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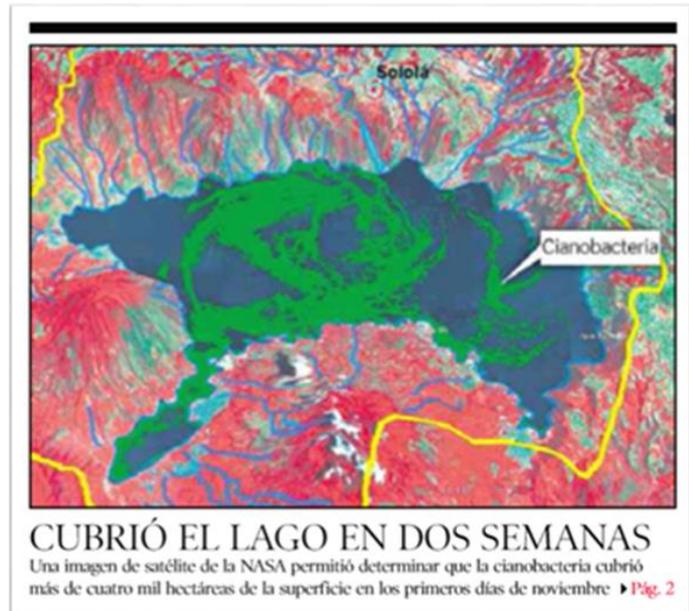
Evaluation Brief: SERVIR Products and Tools

Water Quality Monitoring for Lake Atitlán, Guatemala

Background

Lake Atitlán is one of the largest lakes in Guatemala, a major tourist destination, and regarded as a national symbol due to its natural beauty and archeological significance. More than 250,000 people live in the lake region, with more than 100,000 of those relying directly on the lake for their drinking water. As is true for many of Guatemala's other lakes, Lake Atitlán's water quality has been in decline since the 1970s, with the decline accelerating in the 1980s and 1990s. The government of Guatemala established the Authority for the Sustainable Management of the Atitlán Basin (AMSCLAE) in 1996 to address some of these issues, but it was hampered by poor coordination, weak investment funds, and little public participation.

In late 2009, a freshwater algae bloom of unprecedented size occurred, with large stretches of unpleasant looking, foul smelling, and potentially toxic mounds of algae appearing across the lake, impacting a wide range of livelihood activities related to the tourism and fishing industries. Guatemala's Ministry of Environment and Natural Resources (MARN) reached out to SERVIR a joint development initiative of NASA and the United States Agency for International Development (USAID), requesting technical support to analyze the seriousness of the pollution problem and to provide satellite-based monitoring for this strategic Guatemalan resource. In



NOV. 22, 2009, FRONT PAGE IMAGE FROM PRENSA LIBRE, GUATEMALA'S MOST WIDELY READ NEWSPAPER

Product Details

- Presents lake extent (surface area), lake temperature, and chlorophyll concentration used as a proxy for cyanobacteria presence.
- Can be presented as static maps, time-series comparisons using side-by-side images, or data tables and graphs displaying change over time numerically rather than visually.
- Measures chlorophyll concentration using a unique SERVIR-developed algorithm to infer the presence of algae blooms and, in the case of Lake Atitlán, potential cyanobacteria blooms.
- Uses Landsat, ASTER, and Hyperion satellite imagery provided to MARN and several Guatemalan watershed authorities through SERVIR at no cost.
- Provides data and imagery for multiple Guatemalan lakes, but no others have been used as extensively as Lake Atitlán's.
- Inspired major changes to national and local environmental policy and practice when product imagery was featured on the front page of Guatemala's primary newspaper.

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response, SERVIR and its regional partner the Water Center for the Humid Tropics of Latin America and the Caribbean (CATHALAC) generated a broad range of satellite-based water quality analysis and imagery products, which they made available to contacts in the environmental management sector and placed on the SERVIR and CATHALAC websites, where the public could easily access them.

