

The Global Adaptation Atlas

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Executive Summary

Threats posed by climate change bring existing development challenges into sharper focus. Even if we are successful at averting the most severe predicted impacts, local climate changes will complicate the already-demanding tasks of finding clean water, combating disease, and sustaining livelihood activities essential to the survival of communities around the world.

Numerous policy and funding mechanisms have recently emerged to support adaptation, the process of adjusting to changing environmental conditions. Some of the largest funds are expected to channel billions of dollars to adaptation activities over the coming decades. However, the allocation of these funds remains controversial, in part because of the diversity of possible interventions, including drip irrigation installations to help African farmers weather more severe droughts, mangrove restoration programs to help Pacific Islanders buffer against natural disasters, and levees to protect Southeast Asian communities from sea-level rise. Successfully implementing, tracking, and evaluating such projects will require extraordinary new ways of coordinating and disseminating data to understand: What are the critical impacts we need to address? What are our options for responding? Have our efforts been effectively targeted over time?

To answer these questions, we propose to create a dynamic new online tool: *The Global Adaptation Atlas* (patent pending). Using mapping software, including ArcGIS Server and Google Earth, our goal is to capture ever-evolving information on both climate impacts and adaptation activities to allow scientists, policymakers, and citizens to visualize what impacts are likely to affect their region(s), what other activities are already underway, and what gaps need to be filled.

To develop the *Atlas*, we have initiated collaborations with key data partners around the world. We plan to use existing databases on climate impacts and development and environmental aid to develop a prototype that will eventually automate the upload of new relevant climate impact science and build on existing internet search tools to invite practitioners, donors, and others to enter, update, and verify information about their adaptation projects. All data will be made publicly-available, and we further envision linking with tools like Google Scholar to capture quality metrics, such as whether studies have been peer-reviewed or cited.

Successful adaptation depends not on less site-specific attention, but on more effective long-term coordination, without which we run the risk of investing in adaptation measures that could undercut one another. For example, rainwater collection programs in warmer parts of the world could inadvertently create pools of standing water in areas newly susceptible to mosquito breeding, which in turn could undermine public health programs targeting malaria or dengue fever outbreaks. As a result, people require information not only on how their local climate could change, but also on what others in the area are doing in response. Right now, no central clearinghouse accessibly and comprehensively combines these data. With the *Atlas*, we aim to bridge this gap.

The Global Adaptation Atlas

Linking Science, Policy, and Practice to Build Resilience to Climate Change

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A new issue—adaptation—has recently begun to penetrate policy discussions on how to manage climate change, perhaps the most complex environmental problem of our time. Even if mitigation successfully stabilizes global greenhouse gas emissions and averts the most severe predicted ecosystem effects of climate change, there will still be significant local and regional impacts on humans in many parts of the world. Impacts are expected to be especially severe in developing countries where populations rely on local natural resources, like the crops they grow and the fish they catch, for their livelihoods and may lack the capacity to respond to and recover from sudden or severe events.

Adaptation, the process of adjusting to changing environmental conditions, encompasses a broad set of activities designed to reduce human and ecosystem vulnerability to climate change and its potential long-term impacts. Interventions can range in scale and scope from small installations of rain water collection and drip irrigation systems to help farmers weather more severe droughts to national investments in dikes and levees to respond to sea-level rise.

Until recently, projects like these were seen as either poverty alleviation development activities or solely as backstop measures in the event that mitigation efforts failed. Now there is growing recognition that reducing emissions and building resilience to climate impacts are complementary—not competing—objectives. Despite this shift in awareness, adaptation remains a daunting challenge, requiring coordination at unprecedented scales from the local to global level across nearly all sectors of the economy and all types of ecosystems. In many cases, the countries and regions in greatest need of adaptation measures are the least equipped to develop, manage, and coordinate large-scale programs.

The global community is now slowly converging around international and national policy options for mitigation, and in parallel, a variety of large and smaller-scale funding mechanisms have emerged to spur investment in adaptation. However, the allocation of adaptation funding remains highly controversial, and limited lessons can be drawn from the decades of experience with mitigation policy design that can be applied to adaptation policy development and investment. The primary reason for this disconnect is a single fundamental difference between the problems of mitigation and adaptation: location, location, location.

