May 2015 Stockholm Summit on Natural Capital Use Case #2. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

FINANCIALLY AND ETHICALLY SOUND INVESTING

“IT’S NOT WHAT YOU LOOK AT THAT MATTERS, IT’S WHAT YOU SEE.”

- Henry David Thoreau

The Council on Ethics for the Norwegian Government Pension Fund is mandated to assess companies’ environmental, social, and human rights impacts and recommend the exclusion of companies from the fund based on ethical considerations. Recommendations are based on facts, are well reasoned, and are made public. The Council also believes that some companies have changed their behaviour in order to avoid being excluded from the fund.



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Norway is in a particularly favourable financial position due to the rich abundance of oil and gas that was discovered over forty years ago. As a whole, Norwegians believe that the prosperity enjoyed by present generations carries obligations and that, because these resources are limited, it is not fair that these riches benefit only the few generations that happen to experience their extraction. Rather, it is held that wealth generated by these resources must be safeguarded for future generations.

The Norwegian Government Pension Fund is a Sovereign Wealth Fund and is invested in equities, bonds, and real estate. The Fund’s market value is about USD 900 billion, and the Fund is currently a shareholder in more than 9,000 companies worldwide. It is owned by the Ministry of

Finance, on behalf of the Norwegian people, and is managed by Norges Bank Investment Management, the investment management arm of Norges Bank (the Central Bank).

In 2004, Ethical Guidelines for the Fund went into force. The Guidelines are based on two ethical obligations for the Fund: 1) ensuring that future generations will benefit from the petroleum wealth by generating sound return in the long term, and 2) respecting the fundamental rights of those affected by the companies in which the fund invests by avoiding investment in companies which are or will be complicit in grossly unethical activities.

Established by the government in 2014, the Council on Ethics was tasked with advising the Ministry of Finance on the exclusion of specific companies from the Fund if their activities contravene the ethical guidelines. As of 1 January 2015, it is Norges Bank that decides on the exclusion of com-

panies. Both the Bank’s decision and the Council’s recommendation are made public and are publicly available.

Companies may be excluded from the fund based on two primary criteria: product criteria (some weapons, the sale of weapons to certain states, and tobacco) or conduct criteria. The conduct criteria are five-fold: complicity to serious or systematic human rights violations; serious violations of the rights of individuals in war or conflict situations; severe environmental damage; gross corruption; and other particularly serious violations of fundamental ethical norms. The ethical guidelines stipulate that only serious norm violations provide grounds for exclusion, and there must be an unacceptable risk of the norm violations continuing. At year-end, 60 companies were excluded from the fund.



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PROMISING ADVANCES

Once a decision has been taken on whether or not to exclude a company, the Council's recommendation is published. The recommendation details the activities of the company, the associated impacts, and the Council's assessment. There is often an extensive dialogue between the Council and the company being assessed. In many such dialogues, companies have stated that they wish to avoid being excluded because of reputational risk.

The recommendations communicate to other companies how the Fund views different types of activity. Several companies have contacted the Council to discuss planned activities similar to activities which have been addressed in previous recommendations. This indicates that the recommendations are well-known, that they communicate what can be expected of companies, that they can affect the conduct of companies, and that divestment can be a tool for change.

SOLUTIONS SCIENCE AND TOOLS

The Council's recommendation to exclude a company is based on thorough research and concrete assessments of the company's activities on the ground. For example, in 2011 the Council identified all companies involved in logging or plantation activities in tropical forests. Based on information from the companies (including detailed information about the

environmental impacts of the operations, concession maps, environmental impact assessments, social impact assessments, and high conservation value area assessments) and its own independent research (drawing on information from satellite images, land cover maps, academic literature, and the expertise of local consultants and experts), the Fund endeavors to assess individual concessions. They ask questions such as: What are the impacts on biodiversity? How are people's livelihoods and health affected? What has the company has done to alleviate impacts?

The Council weighs whether forests or peatlands will be converted, the scale of the clearing, to what extent the license areas overlap with important ecological values, and how the conversion of forest or peatlands might affect endangered species, habitats, and peoples' livelihoods. Ultimately, the Council makes a determination about whether the company's measures are sufficient to maintain important ecological and social values in the concession area.

Governments and companies are often not willing to disclose information necessary to carry out a thorough assessment. However, tools are now being developed in this sector, such as the Zoological Society of London's Sustainable palm oil toolkit, which is a good step forward to provide information investors can use in their assessment of companies.

SCALING UP

The situation on the ground is often not consistent with the policies of the companies. To assess companies beyond their policies requires resources, knowledge, and capability. Not all investors have these resources. Moreover, ethical risk evaluated by the Council is not always a financial risk. It depends on the market and how important reputational risk is for the company. Investors must be willing and able and have the competence to ask the right questions. The Council's public recommendations can be used by all to inform investment decisions. Improved transparency, access to data, and tools will enable faster, easier assessments. Better assessments will lead to better investments and continue to guide financially and ethically sound corporate conduct.

SUGGESTED CITATION:

Jervan, H. 2015. Financially and Ethically Sound Investing: Council on Ethics for the Norwegian Government Pension Fund. May 2015 Stockholm Summit on Natural Capital Use Case #3. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

INCLUDING THE VALUE OF NATURE IN BUSINESS DECISION-MAKING

As part of its 2025 Sustainability Goals, The Dow Chemical Company has set a goal that, by 2020, each of Dow's thousands of capital, real estate, and R&D projects will be evaluated for how they enhance or impact nature; and by 2025, will deliver USD \$1 billion in net present value through projects that are good for business and good for ecosystems. To make these assessments possible, Dow has been collaborating with The Nature Conservancy to create new scientific methods and tools for assessing how nature and the benefits it provides are relevant to regular business operations. These innovations have the potential to fundamentally redefine the role of business in sustainable development.



As one of the world's largest and most innovative science and technology companies, Dow addresses many of the world's pressing challenges. An employer of approximately 53,000 people around the world, Dow produces 6,000 different product families at plants spread throughout 35 countries – uniquely positioning the company to leverage the interdependence of environmental practices and economic growth into advances for human well-being and ecosystems.

