

Guatemala Fog Collection Project, 2004

Juan Luis García¹, Robert Schemenauer², Melissa Rosato³ and Pablo Osses⁴

¹*Geosciences Institute, Austral University of Chile, Valdivia, Chile*

²*FogQuest: sustainable water solutions and Environment Canada
P.O. Box 151, 1054 Centre Street, Thornhill, ON, L4J 8E5, Canada*

³*FogQuest: sustainable water solutions*

⁴*Geography Institute, Pontifical Catholic University of Chile, Santiago, Chile*

A fog collection project was initiated in December 2003 in the Lake Atitlan basin, Guatemala, Central America. Working with Veterinarians Without Borders (VSF) and the Autoridad para el Manejo Sustentable de la Cuenca del Lago de Atitlan y su Entorno (AMSCLAE), FogQuest installed 13 Standard Fog Collectors (SFCs) during January and February 2004 around the lake. They were close to rural villages in which both Guatemalan organizations had the most interest. Data from January to April are presented, which correspond mainly to the winter dry season. The best collection sites averaged more than 4.9 liter of water per square meter of mesh per day over the four month period. These values were registered on the south side of the lake as well as on the north side. Overall it was observed that sites located on the north side of the lake collected larger amounts of water than those on the south side. This could be due to differences in altitudes on the sides, with higher altitudes on the north lake side. The present evaluation shows a positive scenario of water production that could complement the local water supply, with a significant benefit to local domestic and economic activities.

1. INTRODUCTION

The Atitlan basin is located in the central southern region of Guatemala, about 100 km from Pacific Ocean. It corresponds to a complex volcanic mountain system, with a maximum altitude of 3557 m.a.s.l. (Volcán Atitlan). In general terms, the higher altitudes are in the northern part of the watershed. This mountain system is the reason for the presence of dense fog. Humid air masses coming from Pacific Ocean find this relief to be an obstacle and are obligated to ascend, producing an adiabatic cooling and condensation. Low clouds appear over the mountains after midday and its very common that the lake system, or a great part of it, ends the day covered by a dense deck of clouds.

People live in rural villages, where the main activity is growing coffee. Atitlan coffee is considered one of the best, comparing well with any other coffee produced in the world. The rainy season takes place in the summer time (June - September) and represents the source of water to irrigate coffee plantations. During the rest of the year people are not able to grow crops (including coffee) because there is no water available, although soils and other necessary resources are present.

Potable water is commonly limited in several villages. This water is obtained from mountain springs, although small coastal cities pump water from Lake Atitlan (Santiago de Atitlán, San Lucas del Toliman, Sololá, among others cities)

The 13 Standard Fog Collectors (SFCs) were constructed in Guatemala, with locally available materials, except for the mesh, which was imported from Chile and Canada. Veterinarios Sin Fronteras (VSF) and AMSCLAE assisted with the field work during the installation period (January - February). In addition, local people participated actively and were highly interested in the project. The field work was carried out using fog collection protocols and instrumentation that have been developed in Chile (Schemenauer and Cereceda, 1994a; Schemenauer and Cereceda, 1994b).

Local people were trained to record data at each site. To ensure the quality of the data, each observer was briefed and tested on how record the data after the installation of the SFCs. After a period of about four weeks, their work was checked again during their daily measurements.

Fog collector data, weather observations and rainfall data were of good quality, although a few minor errors were recognized during its

processing in Chile as well as some gaps in data records.

2. FOG COLLECTION SITES

One of the main restrictive conditions for the project in the Atitlan region was to find clear spots with no vegetation or at least with low vegetation. This is necessary because vegetation inhibits the wind flow, which is a basic condition for fog collection, both with an SFC or an LFC. Many of the sites chosen were corn and coffee plantations, with plants lower than 1 m and distributed downslope with respect to the SFCs. Some of these crops were harvested at the moment of the installation of the collectors, and this resulted in better site conditions.

Sites were located both to the north and south of Lake Atitlan. In general terms, northern sites were selected at higher altitudes than southern ones, in response to the difference in mountains altitudes found between the regions. Site altitudes in the south part of the lake averaged 1949 m.a.s.l., while north of the lake they averaged 2565 m.a.s.l. (Table 1).

Seven of the 13 SFCs were oriented to the southeast, 4 to the south, 1 to the northeast and 1 to the west.