Policy Context

Mitigation is a global problem, where emissions reductions anywhere provide benefits everywhere. In sharp contrast, adaptation is an inherently local problem, where responses must be targeted and site-specific to be effective. As a result, the geographic location of key impacts,

populations, and resources – where, whom, and how hard droughts, storms, or floods will hit – really matters.

Current climate models are not well-suited to evaluate highly localized impacts or adaptation needs. Global assessments have typically been focused on macro-scale trends in natural systems, making it extremely challenging to assess local climate impacts, especially in developing nations, where there are large gaps in monitoring and baseline research. Nonetheless, decision-makers at all levels of government have already begun to establish funding mechanisms for adaptation. The largest and most recent of these is the UNFCCC Adaptation Fund. It already holds approximately \$50 million dollars (USD), a figure that is expected to grow into the hundreds of millions over the coming decades. Yet significant disagreement exists about how to set allocation priorities and identify target areas for new investment.

This conflict is not unique: governments, donors, and development practitioners at all levels around the world are making similar decisions about how to address and prioritize climate change within ongoing projects and programs. To date, all of these efforts have largely been driven by current political concerns in the absence of a clear picture of future impacts. It is critical, starting now, to use the data we have to inform priorities for adaptation funding and early capacity building efforts, and strengthen the links between science, policy, and practice. Successfully supporting adaptation will demand extraordinary new approaches to:

- synthesizing data on projected climate impacts,
- integrating this information with data on adaptation responses on-the-ground,
- disseminating data widely and supporting outreach at multiple scales,
- and monitoring and evaluating interventions to help set priorities for the future.

Without careful coordination, we run the risk of investing in adaptation measures in one sector that could duplicate or negate investments in another sector both in the short-term and the long-term. For example, new rainwater collection reservoirs in areas affected by climate change could create large pools of standing water in areas more susceptible to breeding of mosquitoes, which in turn could undercut public health interventions targeting outbreaks of malaria or dengue fever, by changing local exposure to mosquito-borne diseases. As a result, stakeholders not only require information on how the local climate is anticipated to change, but also information on what others in the region and around the world are doing in response. Right now, no central clearinghouse exists for both these kinds of data.

The Project

Dialogues at the recent United Nations Conference of the Parties (COP 14) in Poland, underscored that adaptation policy design is a fundamentally spatial problem. Geography is one of the few common threads connecting climate impact science to programs designed to promote adaptation. Therefore, mapping can play a central role in building and maintaining the essential linkages among science, policy, and on-the-ground practice. Because adaptation is both a global and a local problem affecting populations and ecosystems around the world, it is natural that responses

will be sector-, site-, and population-specific. As a result, success depends on real-time coordination of impacts and actions.

We propose to create a web-based digital “atlas” on global adaptation, with maps of the best-available science on impacts and up-to-date information on adaptation projects. Our aim is to use existing mapping software to create a platform on which to layer relevant demographic and natural resource data, just as it is now possible to cue up an existing map and add satellite terrain imagery and street-level information. The real-time adaptation data displayed online would allow scientists, policymakers, and global citizens to visualize what impacts are likely to affect their region(s), what activities are already underway, what gaps exist, and where to act.

For example, a philanthropic foundation program officer in Mali working on supporting innovative irrigation systems for agriculture and a local health official concerned about the spread of dengue in the same area would both be able to view the potential impacts of climate change on agricultural productivity and disease spread in the country and across a wider region of West Africa. The public health specialist could address risks of mosquito breeding created by new irrigation ponds or channels and compare locations of new disease vectors against the existing. Similarly, local agriculture extension agents funded by government ministries could be provided with health information in tandem with education materials on water and irrigation to distribute to individual farmers. All would receive tailored feedback from the Atlas on local, regional and global best practices for similar types of projects and relevant parallel efforts.

At a larger scale, for example, foundation program officers at the Gates Foundation, international agency staff at the WHO, and Adaptation Fund staff at the Global Environment Facility (GEF) could search and sort projects to view their own and other current grants in a sector or geographic area to identify opportunities for coordination, anticipate unintended intersections of existing projects, and set priorities for new programs and investments.