On November 22, 2009, one of the SERVIR images showed that the blooms had affected approximately 38 percent of the lake surface. The Minister of Environment presented this dramatic image to the press with grave warnings about the condition and future of the lake. The images caused a huge sensation, made the front page of Guatemala's most widely read newspaper, *Prensa Libre*, and were picked up by national and local news agencies in Guatemala and news outlets around the world. The resulting publicity brought the plight of Lake Atitlán to the wider public and mobilized public opinion and the Guatemalan government to take measures addressing the environmental degradation of the lake.

Product Usage

The newspaper image and other outputs from the SERVIR product have been used to shape local and national environmental policy; to increase conservation and restoration funding for the lake region; and to direct, strengthen, and inform research.

Shaping Environmental Policy and Practice

The product was used to shape environmental policy at both the local and national levels.

- MARN used the images, analysis, and massive public response to mobilize high-level political support for environmental reforms and an overhaul of the country's environmental policy framework.
- The product outputs influenced and informed two key policy documents published in 2011: regulation for residual waters of Lake Atitlán and the National Policy and Strategy for Integrated Water Resources Management of Guatemala.
- MARN delegated increased authority to AMSCLAE through new enforcement mandates related to water treatment, pollution, and overuse of fertilizer by area farms.
- Local hotels undertook self-imposed improvements to in-house water purification systems.
- Construction of public washbasins for laundry and a shift to non-phosphate detergents reduced lake impact by local communities.

Increasing Funding

The attention brought to the 2009 algae bloom event by the SERVIR/CATHALAC imagery significantly influenced decision-making related to funding on local, national, and international levels.

Research Overview

This briefing presents highlights from a case study conducted as part of the SERVIR performance evaluation, examining the water quality monitoring product in Guatemala. This product was developed with support from SERVIR as part of a partnership among NASA, USAID, and CATHALAC.

This briefing and the case study that informed it describe highlighted findings from research that a team of United States- and Guatemala-based evaluators undertook under the E3 Analytics and Evaluation Project in February 2015.

Evaluators collected data from focus group discussions, semi-structured interviews, and site visits, supplemented by a desk review of relevant literature and specialized sectoral knowledge from local team members.

The evaluation team conducted more than 25 interviews in Panajachel, Solola, and Guatemala City. Interview and focus group participants were drawn from national and local government agencies, non-governmental organizations, and academic institutions working in the environmental, health, and tourism sectors.

- The local conservation group *Amigos del Lago* (Friends of the Lake) incorporated information and imagery from the SERVIR analysis into its fundraising appeals. The SERVIR imagery and its appearance in the national and international news had a substantial, positive impact on the budget, capacity, and public support for *Amigos del Lago*.
- On a national level, the public response to the SERVIR imagery led MARN to increase annual funding to AMSCLAE more than tenfold.
- On an international level, USAID decided to fund and expand new and preexisting lake research activities under the umbrella program *Unidos por el Lago Atitlán* (United for Lake Atitlán). This represented an unprecedented degree of project funding channeled to Guatemala's environmental research, information sharing, education, and lake protection activities.

Directing, Strengthening, and Informing Further Research

Beyond the vivid newspaper images, the SERVIR product data impacted research in the following areas:

- The satellite-derived imagery showed the areas where the algae blooms were most concentrated, indicating locations where fertilizer runoff and pollution were more common, which informed targeted sensitization in those outlying areas.
- *Unidos por el Lago Atitlán*, *Universidad de Valle*, and AMSCLAE collaborated directly with SERVIR to synchronize their own water quality sampling activities with the times when satellites passed overhead to collect imagery for SERVIR's water quality measurements, enabling comparison and calibration of findings and analysis.
- Representatives from MARN, AMSCLAE, and academia received training from SERVIR so they could use the same remote sensing and algorithm application techniques for their own work.

