A Meteorological Community Project in South Africa

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In a 2006 BAMS article, Washington et al. express concern regarding the state of climate research in Africa. They list the shortage of long-term and reliable climate observations as well as the shortage of climate scientists as two major constraints on African climate science. They stated that only nine articles with lead authors from Africa have appeared in two climate-related journals in the period of 2002–04. Further investigation reveals that all of these authors were from scientific institutions in South Africa. South Africa has the largest economy in Africa, with a gross domestic product (GDP) of $576.4 billion (U.S. dollars) in 2006. This is around 25% of the entire African continent’s GDP. Education is the largest category of government spending, with just over $14 billion (U.S. dollars) made available by the South African government for education in 2007/08. However, the proportion of the South African population with tertiary education is only 3%, which is one of the lowest in the world. In 2006, only 16% of students finishing high school in South Africa obtained higher-education endorsement, a requirement for entrance into university. Of the nearly 528,525 students taking final exams in 2006, just 5% passed mathematics and physical science with sufficiently high grades to get into university. These two subjects are generally required by science faculties at universities. Hence, only a very small number of students became eligible to pursue professional careers in science and technology that year.

The problems with education in South Africa are complex. Impoverished communities, poor school resources, and inadequate teacher training are some of the major socioeconomic obstacles. Muwanga-Zake (2001) describes these problems with science education at high schools in the Eastern Cape province (see Fig. 1 for location). In addition, nearly one-third of the schools in South Africa do not have a reliable and safe water source. This affects more than two million students daily, and has become the focus of a growing cooperative program between university meteorology students and the rural schools that are so desperately in need of basic resources.

A COMMUNITY PROJECT IN METEOROLOGY. The exceptional need for infrastructure and capacity at some rural schools in South Africa necessitated the conception of a community project at the University of Pretoria. This project is presented as a second-year subject and forms part of the B.S. (meteorology) degree in the Faculty of Science. The
community project has two broad aims. The first is to introduce meteorology students to the concept of project management. Great emphasis is placed on group work, and the students are required to identify a community that would benefit from an outreach program. The students consequently have to find sponsorship and then plan, execute, and document the project. At the completion of the course, they are required to submit a report and present their project to faculty members.

A second, and very important, aim of the community project is the outreach program at a rural community. The community project has found a synergy with the projects responsible for the erection of fog water collection systems at rural schools. This paper focuses on the community project activities at Tshanowa Junior Primary (JP); however, similar projects have been conducted at schools at Lepelfontein, a very small community located on the west coast of South Africa, as well as in the Lusikisiki area of the Eastern Cape province. The outreach program at the school usually consists of a presentation where meteorological concepts are explained at an age-appropriate level. Whenever possible, we also endeavor to improve the infrastructure at the school.

FOG WATER COLLECTION. In 1999, a fog water collection system was erected at Tshanowa JP in the Soutpansberg (Salt Pan Mountains), within the Limpopo province. The elevation of the school is 1,004 m above MSL and is exposed to fog-bearing winds from the east, southeast, and northeast. No formal water infrastructure exists at Tshanowa JP, and water has to be collected from a nonperennial spring located approximately 2 km away (Fig. 2). The mountainous area in which the school is located receives approximately 1,000 mm of rain annually, most of which falls in summer (October–March). Fog water collection in the Soutpansberg, however, occurs year-round when moist maritime air from the Indian Ocean moves over the escarpment, resulting in an extensive layer of stratocumulus against the mountains. Netting (Fig. 3) intercepts the low cloud water droplets, which trickle into a gutter attached to the bottom of the net. A sand filter removes solid impurities and the water is then channeled via pipes to three 10,000-L containers, where it is used daily by the school’s 300 students. Olivier and Rautenbach (2002) found that the cloud-water yield in 9 months during 2000/01 was close to 150,000 L, and the maximum yield rate exceeded 3800 L day⁻¹.

Although the location of Tshanowa JP is sufficient for fog-water collection, there are other schools in the vicinity that are better positioned for fog water collectors. The elevations of these schools are higher and, hence, will intercept more clouds. However, the fog water collection system was erected at Tshanowa...
JP first because of the enthusiasm for the project expressed by the headmaster and the other educators at the school. The involvement of the educators with the school and the community has also ensured that the community projects at the school have been sustainable and have worked to benefit the learning process of the school children.