Atlas Objectives and Architecture

To meet this coordination challenge, the Atlas will consist of four key building blocks aligned with the following objectives:

- Compile the best-available natural and social science data on climate impacts
- Integrate these data with up-to-date information and maps of on-the-ground adaptation projects to highlight “confluences of impact and (in)action”
- Build a virtual global community of practice centered on climate change adaptation to support outreach and share best practices
- Support long-term monitoring and evaluation through the development of a spatial data archive and help set priorities for future adaptation investment

Our aim is to use Geographic Information Systems (GIS) software to create an integrative platform on which multiple communities of users can contribute, layer, and view adaptation science and project information in a quality-controlled “wiki” format.

Building Block 1: Compiling and Organizing Climate Impact Science

Scientists around the world are making great strides in creating fine-grained regional and local assessments of climate impacts; however, these data remain largely fragmented across research disciplines and fundamentally disconnected from the scales at which adaptation policies and decision are made. To consolidate the enormous amount of natural and social science data on climate change impacts in a format relevant for decisionmaking, we plan to focus on five main themes: food, water, land, health, and livelihood. These themes serve as an organizing framework for research on the natural and human systems effects of climate change and for planned adaptation strategies to manage impacts.

The first phase of developing the Atlas will involve compiling data on human impacts for various climate scenarios and layering this impact data using GIS. We have already initiated partnerships with several key data centers and clearinghouses around the world to use their databases of climate impact data and streamline conversion of the data into compatible map layers. The aim is to create the outline for a mosaic of the best-available climate model projections, which can evolve as impact science and local observations improve.

The focus of this building block will be on establishing a structure to help users make robust and transparent decisions about overlaying various climate impacts at different scales and for different parts of the world in order to avoid missing or double-counting specific impacts across sectors. The Atlas prototype developed using existing data will then serve as the basis for an upload “wiki” feature for input of new impact data from the wider science community and a mechanism for coordination of new research.

Building Block 2: Mapping On-the-Ground Adaptation Projects

In addition to mapping climate impacts, it is essential to gather data on adaptation activities intended to manage and reduce impacts at various scales. The second building block centers on automating the process of mapping adaptation projects and activities around the world using an online survey mechanism. Project information will be identified using an automated search and filtering application, paired with carefully designed and deployed online survey inviting development practitioners, donors, and program managers to enter, update, and/or validate descriptive information about adaptation projects in the Atlas (sector, size, location, population served, funding source, timeline, etc.). The resulting entries, which form a searchable database of adaptation activities over time, can then be overlaid on climate impacts maps to identify “hotspots of impact and (in)action.”

We plan to begin by building on collaborations with various development, humanitarian, and environmental aid organizations to create a catalog of climate-relevant projects funded to date around the world. Using these data as a proxy and baseline for future adaptation funding and project data, we envision creating a framework for automating the collection of thousands of adaptation projects. The resulting dynamic online map(s) of points and areas plotted alongside one another across the world will allow users to see gaps and overlaps in the types, sizes, and locations of adaptation projects relative to key climate impacts.

As adaptation activities proliferate and cover ever-wider sets of activities—including basic research, capacity building, development planning, retrofitting infrastructure, and designing new insurance mechanisms—tracking and updating adaptation records will become increasingly challenging. Through an automated approach, we hope to overcome the hurdle of conducting repeated and fragmented paper surveys and assessments. The power of the Atlas will derive from the spatial integration of existing and emerging repositories of adaptation projects around the globe. The resulting data can be filtered and sorted to analyze patterns of adaptation investment over time and evaluate the relationships of these patterns to corresponding climate impacts. In the future, we plan to incorporate the project databases of major institutions, such as the UN Adaptation Fund, the World Bank Development Marketplace, and the Global Environment Facility.