Sustainability goals have helped companies manage risk and improve efficiency. Dow was among the first global companies to adopt sustainability-based environmental

goals and has seen significant returns on its early investments, including at least USD \$6 billion in savings since 1995. By setting ambitious 10-year goals paired with careful metrics that they publicly report on quarterly, the company is demonstrating how sustainability is both good for the environment and good for business.

DOW'S 2025 SUSTAINABILITY GOALS & THE VALUING NATURE GOAL

After two decades of success, Dow announced its third era of decade-long sustainability goals on April 15, 2015: the 2025 Sustainability Goals. This groundbreaking set of seven goals includes a landmark goal dedicated to “Valuing Nature”:

“Dow applies a business decision process that values nature, which will deliver business value and natural capital value through projects that are good for the Company and good for ecosystems. Dow will generate USD \$1 billion by 2025 in the form

“DOW AIMS TO REDEFINE THE ROLE OF BUSINESS IN SOCIETY. WE WILL PUT THE POWER OF THE ‘HUMAN ELEMENT’ TO WORK - UNLOCKING THE POTENTIAL OF PEOPLE AND SCIENCE, COURAGEOUSLY COLLABORATING WITH NEW, SURPRISING PARTNERS, AND INTEGRATING THE VALUE OF NATURE INTO BUSINESS DECISIONS ACROSS OUR ENTERPRISE.”

- Andrew N. Liveris,
Dow Chairman & CEO,
April 2015

of cost savings or new cash flow as measured by net present value, a measure of future cash flows discounted to the present day.”

The Nature Goal will serve as a catalyst to truly keep nature in mind as part of decision-making at Dow. Said another way, Dow has set a bold goal of generating USD \$1 billion of net present value in new cash flow from projects that are good for business and good for ecosystems.

NATURAL INFRASTRUCTURE AT DOW SEADRIFT OPERATIONS: A WIN-WIN EXAMPLE

Dow has undertaken efforts to use engineered natural technologies in our operations. One of the first examples within Dow that has proven the value of nature to our operations is the constructed wetland wastewater treatment plant at the Dow-owned UCC site in Seadrift, Texas.

Conditions at the existing wastewater treatment system at the site resulted in algae blooms, as well as the plant exceeding its discharge

permit criteria for total suspended solids (TSS) and requiring extensive pH adjustments. After alternatives were investigated, a pilot-scale constructed wetland was completed on site for a year, prior to launching the full-scale project. For the permanent conversion, the tertiary pond used in wastewater treatment was converted into a constructed wetland in approximately 18 months and has been in full operation since then, meeting all discharge requirements, and eliminating the need to adjust discharge pH (previously done around the clock).

A traditional wastewater treatment plant was originally proposed at a cost of approximately USD \$40 million. However, an engineer's ingenuity and willingness of the site/business leadership to consider alternatives resulted in a very different solution: constructed wetland for wastewater treatment – proposed at a cost of approximately USD \$1.5 million. With a net present value of more than USD \$200 million, this project generated savings that were significantly higher than the initial capital savings, plus additional savings from labor, maintenance and supplies. As important, there were added benefits of exceptional, new wildlife habitats, 100 acres of natural habitat created, and emissions reduction by more than 90%.

Based on the success of this project, Dow has dedicated staff resources to evaluate opportunities to deploy engineered natural technologies at sites around the globe. Today, Dow is working with The Nature Conservancy on an analysis tool that will augment and complement this effort – the Ecosystem Services Identification and Inventory (ESII, pronounced “easy”) Tool.

The ESII tool will allow a layperson to walk a property using the ESII app on a tablet, which collects simple, site-specific data about the landscape that can be translated into metrics useful to Dow engineers and finance staff. By linking to a geographic information system (GIS) and other databases, the tool can show, for example, how much sediment a patch of vegetated land is keeping out of a stream, and Dow can then estimate the dollar cost of replacing that service with an engineered filtration system. The tool can track eight ecosystem services, including water provisioning, water quality control, water quantity control, air quality, climate regulation, erosion control, flood control and aesthetic values.

Dow and TNC are working to complete development of the ESII tool, publish their methods, and eventually share the ESII tool broadly with other businesses. If the ESII tool and Dow's Nature Goal approach were widely adopted, it could transform business culture,

bringing awareness of ecosystem services into boardroom discussions.

IMPLEMENTATION CHALLENGES

Dow faced several challenges as it conceptualized the Seadrift project – not unlike those that most companies would face. For example, organizations are typically not staffed with the requisite skills or supported by the culture necessary to bring this category of technology to scale. As such, champions are required to investigate and drive these non-traditional, cost-advantaged solutions in today's companies. According to the innovative site engineer who introduced the idea of a constructed wetland, “It's hard to sell a swamp to an engineer” – as they are much more likely to choose concrete.

Leadership emphasis and cultural change are needed more than further pilot projects. The Seadrift constructed wetlands project was successful because of the passion and vision of site leadership and engineering.

PUBLICATION OF RESULTS A full analysis of this project, its successes and value creation was published in the peer-reviewed *Journal of Industrial Ecology* in April 2014. The life cycle assessment portion of the work also appears in the Proceedings of the LCA XIII International Conference (2013).

CONCLUSION Dow has already seen marked success in implementing innovative, natural infrastructure approaches at its facilities, which supports the business case for increasingly pursuing this strategy moving forward. The landmark collaboration between Dow and TNC – which stemmed from Dow's interest in better understanding in these options – has helped advance this approach, leading to the development of science-based tools that will further inform decision-making in this arena by estimating the value of the services nature provides. Dow looks forward to continued progress throughout the collaboration that will advance the mutual interests of business and nature.

Looking toward 2025, delivering the “Valuing Nature” goal will be a key priority for Dow as the Company looks to continue breaking boundaries, delivering projects that are good for business and good for ecosystems – ultimately resulting in USD \$1 billion in net present value.

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STRATEGIC AND SUSTAINABLE BIOFEEDSTOCK

Unilever is developing new software that has the potential to inform feedstock sourcing decisions, showing where agricultural expansion would have the lowest impacts on carbon sequestration, biodiversity, and water quality.