OUTREACH AT TSHANOWA JP. Tshanowa JP is a very small school—there are four classrooms and education is provided only up to grade 5. Very few of the children and only some of the educators are competent in English. The students who know English irrefutably receive the most benefit from the outreach program at the school (Fig. 4).

The involvement of the university’s second-year meteorology students with Tshanowa JP started in 2002. The six students completing the course that year named their project “Mist Call.” They erected a basic Stephenson screen to house wet- and dry-bulb thermometers, a wind vane, and a rain gauge at the school. A weather log book was left at the school, and the teachers and children were encouraged to make daily weather observations. It was explained that the temperature and dewpoint temperature should be closer together on days when fog occurs. Subsequent visits to the school revealed that early morning observations were done regularly. The meteorology students designed several experiments to explain the concepts of condensation, evaporation, and cloud formation to the younger students. And, they created a story called “Lebo the water drop” to explain the water cycle. Lebo would disappear when she is heated by the sun and appear again as she gets colder. The first group of university students visiting Tshanowa JP made a great effort to complete their tasks, and ultimately delivered their presentation with immense enthusiasm. The students and educators at the school appreciated this effort and enthusiasm so much that it created an expectation for future visits.

In the following year (2003), the next community project group named themselves Students Taking Real Action with Water (STRAW). This group excelled with the hard physical labor needed to improve the infrastructure at the school. They secured rain gutters on the corrugated iron roof of the school building and piped the gutters to containers in order to collect rainwater.

The stored rainwater is used to irrigate a garden, which was also established by students in the STRAW community project. Feeding schemes exist at many rural schools in South Africa. The government makes money available to the schools, which in turn ensure that all children receive one cooked meal a day. At Tshanowa JP, the women of the community prepare the food daily. The garden was established to provide vegetables as a healthy supplement to the food provided by the feeding scheme. The presentations to the students in 2003 included instructions for creating temperature and rainfall graphs from the year’s weather observations.

The subsequent visits to the school have largely been to maintain the infrastructure and to continue with the presentations to the school students. In 2007,
FIG. 6. The headmaster of Tshanowa JP and a student from the University of Pretoria discuss the maintenance of the fog collector.

with a generous sponsorship from the South African Weather Service, the University of Pretoria community project erected a fog net at TshivaJha JP, which is also located in the Soupansberg. In an unpublished 2006 manuscript, E. Pretorius identified 93 schools in the Soutpansberg where fog-water collection systems could be established, providing potable water to approximately 29,000 students.

The community project has had significant success at Tshanowa JP. Good interaction exists between the staff from the University of Pretoria and the educators at the school. Students completing the project have established and maintained infrastructure centered on supplying water and food to the schoolchildren over the years, while their presentations have explained meteorological concepts. The young students are continuously made aware of the importance of physical science and mathematics in explaining the physical world around them, and they are encouraged to continue with these subjects.

CONTRIBUTION OF THE EDUCATORS AT TSHANOWA JP. The enthusiasm and involvement of the educators at the school have been major contributing factors to the success of the community project. They have been very helpful during the visits and have been prepared to contribute in numerous ways. The educators often have to translate the presentations into Venda (the local language), because many of the students do not understand English. They provide the necessary structure and discipline to help make the project successful. Good examples of this are the weather observations that are done regularly and the vegetable garden that is now cultivated by the school children. The headmaster created a vegetable-growing competition for the different grades, where the class taking the best care of its part of the garden wins the contest (Fig. 5). The involvement of the University of Pretoria at the school has also allowed the headmaster to obtain funds from the local Department of Education. This money has been used to beautify the school, creating feelings of ownership and pride within students and the community.

MAKING A SUCCESSFUL AND SUSTAINABLE COMMUNITY PROJECT. The community project has visited Tshanowa JP on five occasions during the past seven years. The repeated visits to one school were one of the fundamental necessities in creating a sustainable community project. This allowed for time to create trusting relationships with the educators, students, and the community (Fig. 6). Focusing the community project effort on one school creates a sense of expectation for the school’s students and educators. Although the presentations at the school are meant to be educational, they are usually done in a fun manner with competitions, prizes, and treats for the students (Fig. 7). The expectation of the annual visits also necessitates a sense of responsibility from the educators in ensuring that the garden and other infrastructure are maintained. It is very important that the community takes responsibility for the infrastructure provided, and it was made very clear from the onset that our involvement at Tshanowa JP would only continue as long as the fog-water collection system, rain gutters, and garden are maintained.