Building Block 3: Creating a Tailored Outreach Vehicle

The process of conducting online searches and surveys to collect information about adaptation activities opens the door to the third component of the Atlas: outreach and dissemination. A major feature of the Atlas will be tailored user feedback. By tracking Atlas entries and user searches, we plan to develop a third “recommendation engine” style application to manage user profiles and provide tailored feedback on local, regional, and global best-practices for types and sizes of projects corresponding to user interests. A user who enters information or searches for projects on micro-insurance programs for small farmers in Mali would be able to view collections of information on projects in the same sector and/or coverage area in Mali, projects in different sectors (water, health, etc.) across West Africa, and projects of similar type and size across the world. This structured and tailored approach will also include a rating feature, where practitioners and users can rate projects already in the Atlas to create a record of best practices and lessons offered. Because adaptation is both a process and an outcome, capacity building is an essential component of successful adaptation over time. This approach to outreach and education can help build awareness and shape and motivate additional adaptation measures. Further, this type of knowledge is an essential element of scaling-up best practices under different contexts, governance structures, and institutions.

Building Block 4: Sustaining Long-term Monitoring and Evaluation

The goal of the final component of the Atlas is to establish a robust platform for monitoring and evaluation. By creating a spatial data archive, the Atlas will support new research and analysis on where around the world data on climate impacts is inadequate, policy action is lacking across regions and sectors, and adaptation-related decisions and activities have the potential to duplicate or negate one another in the absence of coordination.

Because this tool (and all user-released data) will be publicly available, this archive also has the potential to support monitoring and assessment activities for local adaptation projects and policies. In addition, the database can be used to help donor alignment and track large-scale adaptation funds controlled by international agencies, national governments, and philanthropic organizations in concert with one another. Monitoring, assessment, and evaluation are critical

challenges when it comes to adaptation. The eventual goal of any adaptation effort is to prevent adverse impacts from climate change. As a result, defining and measuring success will depend on having a clear baseline to be able to effectively evaluate progress and delays.

Implementation Plan

The first phase of the Atlas consists of a one-year effort beginning in December 2008 focused on Building Blocks 1 and 2. Early research in support of the Atlas is well underway (Vajjhala and Nackoney, in prep), and we anticipate expanding our data partnerships over the coming year. Additionally, we have begun to assemble a science and policy advisory board that will consist of 12-15 independent experts from an array of disciplines. Board positions will be three-year rotating positions, and the responsibility of board members will be to periodically (quarterly) visit, use, and assess the Atlas; to participate in an annual meeting to review major Atlas developments; to contribute one commentary (blog posting) on the Atlas per year; and provide support for outreach to scientists, decisionmakers, and policymakers associated with international and national adaptation programs and planning processes.

We expect to engage our data partners and advisory board members over the course of this year to user test the Atlas and to build relationships with key communities of natural scientists, social scientists, and policy makers. We also plan to solicit feedback from major climate groups, such as the readership of the Climate-L distribution list (a news and announcement list service on climate change issues), prior to launching the tool for wider use. We anticipate beginning work on Building Blocks 3 and 4, following the December 2009 launch of the tool.

Measurable Objectives and Outcomes

Several key outcomes will be tracked immediately following the launch of the Atlas, including:

- Counts of total number of climate impacts and projects mapped by theme and region
- Count of total number of Atlas entries and users by sector and region
- Total number of website “hits” and downloads of archival data over time
- Counts and citations of research and policy papers using Atlas impact and action databases, including studies on the type, sizes, and locations of impacts and adaptations
- Reports on meeting(s) of advisory boards and external meetings and conferences
- Written feedback by advisory board members on Atlas design, outcomes, and outreach

The information collection, integration, dissemination, and decision-support objectives of the project will be carefully tracked using these and other measures throughout the development of the Atlas. We anticipate that advisory board members and Atlas users will also contribute feedback on possible measures of success as the tool evolves to respond to diverse user needs.

Timeline and Benchmarks: Phase One - Prototype Design and Development

December 2008 – Science Data Compilation

Early and ongoing work has focused on data compilation and coding within our five themes – food, water, land, health, and livelihoods; developing decision rules for data compatibility; harmonizing formats for upload and overlay; and developing the structure for a wiki to elicit basic “meta-data” for future Atlas climate impact entries.