"WE CANNOT CLOSE OUR EYES TO THE PROBLEMS THE WORLD FACES. BUSINESS MUST MAKE AN EXPLICIT, POSITIVE CONTRIBUTION TO ADDRESSING THEM. I'M CONVINCED WE CAN CREATE A MORE EQUITABLE AND SUSTAINABLE WORLD FOR ALL OF US BY DOING SO. BUT THIS MEANS THAT BUSINESS HAS TO CHANGE."¹

- Paul Polman,
CEO, Unilever



Unilever is one of the world's largest consumer goods companies with product sales in over 190 countries, serving two billion consumers on a daily basis. The company has more than 400 brands, annual revenues approaching €50 billion and is one of the largest buyers of agricultural products, including 12% of the world's black tea, 3% of tomatoes for processing, and 3% of palm oil.²

Unilever has become a global leader in setting and achiev-

ing ambitious environmental sustainability goals. The company has pledged to achieve 100% sustainable sourcing of agricultural commodities and zero net deforestation by 2020³ and to decouple growth from greenhouse gas emissions, water use, and waste. Fulfilling this ambition requires innovation and new approaches. As part of this commitment, Unilever is making enterprising changes in product packaging to reduce waste at every stage of a product's life cycle, from manufacturing to shipping to post-consumer recycling.⁴

Unilever R&D is exploring whether a transition to bioplastic packag-

ing material, using sugar cane, corn or switchgrass as feedstock, could improve the environmental footprint of the company's products. Given the size of Unilever's operations, any shift in its supply chain could have substantial, radiating impacts. The agricultural expansion required in pursuing any large-scale bioplastic (and therefore biofeedstock) strategy would need to be carefully evaluated and planned in order to simultaneously make progress towards the company's sustainability goals.



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whereby beyond a certain level of expansion, negative impacts to natural capital would dramatically accelerate.

To answer these questions, The Natural Capital Project has been working with Unilever's experts to integrate large data sets that capture biological and physical information about the landscape (such as soil type, slope, hydrology, and current vegetation levels) together with land ownership and management data. These data sets have been used to run scenarios that simulate different trajectories of land-use change for biofeedstock expansion in Brazil and the U.S. Results are starting to demonstrate that the pattern and spatial configuration of conversion to agriculture have significance for the scale of impacts on biodiversity, carbon emissions and water quality. Further testing of early results aim to address questions such as: "how much does the pattern of expansion in a forest matter for carbon storage?" Or "how much natural habitat in the landscape needs to be retained to secure water quality?" The approaches developed in this collaboration have the potential to complement Life Cycle Assessment (LCA) methods, which do not adequately address patterns of land use conversion across landscapes.

PROMISING ADVANCES

To assess the impacts and trade-offs associated with bioplastic feedstock materials, Unilever and The Natural Capital Project have created newly integrated datasets defining biological and physical conditions in two continents, and are developing new computer processing methods that can assess changes in ecosystem services across high-resolution land change scenarios. The new science and software aim to achieve larger scale, finer resolution data processing, and ultimately much faster analysis of many scenarios for business decisions. Unilever is showing how science and software for mapping changes in ecosystem services might be used to guide R&D strategy, contributing to a better understanding of business risks and growth opportunities.

SOLUTIONS SCIENCE AND TOOLS

Unilever is partnering with The Natural Capital Project to discover: "Are there places where biofeedstock expansion could occur with minimal impact on natural capital, and if so, where?" The collaboration also wants to understand if there are "threshold levels" in each place,

SCALING UP

Like Unilever, many of the world's leading companies see environmental stewardship as crucial to their brand, social responsibility, and to securing long-term profitability. However, they often lack the data, science and technology to enable them to make optimal long-term decisions about how they both depend on and impact natural capital.

Unilever and The Natural Capital Project hope to leverage their groundbreaking work on biofeedstock assessment into a global tool that enables all companies to understand the relationships between bio-based commodity demand and land use changes for any agri-based supply chain.

¹The Unilever Sustainable Living Plan: Making Progress, Driving Change

^{2,3}www.unilever.com/sustainable-living-2014

⁴www.unilever.com/images/Waste_packaging_PDF_generator_tcm_13-320109.pdf

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Solie, S., R. Chaplin-Kramer, R. Sharp, S. Sim, C. Mueller, and E. Price. 2015. Strategic and Sustainable Biofeedstock: Unilever. May 2015 Stockholm Summit on Natural Capital Use Case #5. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

CHINA'S DREAM

China has invested over USD \$150 billion in restoring natural capital through a suite of pioneering initiatives since 2000. These investments have dual goals: securing critical natural capital and alleviating poverty, especially in rural inland regions. China has succeeded in establishing the fastest rate of reforestation worldwide. Now entering a new phase of investment, the country is limiting development within 49% of its total land area and paying over 200 million people to perform restoration and conservation activities.

IN NOVEMBER 2012, THE 18TH NATIONAL CONGRESS OF THE COMMUNIST PARTY DECLARED CHINA'S DREAM - IN ITS WRITTEN CONSTITUTION - OF HARMONIZING PEOPLE AND NATURE TO BUILD THE ECOLOGICAL CIVILIZATION OF THE 21ST CENTURY.



Photo ©Stacie Wolny



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China's ecosystem service investments are massive in scale, duration, and innovation. Following extreme droughts and flooding in the late 1990s that were exacerbated by deforestation and other human activities, China recognized that investing systematically in natural resource conservation is essential to the country's long-term prosperity, and its approach is unparalleled anywhere in the world.

China is currently rezoning the entire country to account for ecosystem service importance and ecological sensitivity, and is limiting development on 45 percent of its total land area. These limited development areas, called Ecosystem Function Conservation Areas (EFCAs), are mapped using data and analytics that show where important ecosystem services, such as freshwater production and flood control, originate. People living within these areas are being paid to restore landscapes, change farming practices, and in some cases, to move out of sensitive areas.

The country is also designing a new

metric for tracking natural capital – Gross Ecosystem Product (GEP), the total economic value of ecosystem goods and services, to be reported alongside GDP. GEP will also build policy and financial links between ecosystem service providers and beneficiaries, and over time will make it possible to assess the effectiveness of natural capital policies.