Table 1: Locations of Standard Fog Collectors in the Lake Atitlan basin

Site Name	Site Number	Average (L m ⁻² day ⁻¹)	Location UTM (WGS 72)	Orientation	Elevation
Terreno de Adisco	1	1.19	1613428 - 697788	134	2,125
Cerro Tamalaj	2	1.14	1613219 - 698142	145	2,015
Chitulul	3	0.17	1620479 - 704167	154	1,820
San Gabriel	4	1.06	1619261 - 702445	137	1,938
Cerro Iquitiú 1	5	1.7	1617660 - 701047	190	1,965
Cerro Iquitiú 2	5	2.29	1617660 - 701047	143	1,965
Rey Tepepul	6	4.98	1614639 - 690464	183	1,818
Las Trampas	7	6.51	1640018 - 705088	40	2,680
60 Vueltas	9	1.37	1643071 - 695724	132	2,790
Las Antenas	10	1.39	1632338 - 692543	153	2,542
Palestina	11	1.69	1624691 - 682170	276	2,093
La Fé	12	3.22	1641392 - 700977	200	2,626
El Mirador	13	2.43	1641122 - 702189	188	2,657

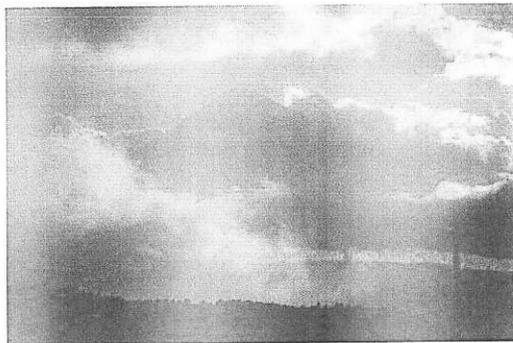
3. RESULTS

3.1 Southern Atitlan Sites

The sites included in this area correspond to # 1, 2, 3, 4, 5 and 6, with a total of 7 SFCs constructed at them. All of the SFCs in this area averaged more than 1 L m⁻² day⁻¹ during the period January - April, except for Site #3. This last one produced little water because it is located in a closed shrub area that inhibits wind flow. In addition, its altitude is the lowest of all the sites. The best averages were found in Site #5 (Co. Iquitiu 2) and

in Site #6, with 2.29 L m⁻² day⁻¹ and 4.98 L m⁻² day⁻¹, respectively. Both sites are located in an open area on a ridge where winds flow constantly. In addition, Site #6 is located in a small saddle between two higher elevations, this creates a funnel effect in the wind coming from the southern lowlands to the lake. In this way, because of altitude and SFC orientation, Sites #5 and #6 have a positive relief context which permits them to collect larger amounts of water.

SFCs in the southern mountains of the lake were oriented to the southeast (5 collectors) and to the south (2 collectors). These last ones averaged $2.96 \text{ L m}^{-2} \text{ day}^{-1}$, while the SFCs oriented to the southeast averaged $1.1 \text{ L m}^{-2} \text{ day}^{-1}$, showing a significant difference between them. The water collected in SFCs with a south orientation (R. Tepepul and C. Iquitiu 1) produced 46 % of the total amount collected in the whole southern area during the January – April evaluation period.



Atitlán Volcano (3557 m.a.s.l.) on the south side of the lake, where Sites #1 and #2 are located.

3.2 Northern Lake Atitlan Sites

The sites included in this area corresponds to the # 7, 9, 10, 11, 12, 13, with a total of 6 SFCs constructed at them. All of the collectors in this area averaged more than $1.3 \text{ L m}^{-2} \text{ day}^{-1}$ between January and April, denoting larger amounts of water collected than at the southern sites. All of them represent very good rates of water collection. The best sites, #7 and #12, averaged $6.51 \text{ L m}^{-2} \text{ day}^{-1}$ and $3.22 \text{ L m}^{-2} \text{ day}^{-1}$, respectively (Table 1). Both sites are located in an open area at the top of the local mountain system where winds and fog pass through. The high altitudes of these sites (more than 2600 m.a.s.l.) allows condensation and fog formation, with low temperatures.

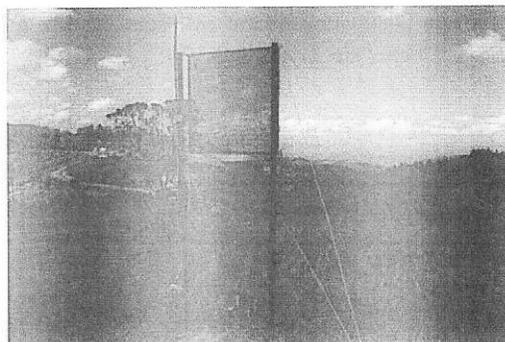
Site #7 is the only one oriented to the Northeast and, as it was found, with the highest water collection. But it should be expected that this SFC collects fog coming both from the northeast as well as southwest sideslopes.