Fig. 6. The headmaster of Tshanowa JP and a student from the University of Pretoria discuss the maintenance of the fog collector.

Fig. 7. Balloons are used to explain the sound of thunder. The school students enjoy the presentation tremendously.
As a required subject to obtain the B.S. (meteorology) degree, the community project is presented every year with a new group of students doing the outreach. This helps to ensure the sustainability of the project. However, the fact that new students run the project every year may be considered limiting to its sustainability because they are not familiar with either the school, the infrastructure, or the community. For this reason, meteorology students from previous groups are often consulted for advice and guidance. The new students also must obtain sponsorship on a yearly basis; at times, adequate funds cannot be secured to visit Tshanowa JP. A longer-term sponsorship program would benefit the sustainability of the project.

**STUDENT EXPERIENCES.** While the success of the community project has been detailed above, the personal growth that the meteorology students undergo during the project is one of its real accomplishments. Students who have affluent backgrounds are often amazed to experience the infrastructure and facilities at rural schools. It is a very valuable learning experience for them to understand the real needs and problems associated with education in South Africa, and they generally feel very privileged to have contributed in some way to improve the conditions. Students who are themselves from disadvantaged backgrounds also benefit from the community project because they better understand their responsibility as role models at the completion of the course. At the beginning of the course, the students are overwhelmed by what is expected of them in one semester. The course concludes, however, with a feeling of enormous accomplishment by the second-year meteorology students.

**FINAL WORD.** In 2006 we found the poster presented in Fig. 8 in one of the classrooms at Tshanowa JP. The students were given the task of drawing a picture of their school. This student drew the school with a fog water collection system, a weather camp, and water containers. The community project has been involved with the establishment of this entire infrastructure, and has clearly had an impact on the way that this child viewed his school.

**ACKNOWLEDGMENTS.** The author would like to extend her sincere appreciation to every student who has participated in the community project since 1999. Their dedication and hard work has made a real difference in children’s lives. Appreciation is also extended to Johan van Heerden (retired head of meteorology) who has been contributing to the community project by word and deed since its inception.

**FOR FURTHER READING**


AMS 2008 Public–Private Partnership Forum
(Formerly the Corporate Forum)
University of California—Washington Center
Washington, D.C.
22–23 April 2008

SESSION TOPICS

Congressional Legislation—Authorization Committees
House and Senate staff will provide an outlook on pending legislation and discuss issues associated with programs and initiatives that may provide opportunities for AMS members.

Congressional Legislation—Appropriations Committees
House and Senate staff will provide an outlook on Federal budget appropriations for NASA, NOAA, NIST, and NSF for weather and climate related activities.

Agency Initiatives, Plans, and Opportunities
Senior staff from NOAA, NASA, DHS, and DOE will look ahead and provide updates on current meteorological, climatological, and oceanographic programs and provide insights on new science initiatives and directions.

Responding to Emerging Climate Change Policies
Climate change has resulted in a diverse response by policy makers, industry, and the media. This session will discuss the weather and climate community’s role in developing and implementing new climate services and products aimed at responding and supporting policies such as carbon trading, clean energy, and other climate change risk mitigation strategies.

Establishing Community Priorities—Defining, Prioritizing, and Advocating Effectively
Congress has repeatedly asked the weather and climate enterprise to clearly articulate our needs. In response, the AMS is preparing a statement on priorities. This session will provide an update on progress being made on this critically important topic.

PURPOSE
To provide an opportunity for weather and climate enterprise stakeholders to meet with senior Federal agency officials and Congressional staff to hear about the status of current programs, learn about new initiatives; discuss issues of interest to the enterprise, and identity business opportunities.

WHO SHOULD ATTEND
All AMS Members are encouraged to attend, particularly AMS Corporate Members, private sector executives, federal agency and laboratory managers and scientists, and university faculty.

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SEATING IS LIMITED: Watch for registration details.