This shift towards systematically restoring and valuing natural capital countrywide is rooted in a growing sense of urgency around the country's natural resources, which have dwindled as the economy has boomed. In 1998, extensive deforestation and subsequent



Photo ©Stacie Wolny

erosion contributed to disastrous flooding along the Yangtze River, triggering landslides that killed thousands and rendered 12 million homeless. Additionally, much of the country's water supply originates inland, and as steep slopes have been denuded for timber and water diverted for rice paddy farming, hundreds of rivers have begun to run dry before reaching the cities that depend upon them.

PROMISING ADVANCES

The government has launched the largest payment-for-ecosystem-services programs in the world. For instance, the Sloping Land Conversion Program and Natural Forest Conservation Program together involve 120 million households, with payments exceeding USD \$100 billion over the first decade (2001-2010). In 2008, the government launched the Ecological Financial Transfer Policy to ensure ecosystem conservation in EFCAs. In 2014, the government increased the annual budgets to USD \$7.5 billion for the 436 counties located in EFCAs. Monitoring using satellite imagery shows

a rapid greening of the land, back to forests and natural grasslands. China has the highest rate of reforestation worldwide. In turn, soil erosion has decreased in some areas by 70%. Social impacts have been mixed. In some places, payments led to improvements in economic measures of well-being, whereas in others the payments weren't enough to compensate for loss of income from shifting livelihoods. Current payments have been adjusted to strengthen incentives for change.

SOLUTIONS SCIENCE AND TOOLS

To develop a plan that would achieve the government's vision, researchers needed to identify: Where are the areas throughout the country that are important for providing clean water and stable hydropower, for controlling flooding, and for securing biodiversity? Once these were identified, they also needed to know: How many people were living in each place? Which ecologically harmful activities were they engaged in? What investments could open sustainable livelihood options for rural households and inspire people to shift their activities, to provide the greatest ecological and economic benefits to society at large?

Countrywide data about slopes, vegetation cover, water flow, and other features were housed among different governing bodies, as were social data. The first challenge to researchers was to gather data and harmonize it.

Researchers then used these data to co-develop The Natural Capital Project's InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) modeling software. The software made it possible not only to map the ecological features of the landscape, but also to overlay information about people and their livelihoods, and to explore scenarios that indicate which restoration activities to do in which places to get the most return on investment, in the form of increased erosion control and ability to store and filter water.

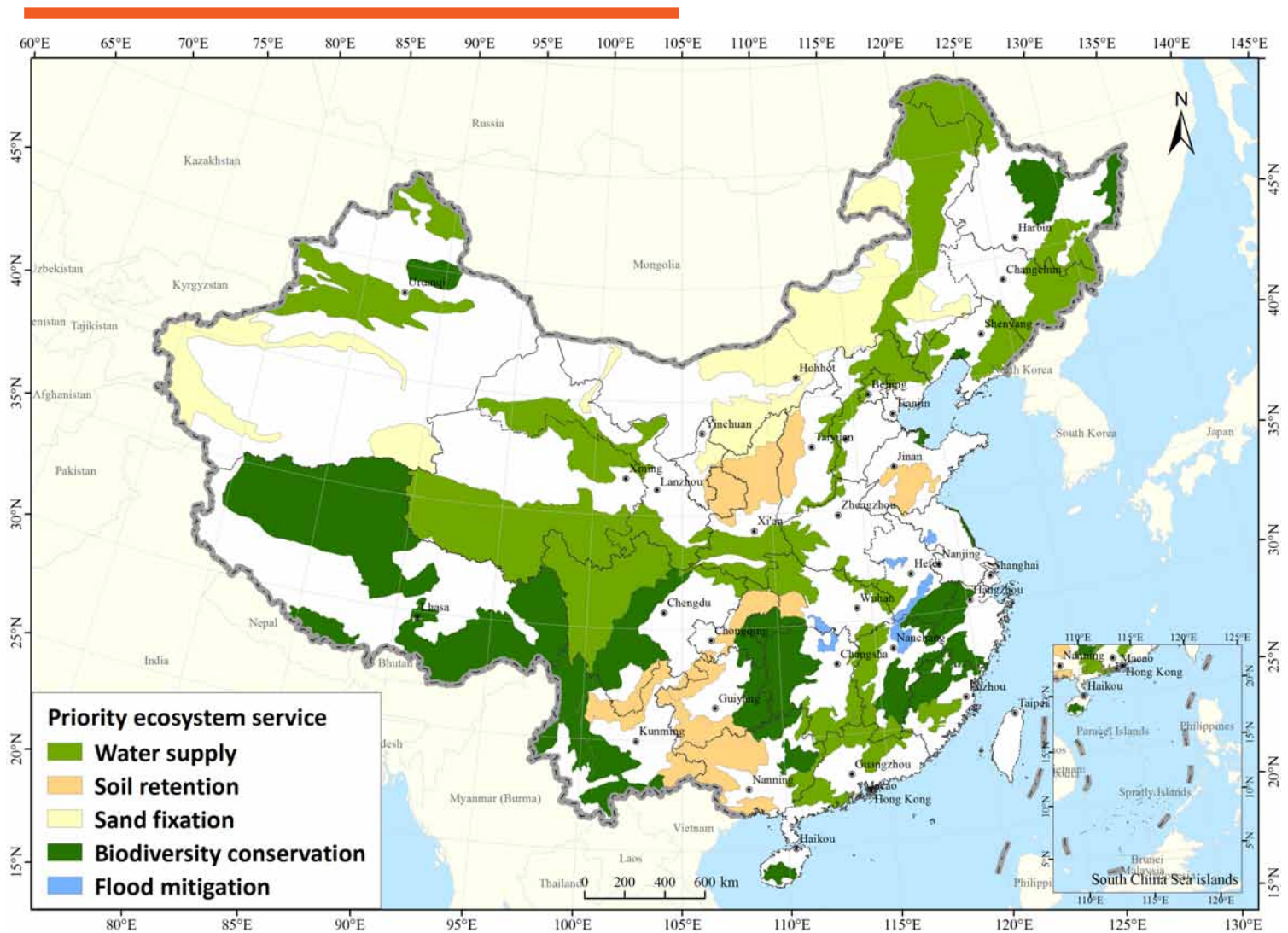


Figure 1. China's new system of Ecosystem Function Conservation Areas (EFCAs). As delineated by the Ministry of Environmental Protection and the Chinese Academy of Sciences, EFCAs will span 49% of China's land area in 58 zones, including 30 provinces and 858 counties. EFCAs have dual goals of securing biodiversity and ecosystem services and alleviating poverty. They have been delimited using InVEST and related modelling. Figure courtesy of Z. Ouyang, Research Center for Eco-Environmental Sciences, Chinese Academy of Sciences.

