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A participatory approach to small community environmental problem assessment: water resource examples in the Caribbean

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Abstract In 1993 the Pan American Health Organization (PAHO), through the Community Oriented Project on the Environment (COPE), worked in two communities in the Caribbean region to remedy water resources problems that presented serious public health risks. In El Conde, Dominican Republic, community members located pollutant sources along with areas susceptible to flooding and devised a street drainage system to solve the problem. In Millbank, Jamaica, residents identified problems with the drinking water distribution system. They received technical assistance and designed a project that included intake redesign, slow sand filtration, drip chlorination, and water supply line repairs. To date, continued funding for COPE project implementation has yet to be obtained. The project so far has shown that the communities can provide a wealth of information that is targeted to their specific problems and that can be useful for other water resources projects.

Un metodo participatorio para asesar problemas ambientales de comunidades pequenas: ejemplos de recursos hidricos en el Caribe

Resumen En 1993 la Organización Panamericana de la Salud (OPS), por medio del Proyecto Comunitario para el Ambiente (COPE), trabajó en dos comunidades en la región del Caribe para remediar los problemas de recursos hidráulicos que presentaron problemas serios para la salud publica. En El Conde, Republica Dominicana, miembros de la comunidad localizaron fuentes de contaminantes con areas susceptibles a inundaciones y diseñaron un sistema de drenaje urbano para solucionar el problema. En Millbank, Jamaica, los vecinos identificaron problemas con el sistema de distribución de agua potable. Recibieron asistencia técnica y diseñaron un proyecto que incluyó el rediseño de la bocatoma, filtración lenta de arena, clorinación por goteo, y el arreglo de las lineas de abastacimiento. Hasta esta fecha, fondos continuados para el proyecto COPE no han sidos obtenidos. Este trabajo ha demostrado que las comunidades pueden recoger valiosa informacion dirigida a resolver sus problemas y que puede ser útil en otros proyectos de recursos hidráulicos.

INTRODUCTION

Many communities that face public health risks from contaminated water supplies or drainage problems also hold the information necessary to remedy those problems. Experience has shown that the best results from water resource projects are obtained when communities participate in planning and running projects with assistance from other sectors (Whyte, 1986). Public health problems with water supplies are often

caused by vector-borne diseases. With respect to vector-borne disease, two interrelated factors determine the occurrence of disease related to water resource development: the vulnerability of the community and the conditions of the local environment (WHO, 1989).

To consider the interaction between community environment and health, the Pan American Health Organization (PAHO) developed the methodological framework of Local Health Systems (SILOS, Sistemas locales de Salud). A SILOS is a community with defined demographic and geographic dimensions, and its collective state of health is a function of its physical and socio-cultural environment (PAHO, 1993a). The condition of the environment can be best managed directly by the people who live in it and have a direct stake in its well being, while drawing support from a larger regional or national framework. In terms of the physical environment, SILOS actions include: (a) increasing understanding about links between economic and social progress and associated changes in lifestyle and environmental quality; and (b) providing technical cooperation at the community level for resolving critical environmental problems to reduce associated health impacts.

To implement the action component of SILOS framework, PAHO, with funds from the United Nations Development Program (UNDP), developed the Community Oriented Project on the Environment (COPE). The short term objective of COPE was to foster cooperation between local, government and nongovernment organizations to show how self-help projects can resolve critical environmental health problems (PAHO, 1993b). In the long term, COPE would promote collective capacity of small communities to develop low-cost environmental action projects through improved understanding and cooperation by national and international agencies and donor groups.

This study focuses on the short-term components of the COPE project in communities in Jamaica and the Dominican Republic. It shows the useful information residing in these communities for identifying environmental problems and it highlights the potential for communities to develop local water resources projects that can reduce health risks. This paper also discusses recommendations for more effective completion of similar projects in the future.

METHODS

The COPE project had three operational phases to achieve its short-term objectives:

- identify communities with environmental problems that represent a potential risk to health, that can be addressed with community action, and which are perceived to be significant by the community;
- develop community-generated projects to address the most important problem with projects that rely on community organization, entail participation, and are locally conceived and implemented; and
- obtain funding for community projects with submission of a comprehensive project proposal to an agency such as the United Nations Development Program.

Communities for the COPE project were identified in 1993 and community projects were developed after conducting an environmental assessment.

Specific communities were selected on the basis of two criteria. First, the community needed strong local organization that had experience in locally organized projects. Second, communities were sought that had serious environmental problems which posed risks to health. The process of community selection was initiated by correspondence between PAHO offices in Washington DC, USA, and national offices in PAHO member countries. Visits to potential sites resulted in selection of COPE project communities.