SFCs in the northern mountains of the lake were oriented to the southeast (2 collectors), to the south (2 collectors), to the west (1 collector) and to the northeast (1 collector), denoting the complex relief existing in this area, with a variety

of differently oriented valleys. The best orientation seems to be northeast and south. The first one averaged $6.51 \text{ L m}^{-2} \text{ day}^{-1}$ and the second $3.0 \text{ L m}^{-2} \text{ day}^{-1}$. The other SFCs, oriented southeast and west, averaged $1.38 \text{ L m}^{-2} \text{ day}^{-1}$ and $1.64 \text{ L m}^{-2} \text{ day}^{-1}$, respectively.

The water collected in the SFC with the northeast orientation (Site #7) produced 46.7 % of the total amount collected in the whole northern area during the evaluation period.

A total of 80 % of the water collected in the north sites was produced at altitudes varying from 2600 to 2800 m.a.s.l.



Site #7 Las Trampas on the north side of the lake, averaged $6.51 \text{ L m}^{-2} \text{ day}^{-1}$

4. LFCs: IMPLEMENTATION AND COMMUNITY BENEFITS

Up to now, 2 Large Fog Collectors (LFCs) have been installed in the project area. The sites chosen for this propose were Site #7 (Las Trampas) and Site #12 (La Fe). These sites have high collection rates (within the 3 best sites) and they are close to rural villages which could be benefit from the water produced.

Considering a water consumption of 25 L day per capita, higher than the average water consumption in Chungungo – Chile, where the first fog project was developed (Cereceda and Schemenauer, 1993), 10 LFCs installed in Site 12 could benefit 50 persons with 1288 L of water produced each day during the dry season (December – April). At Site #7, the people benefitting from the same number of LFCs could reach 100, with 2600 L of water produced each day.

5. CONCLUSIONS

An evaluation project has been developed since January 2004 at Lake Atitlan in Guatemala and preliminary results have shown a positive scenario for fog collection.

Northern sites have recorded better collection rates than southern sites. Southern ones are located at lower altitudes, which may make a difference in liquid water content and in wind speeds. The best collection took place at altitudes higher than 2600 m.a.s.l. (Table 1).

On the south side of the lake, the SFCs oriented to the south collect larger amounts of water than the ones oriented to the southeast. On the north side of the lake, the better collection was obtained from the SFCs oriented to the northeast. The SFCs oriented to the south (sites #12 and #13) recorded very good amounts of water as well.

Installation of LFCs in sites like Rey Tepepul, Cerro Iquitiu, Las Trampas, El Mirador and La Fe could benefit several rural villages that today experience unsatisfied domestic and economic water requirements.

6. ACKNOWLEDGEMENTS

We would like to gratefully acknowledge the support of the organizations VSF and AMSCLAE for the field evaluation project and also funding from the Canadian Embassy in Guatemala for the construction of the SFCs. We would also like to thank the workers in the villages, who assisted with the construction and at present are recording the data from the fog collection sites.

7. REFERENCES

Cereceda, P., R.S. Schemenauer, 1993: La percepción de los consumidores de agua potable de nieblas costeras de Chungungo, Chile. Revista Geográfica de Chile Terra Australis, 24, 7-18

García, J. L., Silva, B. (FogQuest) 2004: Reporte Parcial del Proyecto de Colección de Agua de Neblinas, Lago Atitlan, Guatemala 2004
(*Partial Report of the Fog Water Collection Project in Atitlan Lake, Guatemala 2004*)

Rosato, M., (FogQuest) 2004: Contribución de FogQuest en el proyecto de la colección de niebla en la zona del Lago Atitlán Guatemala, Diciembre 2003 – Marzo 2004.

(*Contribution of FogQuest to the Fog Collection Project in the Lake Atitlan Region, Guatemala, December 2003 – March 2004*).

Schemenauer, R.S. and P. Cereceda, 1994a: A proposed standard fog collector for use in high elevation regions. J. Applied Meteorology, 33, 1313-1322.

Schemenauer, R.S. and P. Cereceda, 1994b: Fog collection's role in water planning for developing countries. Natural Resources Forum, 18, 91-100, United Nations, New York.