SCALING UP

Through careful monitoring and study as these eco-payment schemes are implemented, China is providing a case study for the world, showing how with funding and government leadership, ecosystem services can be restored, while also improving people's livelihoods and creating greater security for businesses who hope to operate there.

The work is happening at both large scales and all the way down to communities where funds are being dispersed.

The current and potential future impacts of ecosystem service investments in China are enormous, certainly within the country – and also globally, in the form of enhanced carbon sequestration and reduced dust export, and perhaps most importantly in lessons on making the investments needed to secure and harmonize natural capital and human well-being everywhere.

SUGGESTED CITATION:

Ouyang, Z., G. Daily, Z. Hua, X. Yi, S. Solie, and Steve Polasky. 2015. China's Dream. May 2015 Stockholm Summit on Natural Capital Use Case #6. Natural Capital Project, Stanford University, Stanford CA, USA. 3pp. Available at www.naturalcapitalproject.org

WATER SECURITY FOR CITIES

Cities face intensifying pressure on their water supplies from rapid urbanization, development expanding into upper watersheds, and climate change. Momentum is building behind water funds, a mechanism for targeting investments from downstream consumers into upstream communities whose care of forests and improved farming practices could enhance water quality and help ensure desired flows. Now 38 major cities in Latin America have or are establishing water funds, and the approach is spreading to Africa and beyond.



Photo ©JuanSe Lozano



Photo ©Stacie Wolny

"WE ALL LIVE
DOWNSTREAM."

- David Suzuki

Nearly two decades ago, New York became the most iconic city in recent times to invest in restoring its distant watersheds. A development boom threatened to transform the interwoven farmland and forest of the Catskill Mountains, where 90% of the city's famously clean drinking water originates. To replace the Catskill's natural filtration capacity with a filtration plant would have cost the city USD \$6 billion, plus another half billion in annual operating expenses. This staggering price tag inspired a cheaper, nature-based approach to securing water quality, avoiding the need for a new filtration plant by investing USD \$1.5 billion instead in upstream restoration

and improved farming and forestry practices. This benefited city residents, who secured clean water for the lowest cost, as well as upstream landholders, who were compensated for their efforts; and all this occurred while preserving scenic beauty, tourism and recreation opportunities, and wildlife habitat.

Like New York, cities worldwide are experiencing increased demand for clean water, while climate change and development threaten the supply. The forests and grasslands that surround cities collect and release vast quantities of water. Roots anchor soil in place and soak up rain, releasing water slowly, so that more water flows in rivers between rains and during the dry season. But as unchecked development encroaches into watersheds, water quality can diminish, and fast run-off can lead to major flooding. Because these changes typically happen outside municipal boundaries, many

cities are pursuing novel, creative solutions similar to New York's public-private partnership approach.

The potential for these solutions around the world is high. The Urban Water Blueprint report, released by The Nature Conservancy and partners in 2014, showed that investments in watershed conservation aimed at improving water quality would result in a positive return in at least 1 in 4 of the world's largest cities. The challenge lies in turning this opportunity into action.

PROMISING ADVANCES

In 2000, Quito, Ecuador formalized Latin America's first water fund. A water fund is a collaborative finance mechanism whereby downstream, urban water users such as utilities and businesses agree to pay people upstream to conserve or restore for-



Photo ©Stacie Wolny

ests and other natural vegetation, or to change farming and grazing practices in ways that protect or enhance water quality.

In the Cauca Valley, Colombia's top sugar cane producers have partnered for over 20 years with community-based river associations and a peace and justice group working in rural highlands that have experienced decades of civil war. Since the fund's official inception in 2009, it has garnered USD \$10 million in support, providing incentives to landowners for activities such as planting trees along streams to reduce erosion or to stabilize soils in pasture areas. The river associations and the peace and justice group work to ensure that the water fund also improves livelihoods and security in the area through, for example, providing training to improve local governance capacity and supplies for home gardens and agroforestry systems.

SOLUTIONS SCIENCE AND TOOLS

One of the challenges that water fund designers face is figuring out exactly which watershed conservation activities will maximize returns for clean water, desirable flows, and other targeted benefits. The Resource Investment Optimization System (RIOS) is a fast, efficient, free and open-source tool designed by The Natural Capital Project to help guide investments. RIOS uses modeling and data about soils, nutrient retention, flood mitigation, biodiversity, climate, and hydrology and combines these with social and economic data to identify portfolios of places and activities for targeted investments.

Specifically, RIOS helps decision-makers figure out: "Which set of investments (in which activities, and where) will yield the greatest returns toward multiple

objectives?" "Which changes in ecosystem services can I expect from these investments?" and "How will the outcomes of these investments compare to what would have been achieved under an alternate investment strategy?"

Additionally, The Natural Capital Project has worked closely with water fund investors to develop monitoring systems, which will eventually help show which actions were most successful.

SCALING UP

Early water funds have inspired dozens more – now springing up all over Latin America – and hundreds globally, through related approaches. Securing clean water globally will require both engineered and natural solutions. Where cities have access to data and the political will to collaborate, investments in watersheds can make a significant contribution. The Urban Water Blueprint shows that protecting forested lands has the potential to improve water quality for 430 million people.

In Latin America, one in eight people lack access to clean water, and the idea of using water funds to help improve water security is taking off. The Nature Conservancy's Latin America Conservation Council and the Latin American Water Funds Partnership - launched by TNC, FEMSA Foundation, the Inter-American Development Bank and the Global Environment Facility - are supporting 20 water funds, pledging USD \$27 million dollars, and using RIOS to help plan the restoration of 7 million acres of critical watersheds.

Now, together with partners, The Nature Conservancy is testing the potential for water funds in Africa, including in Nairobi's source watersheds, where a USD \$10 million investment in water fund conservation interventions is projected to return, over 30 years, USD \$21 million in economic benefits.