January 2009 – Hiring of Application Development and Web Design Consultants

We have begun work with Blue Raster, LLC (see description in staffing section) on the Atlas schematic design, geodatabase architecture, and application features.

**February 2009 – Provisional patent application submitted for the Atlas design, patent pending*

February 2009 – Adaptation Project Database Evaluation

We have initiated collaborations with multiple adaptation related organizations, and we will explore and geo-code data provided by our partners to support the design and testing of the Atlas adaptation project search and input survey mechanism.

March 2009 - May 2009 – Rapid Prototype Development

Using existing repositories of climate data and baseline adaptation project data, the core team and consultants will spend several months creating, testing, and evaluating the science layer upload application (Building Block 1) and the adaptation project mapping application (Building Block 2).

April 2009 - June 2009 – User Interface Design

Work with consultants to design and develop the website and interface for the Atlas map/data explorer with a focus on specific design features, such as the development of user profile options.

July 2009 - September 2009 – Atlas Prototype Testing

Collaborate with partner organizations and advisory board members to coordinate an extended period of user and collaborator testing of the Atlas prototype and interface.

August 2009 - November 2009 – Refining Prototype with Feedback from Advisory Board

The final months of Phase One will be dedicated to meetings and presentations to gather feedback on Atlas and solicit participation of science and policy advisors from around the world.

December 2009 - Launch of Prototype at COP 15 event in Copenhagen, Denmark

Phase One will conclude with the first convening of the science/ policy advisory board and the launch of the Atlas prototype at the 2009 UN Framework Convention on Climate Change negotiations in Denmark.

Core Team and Staff

Shalini Vajjhala is a Fellow at Resources for the Future and the leader of the Atlas project. Her research focuses on the social impacts of large-scale development and environmental policies with critical public participation components. She has worked extensively on integrating and applying participatory mapping methods and Geographic Information Systems (GIS) technology to diverse issues including climate change adaptation, environmental justice regulation, renewable energy siting, and carbon sequestration risk management. Shalini holds a Ph.D. in Engineering and Public Policy from Carnegie Mellon University. Prior to joining RFF, she worked as an architect, community organizer, and design instructor in Pittsburgh.

Dan Spadaro, a Vice President in the Technology Division at Goldman Sachs, joins the RFF team through the Goldman Sachs Public Service Program, for one year beginning December 1, 2008 as the full-time Strategic Leader of Technology on the Atlas project. He is a technology professional with over 20 years experience supporting various industries and technologies, with the last 12 years primarily focused on the design, implementation, and support of financial application systems technology infrastructure at firms including Morgan Stanley, Deutsche Bank, and Goldman Sachs. Dan holds a B.S. in Engineering Science with concentration in Electrical Engineering/ Computer Science and is currently completing an M.S. in Environmental Science focusing on climate change.

Janet Nackoney is an environmental conservation professional with 10 years of experience in natural resources research and GIS. As part of her own consulting company, Summit Geographics LLC, she has been working on adaptation research and the Atlas project as a part-time GIS Specialist at Resources for the Future for over one year. She specializes in spatial data analysis and mapping for a diverse array of natural resources, conservation, humanitarian, and international development applications. Janet holds an M.A. in Geography from the University of Maryland.

Nisha Krishnan is a research and technology assistant on the Atlas project and a former IT/web intern at RFF. She was instrumental in the development of RFF's new website, and has been near full-time on the Atlas team since September 2008. Nisha holds a B.A. in Economics and Political Science from Macalester College and is currently completing her M.A. in Applied Economics from the Johns Hopkins University.

Michael Lippmann, Blue Raster, LLC, has more than 10 years of experience in environmental policy and web application development. Since 2002, Michael has managed information technology projects at Blue Raster. He currently provides web application development, web geographic information system (GIS) development, policy analysis and project management support. He has broad experience with environmental research and has worked with numerous federal agencies in his management of the design, development, and deployment of many award winning interactive mapping/GIS and database-driven web applications.

Stephen Ansari, Blue Raster, LLC, has more than 10 years of experience in website and web application development that provides the foundation for managing and developing business mapping solutions and customized web application solutions.