Factors Affecting Product Use

All interviewees agreed that, more than anything else, the timing and the placement of the satellite image on the front page of *Prensa Libre* was a catalytic event. Several other factors also impacted product use, including the visibility of the lake and the algae bloom event, and the way that the positive relationship between MARN and SERVIR facilitated rapid generation and distribution of the SERVIR product outputs. Two notable factors that appear to curb more extensive use of the product and its outputs are the limited awareness of its wider capabilities and staff turnover at partner government institutions.

Limited Product Awareness

Although all interviewees acknowledged and remembered the front-page image from *Prensa Libre*, most did not know or remember the source of that image. With the exception of specific individuals who had direct experience working with CATHALAC and SERVIR, interviewees had low awareness of the time series data and the much more extensive analysis that underpinned the images of the lake's algae bloom. Furthermore, the parallel application of the SERVIR product to create outputs for several other, less prominent Guatemalan lakes was almost entirely unrecognized outside of an even smaller group of specialists.

Staff Turnover at Government Institutions

One of the challenges encountered in Guatemala is the issue of staff turnover rates for everyone from top-level political appointees to local administrators and technical staff. As a result, government institutions have suffered disruptions to established policy and a loss of institutional memory, leading to a lack of awareness or understanding of what products and product outputs are available. This was seen following the 2011 elections, when major turnover in the top-level staff of all government institutions

removed some of the active champions for the product and derailed aspects of the nationally driven lake restoration and preservation activities.

Current and Future Impact

The evaluation team found that the image of the lake had a clear effect on the public consciousness around the environmental damage occurring in Lake Atitlán and directly motivated the subsequent groundswell of effort to address the causes of the lake's environmental degradation. Interviewees from the public, private, nonprofit, and academic sectors consistently agreed that public exposure to the SERVIR image on the front page of *Prensa Libre* was the catalyzing factor in changing public activity related to the lake and its condition. Prior to that, the risk of an algae bloom event was not fully appreciated, and its manifestations were treated as temporary and localized. That increased awareness brought more attention to pollution control, which the key to limiting bloom incidence.

Local organizations like *Amigos del Lago*, which previously struggled to raise funds for basic environmental awareness activities, are now collaborating with private industry, international donors, and the Guatemalan government on large-scale protection and restoration activities. The visibility and attention that the lake received from the 2009 SERVIR image helped them raise funds for planning and initial implementation of a comprehensive approach to reduce wastewater inflow to the lake. However, algae bloom events can be separated by several years, so the public must regularly be reminded of the causes of the problem, or there is a danger of the losing the recent gains. The process of successfully halting and ultimately reversing the underlying causes of Lake Atitlán's algae bloom event will take many years, and the stakes for the lake are high. According to lake researchers, the lake will not be able to return to a healthy state if a comprehensive program is not underway by 2020,

At this time, local institutions have not demonstrated the capacity to apply the SERVIR water quality monitoring algorithm and methods on their own and are still reliant on assistance from SERVIR or CATHALAC. Furthermore, although the product has utility for other large lakes in Guatemala, the SERVIR product outputs for those locations remain underutilized. Moreover, SERVIR repeated its water quality monitoring analysis for Atitlán in 2010 and 2015, and remains attentive to the needs of its Central American partners, but it no longer has a regional hub in Mesoamerica, which limits its involvement in that region. Thus, despite the product's past success, future impact is not assured.

Recommendations

The evaluation team provides the following recommendations:

- Continue or expand training activities related to the water quality monitoring process using the established chlorophyll monitoring algorithm developed by the SERVIR team.
- Address the limited awareness of the analysis products beyond very narrow practitioner circles by making analysis data easier to find and by putting it into a more accessible format (e.g., Word or PDF publications).
- Look for other opportunities to leverage SERVIR's capabilities for similar analyses to inform other environmental programs in the region and elsewhere.
- Increase tool and data-product use by building relationships with specialists and stakeholder groups who are well connected to local actors working on relevant issues (e.g. local anti-pollution or environmental conservation organizations).