Environmental problem assessment and community project development was an interactive process based largely on techniques of Participatory Rapid Rural Appraisal (PRRA) (Theis & Grady, 1991). PRRA relies on a variety of techniques to assess problems, plan solutions, implement them, and evaluate needs again. Specific to this project, community environmental problem assessment and project development had four components:

(a) *Initial problem identification* was determined in semi-structured interviews and meetings with community leaders.
(b) *Community profiles* were generated with household surveys of 10–15% of residents (Babbie, 1990), providing a representative overview of education, employment, social factors, health infrastructure, housing conditions, water supply and sanitation in addition to individual perceptions of health concerns and environmental problems.
(c) *Problem prioritization* began with semi-structured interviews, continued with community meeting discussion of health, quality of life and environmental problems, and was finalized with a simple ranking system to prioritize health and environment problems.
(d) *Project formulation* for a community action project was conducted at community meetings and small group meetings to address the highest priority environmental problems which were related to serious health problems with additional information on problems specifics collected in on-site tours and interviews.

RESULTS

Site selection and problem identification

This paper focuses on work in El Conde, on the outskirts of Santo Domingo, Dominican Republic, and Millbank, Jamaica near Port Antonio. These two communities had strong local organization and serious environmental problems potentially affecting public health. Communities were also selected in Brazil, Mexico and Chile. Some communities that were visited had strong organization yet had no serious local environmental problems that posed a risk to health. In these cases, communities with potentially serious environmental health risks but less organization were selected.

Household surveys provided an early profile of the community and gave evidence for links between water resources problems and environmental health (Table 1). In El Conde, the local lead battery factory emissions killed vegetation

Table 1 Selected survey results for El Conde and Millbank (in % of total).

	El Conde	Millbank
Sanitation:		
Toilet without sewer	33	7
Latrine	54	93
Open field	13	-
Drinking water:		
Private faucet	75	57
Shared faucet	21	14
Well	4	-
Lake or river	-	93
Rain	-	7
Major health concern:		
Respiratory problems	45	-
Fever	10	11
Diarrhoea	5	-
Eye problems	5	-
Colds	-	39
Flu	-	14
Major environmental quality concern:		
Battery factory	51	-
Water in streets	21	-
Chicken farm odours	17	-
Contaminated tap water	6	7
Pests in the house	5	-
Garbage in the streets	-	15
Dust and smoke in the air	-	7
None	-	71

downwind of the factory. This was the most important environmental problem to 51% of survey respondents (Table 1). The battery factory was also viewed as a potential health threat with 45% in the survey reporting respiratory problems. Water in the streets was seen as an environmental problem to 21% of respondents, but was not identified as a health risk. In small group meetings with community leaders, flooding was identified as a health threat. This group conclusion was strengthened by the household survey results showing 13% of those surveyed using open fields instead of latrines or toilets for personal sanitation.

In Millbank, 71% of survey respondents identified no environmental quality concerns. Garbage in the streets was identified by 15%. The link between environmental quality and health was strongest for drinking water supplies. Some or all of the time, 93% of those surveyed used river water for drinking and cooking. The presence of garbage in the streets and fields along with predominance (93%) of homemade latrines represented a risk of disease transmission through the water supply.

In Millbank, the community identified the road as the single most pressing quality of life problem. Precipitation in the area ranks among the highest in the world, reaching 8900 mm $year^{-1}$ (M. White, Hydrology Consultants Ltd, Jamaica, personal communication, 1996). The continual rain makes the road to Millbank

impassable frequently throughout the year. Interruptions in the water supply and dirt in the water when it was available represented the second most important problem. With the close ties between health and the water supply as well as the potential for significant improvement through the COPE project, the water supply was chosen for community action.

Specifics of water resource problems and solutions

Detailed information targeted to the street flooding problem in El Conde was gathered from walking tours with the community leaders and interviews with inhabitants of the most affected parts of El Conde. Three pollutant sources were identified that represented important health risks during street flooding. Two of these were from poor sanitation: improperly constructed latrines in the uphill part of El Conde were subject to flooding, and use of open fields instead of any latrine provided a potential source of human waste to flood waters. The third source was a chicken farm in the middle of El Conde which was susceptible to flooding in extreme precipitation events. Two streets and 36 houses were located in areas where flood waters inundated homes. In the lowest elevation area on the edge of El Conde, inhabitants reported up to 20 cm deep flood water within their homes.