New screening and analysis tools, along with ongoing advances in global data, are driving major advances in the ability of cities and businesses to identify water risks and implement solutions. To realize their potential, water funds need creative partnerships and financing, solid performance metrics, and easy-to-use tools so decision-makers can make smart choices about how and where to apply them.

SUGGESTED CITATION:

Solie, S., A. Vogl, J. Goldstein, G. Daily, and M. Ruckelshaus. 2015. Water Security for Cities. May 2015 Stockholm Summit on Natural Capital Use Case #7. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

RESILIENT COASTLINES AND COASTAL COMMUNITIES

New science and data are showing how protecting and restoring coastal habitats can also protect people and properties from rising seas and powerful storms, and how increasing coastal resilience through investments in “green infrastructure” can be an efficient alternative to building sea walls and levees. Increasingly sophisticated yet easy to perform natural capital analyses are changing policy priorities and helping to redirect investments in coastal areas.



In the past thirty years, the average frequency of extreme weather catastrophes has increased by a factor of five.¹ Yet because populations, economic activity, and assets are increasingly concentrated in regions with high risk of flood or storm damage, economic losses resulting from these catastrophes have risen even more steeply, now costing hundreds of billions of dollars annually.² As coastal and freshwater wetlands are filled in for development, rivers are diverted, forests fragmented, and fire suppressed, local communities become more vulnerable to extreme

weather events. Recent studies estimate that the continuation of these trends, coupled with climate change, could result in a more than nine-fold increase in global flood damages in large coastal cities between now and 2050.³

Many of the same coastal wetlands, reefs, and other natural habitats vulnerable to development can mitigate risks to coastal areas by dampening strong winds and waves and absorbing floodwaters. But this protective capacity is only just beginning to be appreciated. Scientists and decision-makers have been working together to figure out where natural solutions, known as “green infrastructure,” can reduce risks to coastal communities most effectively. Meanwhile, international agencies and governments are

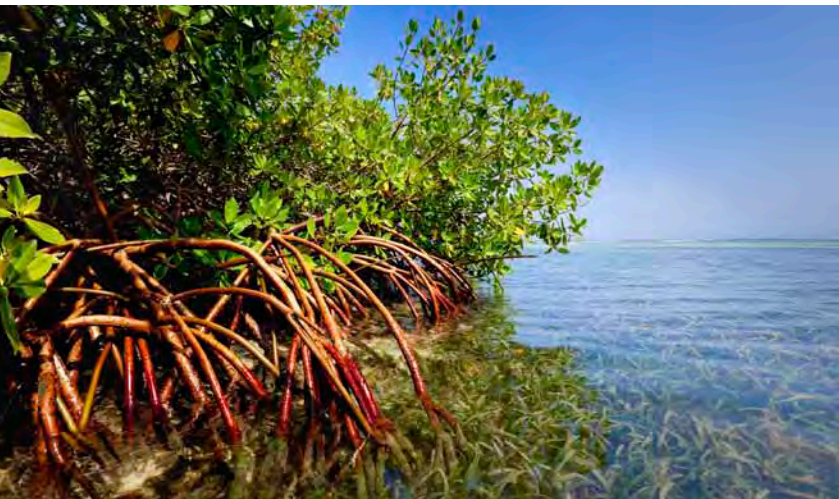
“IN OUR VISION OF A STRONGER, MORE RESILIENT CITY, MANY VULNERABLE NEIGHBORHOODS WILL SIT BEHIND AN ARRAY OF COASTAL DEFENSES. WAVES RUSHING TOWARD THE COASTLINE WILL, IN SOME PLACES, BE WEAKENED BY OFFSHORE BREAKWATERS OR WETLANDS, WHILE WAVES THAT DO REACH THE SHORE WILL FIND MORE NOURISHED BEACHES AND DUNES THAT WILL SHIELD INLAND COMMUNITIES.”

- Michael Bloomberg,
Mayor, New York City, USA



spending billions of dollars to reduce dangers from coastal hazards and climate change by building seawalls, levees, or other “grey infrastructure,” often without first considering the buffering capacity of natural areas.

Key questions that need to be addressed to allow for wise use of green infrastructure include: What are the costs, benefits, and relative trade-offs of green, grey, and hybrid coastal defense solutions in particular places? How can cutting-edge coastal resilience science be made accessible and relevant to decision-makers? How do we create incentives to reduce risks by conserving coastal habitats?



SOLUTIONS SCIENCE AND TOOLS

These partnerships have generated new science showing coastal risks and opportunities for mitigation, and user-friendly analytical tools are making the information accessible to decision-makers. For example, The Natural Capital Project has developed two new models for exploring when and where coastal habitats provide protection. One is a screening tool that identifies where habitats protect people and property from sea-level rise and storms. The other is a model that evaluates how intact coastal ecosystems in particular places help lessen erosion and inundation under various storm conditions. These advances allowed researchers to map the entire coast of the United States and identify where green infrastructure has the greatest potential to reduce the value of properties and number of people (including disadvantaged families and the elderly) at risk from coastal hazards, now and in the future.⁴ The Nature Conservancy and its partners have incorporated these models into a decision support system (www.coastalresilience.org) and seven software apps for exploring many dimensions of risk, exposure, vulnerability, and resilience. The Coastal Resilience system includes a visualization platform where ecological, social, and economic information can be viewed alongside sea-level rise and storm surge scenarios in specific geographies.

PROMISING ADVANCES

A number of institutions, such as the Inter-American Development Bank, The Nature Conservancy, and World Wildlife Fund are working to enhance the resilience of coastlines and coastal communities with green infrastructure. A few examples include:

- The Coastal Zone Management Authority and Institute in Belize, with support from The Natural Capital Project and World Wildlife Fund, has used the protective properties of coral reefs, mangroves, and seagrasses to direct coastal development in ways that enhance protection from coastal hazards while increasing revenues from lobster fishing and tourism.
- Swiss Re, one of the world's largest reinsurance companies, is working with The Nature Conservancy to understand whether incorporating natural ecosystems and nature-based coastal defenses into insurance industry models can improve the assessment of risks from natural disasters, and provide an evaluation of the costs and benefits of adaptation measures.
- With support from the Inter-American Development Bank, The Natural Capital Project and The Nature Conservancy are working with the Government of the Bahamas to develop their Master Plan for Andros Island that will promote sustainable development and ensure the long-term viability of forests, wetlands, reefs, and biodiversity that underpin the economy and support livelihoods.
- The Nature Conservancy is working with companies like CH2MHILL, Dow, and Shell to integrate natural infrastructure solutions into standard engineering approaches and toolkits.

SCALING UP

Visionary leadership from governments, businesses, and other institutions can yield more resilient coastal infrastructure, commerce, and communities. Technology advances—sharing data, models, and visualization tools—will help accelerate access to reliable and relevant natural capital information, and encourage more software ‘app’ development for easy, rapid uptake. Communication of science, policy, and investment breakthroughs will inspire bolder solutions. By raising awareness and using new science and tools, leaders can change the suite of options under consideration and direct the billions of dollars being spent now and in the future toward green and hybrid infrastructure approaches to coastal adaptation.

¹ Swiss Re *Sigma* 1/2014

² Swiss Re *Sigma Explorer*; Aon Benfield 2014 Annual Global Climate and Catastrophe Report

³ Hallegatte, S. et al., 2013. “Future Flood Losses in Major Coastal Cities”, *Nature Climate Change*.

⁴ Arkema, K. et al., 2013. “Coastal habitats shield people and property from sea level rise and storms”, *Nature Climate Change*.

SUGGESTED CITATION:

Guerry, A., S. Solie, M. Guy, and M. Ruckelshaus. 2015. Resilient Coastlines and Coastal Communities. May 2015 Stockholm Summit on Natural Capital Use Case #8. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

SOURCING CORN MORE SUSTAINABLY

The Coca-Cola Company and World Wildlife Fund are working with partners in Iowa's Cedar River Valley to pilot and develop a novel approach to inform decisions for securing clean water. The approach will show where to site agricultural interventions that can dramatically reduce pollution into rivers and streams while maintaining production and helping to mitigate greenhouse gas emissions.



"WATER IS OUR MOST VITAL SHARED RESOURCE. IT'S CRITICAL FOR OUR BUSINESS AND ESSENTIAL TO SUSTAINING THE COMMUNITIES WHERE WE OPERATE. WE'RE FOCUSED ON RESPONSIBLY STEWARDING AND PROTECTING THIS RESOURCE ACROSS OUR VALUE CHAIN."

- Greg Koch,
Senior Director, Global Water
Stewardship



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Steady rainfall and rich soils have made Iowa the largest corn-producing state in the United States, and among the top producers in the world. While current agricultural practices create high yields, they also contribute to degraded water supplies. Excess nutrients from fertilizers wash from soils into streams and rivers, polluting waters for communities downstream, and eventually drain into the Gulf of Mexico where pollution from agricultural run-off has made large portions of the Gulf uninhabitable by fish, damaging marine life and fishing livelihoods.

The Coca-Cola Company, one of the world's leading beverage companies and a major buyer of the world's corn, has set company-wide goals to source the natural resources it needs in a socially, environmentally, and economically responsible way. To make progress towards more sustainable sourcing throughout its supply chain, Coca-Cola is engaging its bottling partners and suppliers, along with local communities, to identify risks to clean water supplies, and to co-develop and contribute funding to collaborative restoration and protection plans. One of these pilot projects is based in Iowa's Cedar River Valley.

Agricultural practices such as no-till, cover crops, and riparian buffers,

can improve agricultural production while also significantly reducing erosion and fertilizer run-off—but are they enough to help businesses and society meet their water-related goals? The Cedar River Valley project aims to develop a method for figuring out where to invest in best management practices for the best environmental and production results, for the least cost. The project also aims to collaborate and share information among communities, to identify incentives for changing farming practices to meet sustainability goals, as well as to reduce liability and reputational risks that stem from negative impacts on downstream stakeholders.



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PROMISING ADVANCES

The company, through its partnership with WWF, is collaborating with the University of Minnesota, The Nature Conservancy, and DuPont Pioneer to engage a broad partnership of stakeholders in the middle branch of the Cedar River Valley. The partnership is working to answer the following questions: Which farm management practices, at which sites, provide the greatest benefits in terms of water quality, water use, carbon sequestration, and biodiversity conservation, while maintaining yields? How would the adoption of alternative practices help private and public sectors meet their sustainability goals? How can this be done in a cost-effective way? How can this information be best communicated to multiple supply chain actors, communities, and the public sector?

Changing farming practices requires forming new partnerships and relationships not only with farmers, but also with the communities in which they live; with local, state, and national governments; and with businesses and their customers. Incentivizing farmers to adopt alternative practices will require the involvement of those most affected by these decisions (e.g., downstream communities), the institutions that incentivize farmer decisions (e.g., through government subsidies), suppliers and buyers, and end consumers. Through broad participation with people affected by and making or influencing land-use decisions, land-use policy outcomes will be more likely to meet the needs of multiple stakeholders. Information on the explicit impact of alternative farm practices on stakeholder interests will allow stakeholders to evaluate potential synergies and tradeoffs resulting from

the implementation of different land-use policies and practices.

SOLUTIONS SCIENCE AND TOOLS

The diverse partners in the Cedar River Valley project are compiling spatial data and applying models to map where excess nutrients and valuable soil are eroding into the water. These maps will help identify key places to prioritize changes in farming practices, and to site restoration and conservation actions that would have the biggest impact in reversing water quality trends while minimizing costs in terms of future agriculture production.

WWF and the University of Minnesota are developing a novel tool to allow this analysis to be performed by others easily and efficiently. This optimization tool will display results using an efficiency frontier, which illustrates what can be achieved in water quality improvements and other benefits through the optimal placement of alternative management practices in the watershed. It will also highlight explicit trade offs with other stakeholder objectives such as economic returns to farmers. This tool will provide a platform for analyzing similar questions in other geographies.

SCALING UP

Results from this pilot project will help inform Coca-Cola's water strategies around the world, and could serve as a model for replication in hundreds of locations worldwide. Such analyses will show potential pathways for obtaining significant ecosystem service benefit at lower costs when both benefits and costs of interventions are considered together.