The COPE project for El Conde was designed with the locally determined problem specifics and with assistance from the PAHO office in Santo Domingo. A pasture with a small creek on the edge of the community provided an outlet for the street drainage system. A local workshop existed that could fabricate gutter tiles for nine blocks of local streets. Pipe size was calculated using available design specifications (WHO, 1991). Using a 5-year 30-min storm intensity of 60 mm h^{-1}, peak flow was calculated from the rational formula at 1900 l s^{-1}.

$$Q = 2.78C \cdot I \cdot A \qquad (1)$$

where Q is discharge in l s^{-1}, C is the runoff coefficient equal to 0.5 for 5% slope with medium-low soil permeability, I is rainfall intensity equal to 60 mm h^{-1}, and area, A was 23 ha as determined by a simple survey of drainage area in El Conde. For the calculated peak runoff, it was determined that a 48 cm diameter semicircular channel would be sufficient to carry runoff from the drainage outlet at the edge of El Conde to the pasture (WHO, 1991).

The final COPE project proposal for El Conde included an estimated US$43 000 in counterpart support and sought US$25 000 from the COPE project. Counterpart support was from:

- the community in labour for building, installing and maintaining the drainage system(US$25 000);
- the UN food programme in food support for the community labourers (US$10 000); and
- PAHO and the Secretary of Public Health and Social Assistance in technical assistance and epidemiologic study (US$8 000). El Conde also included in the proposal a community watchdog group to monitor battery factory operations in the neighbourhood. COPE support to be requested from UNDP included

US$20 000 in cement and tools for the project, US$2 000 for additional technical support and US$3 000 for administrative costs.

In Millbank, community members with experience working on the water supply provided specifics of the water intake, chlorination and distribution system. Visits to the intake revealed a diversion structure which filled with sand and gravel as frequently as weekly, clogging the intake pipe and disrupting the water supply. Stream flow fluctuates widely; for example, at Alligator Church on the Rio Grande downstream of Millbank, peak discharge for the water year of 77.3 $m^3 s^{-1}$ on 21 May 1992 was preceded by two weeks on 7 May by the year's low flow of 1.0 $m^3 s^{-1}$ (Underground Water Authority, 1990–1995). At the Millbank intake, low flow discharge was estimated to be 0.35 $m^3 s^{-1}$, and less than half of that was entering the diversion structure. The flow-through chlorination system was not being supplied with chlorine and was not functioning. Finally, in walking tours and at group meetings it was determined that gravity feed water supply lines leading to Millbank's public and household faucets were leaking over most of their length.

Meetings with the Local Advisory Council of Millbank produced a project to remedy problems with fresh water supplies for the community. Redesign of the intake and reconstruction using labour by local masons would provide a flow-through design that captured more runoff at low flow. The intake was designed to work in conjunction with a slow sand filter to provide low turbidity water for the distribution system. Because the intake was below the sand filter, it would also be less susceptible to clogging by gravels and sediment. Disinfection was planned using simple drip chlorinators. The most costly phase of the project was installation of new plastic water pipe to avoid future corrosion and leakage. Household connections were planned using local expertise with coordination by the Local Advisory Committee. Finally, to reduce garbage contamination of the river water, the local ranger district planned ongoing activities for community garbage management.

The final project proposal for Millbank included US$34 000 in counterpart support and US$41 000 in COPE project funds. Counterpart support was to be provided by: (a) the community for labour on intake construction, supply line replacement, and household connections (US$26 000); (b) community members in locally provided materials for household connections (US$2000); (c) the Parish Council of Local Governments for design activities (US$2000); (d) the Portland Health Department for project coordination (US$3000); and (e) the Blue and John Crow Mountain National Park for educational outreach (US$1000). COPE project funds requested from UNDP in the final proposal included: US$3000 for technical assistance with slow sand filter design; US$5000 in materials for intake and chlorination components of the system; US$30 000 for PVC pipe, cement and tools; and US$3000 for education and administrative support.

CONCLUSIONS

Further funding has not yet been obtained to implement the COPE projects in Millbank or El Conde. In Millbank, the road is still the highest priority and work

continues on the road. However, the water supply is still sporadic and only now is a drip chlorinator scheduled for installation by the Portland Health Service (T. Braeken, personal communication). In El Conde, the PAHO country engineer has moved, so expertise for drainage construction is not readily available to the community. The community projects were based on funding objectives of US$25 000–50 000 per project as set by initial UNDP funding of the project. With the many of local resources including available labour and specialized skills, the projects in Millbank and El Conde could have been conducted with smaller budgets.

Future projects to remedy environmental problems with community action projects should be designed with low cost phases early in the project so that the projects may continue in the absence of funding. With or without these projects, ongoing study of water resources in the Caribbean and humid tropics could benefit from the information available from community members.

The projects in El Conde and Millbank showed that small communities could identify water resource problems that have impacts on health and could design projects to remedy those problems. Water resources information provided by the communities was targeted directly to the most pressing problems, and the communities shared in their perception of the importance of the problems. In addition to relieving health impacts of environmental problems, the projects showed the important water resource data that can be provided in areas where water supply and sanitation data are lacking.

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