Many businesses have set ambitious sustainability goals relating to ecosystem services and are engaging with suppliers, farmers, and local governments to identify ways to improve the sustainability outcomes in their value chain. Likewise, governments are setting targets for reducing environmental impacts of agriculture. The innovative optimization approach and tool developed and used in the Cedar River Valley pilot project will enable public and private supply chain actors to evaluate the potential range of environmental benefits and costs of achieving sustainability goals for a landscape.

SUGGESTED CITATION:

Pennington, D., K. Johnson, and J. Rozza. 2015. Sourcing Corn More Sustainably: Coca Cola. May 2015 Stockholm Summit on Natural Capital Use Case #9. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org

A TECHNOLOGY PLATFORM FOR NATURAL CAPITAL SOLUTIONS

“FOR A SUCCESSFUL TECHNOLOGY, REALITY MUST TAKE PRECEDENCE OVER PUBLIC RELATIONS, FOR NATURE CANNOT BE FOOLED.”

- Richard Feynman

The Natural Capital Project and close collaborators are co-developing a data and analytics platform driven by demand for specific information on natural capital needed for planning, investment, and operational decisions. Today's working prototype hosts nineteen open-source ecosystem service models, several key global data sets, and a number of visualization tools that enable decision makers to summarize and interpret results in relevant metrics. Next-generation use cases will advance the platform's utility to inform decisions by broadening the reach and range of data and analytics that it provides and by improving its user experience and interface design.



Photo ©Stacie Wolny

Global population growth and rising per capita resource impacts are greatly intensifying pressure on natural systems. Leaders in public and private institutions are increasingly trying to understand the worth of and risks to natural capital, but these remain largely opaque due to a lack of actionable, high quality information. Data from satellites, drones, crowds, and other sources can provide information on global changes—from urban growth to sea-level rise and deforestation—but further processing is needed to refine that information into a form that is relevant to key decisions that companies, investors, and governments make. For example, mapping where changes in land management will affect the drinking water quality of downstream population centers

currently requires almost a dozen technical steps linking disparate data sets; combining topography information, a stream map, and information on the location of population centers. This added data processing and refinement for modeling takes time and scientific expertise that are not often available to those who require the information for their decisions. In addition, dramatic gains in computational and data-gathering technologies have not yet been effectively leveraged to bring natural capital solutions to decisions at enterprise scales.

PROMISING ADVANCES

The science of valuing nature's benefits has advanced significantly since the Millennium Ecosystem Assessment first reported in 2005 on the status of the world's ecosystem ser-

vices. Relationships between biodiversity, ecosystem services, and their value to people are better understood. Coupled with innovative modeling approaches and new data sources, this science has improved our ability to link environmental changes to specific consequences for the wealth and well-being of people and communities. Today presents an opportunity to harness advances in remote sensing of high-resolution geospatial data, social media, and low-cost cloud computing to incorporate real-time global information on changes in the environment into decisions around the world.

The Natural Capital Project is co-developing a science-based data and analytics platform to assess the risks and opportunities presented by ecosystem change and human activity. This platform comprises a variety of data processing tools, ecosystem service models, and analytics that are explicitly defined by the needs of relevant decision makers. Working with end users from the beginning ensures that the models, data, and metrics of the platform are relevant now to the decisions being made about nature, economic growth, and human well-being.



Photo ©JuanSe Lozano

SOLUTIONS SCIENCE AND TOOLS

The Natural Capital Project currently supports nineteen ecosystem service models that calculate how changes in human activities, climate, and other global drivers affect environmental benefits to people. These benefits range from clean and ample water supplies to protection from coastal flooding and erosion, and from the production of crops, fisheries, and timber, to opportunities for tourism and recreation. Underlying the ecosystem service models is an open-source, geospatial analytics platform that makes it possible to efficiently calculate ecosystem functions over large geographic areas more quickly, and with less computing time, than with any other computing hardware or software. The open-source and accessible nature of the platform encourages independent uptake of these tools that have been downloaded and used tens of thousands of times in over 100 countries. Two customized decision support tools also have been built on top of this platform for specific decision contexts. These tools include the calculation of return-on-investment for specific activities and mitigation offset options for government permitting decisions. Several other independent software developers already have incorporated ecosystem service models and results from this platform into their own user-friendly software. These initial, tailored ‘app’ examples illustrate the potential for third-party software developers to build customized decision support and visualization tools for both private and public use.

A number of collaborators have helped build this data and analytics platform over the past five years through engagement in over thirty demonstrations around the world. This work has created new scientific methods and software designed to provide relevant information for a diversity of decision contexts. As a result, more leaders in government, business, multi-lateral institutions NGOs, and community groups are using natural capital information to change the way that they plan for the future—by securing water supplies for cities, designing zoning plans for sustainable development, and prioritizing investments in habitat restoration to protect people and property from sea-level rise and coastal storms.

SCALING UP

The extraordinary demand for geospatial, decision-specific natural capital information has outstripped our current capacity to provide science support to all potential projects. Lowering the cost of entry—reducing technical demands, time, and financial cost—will accelerate the uptake of natural capital approaches into a wide range of decision contexts for the benefit of human well-being and nature. A mature data and analytics platform plays a critical role in scaling by allowing connections between models from numerous technology providers, and enabling key decision makers at a wide range of organizations to access, understand, and incorporate this information into their decisions. To further this aim, The Natural Capital Project seeks to work with collaborators to develop next-generation use cases that demonstrate new approaches and applications that will broaden the reach and range of data and analytics that the platform provides, and to improve its user experience and interface design.

The ultimate success of the technology platform will also depend on its connection to other key strategies for scaling uptake of natural capital information into decisions. Several innovative communication and collaboration platforms are encouraging the broad sharing of lessons—successes and failures—in applying natural capital information. Combined with targeted policy innovations and a global effort to build technical capacity to support next-generation use cases, public and private sector leaders and citizens will be empowered to quantitatively and objectively incorporate natural capital into major decisions for a more resilient world.

SUGGESTED CITATION:
Ruckelshaus, M. and M. Guy. 2015. A Technology Platform for Natural Capital Solutions. May 2015 Stockholm Summit on Natural Capital. Natural Capital Project, Stanford University, Stanford CA, USA. 2pp. Available at www.naturalcapitalproject.org