The Many Educational Facets of Development Cooperation Between a Kosovan Village and Earth Scientists

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ABSTRACT

Geology is increasingly involved in the planning and implementation of community development projects throughout the globe. A partnership among the Water For Life organization, Wheaton College in Illinois, and the village of Tushile in Kosovo during the past few years has proven to be successful in potentially sustainable improvements, including water resources, sanitation, and soils use. The initiative also provides a fine example of experiential education. Geology majors serve via high-quality research, interaction with the local people, and construction labor to see projects through to completion. Kosovo is the most recent of the forays for Wheaton College Department of Geology and Environmental Science into the realm of international-development service and research. In part to discover a niche for our distinctive institutional mission, we have become committed to undergraduate education in the developing world. The essence of this vision is a two-way experience to benefit our students as well as the communities they serve. The longer-term commitment to collaborate with charitable organizations in working to improve global life and the environment should become a prime objective for geoscience education. Professors, as mentors, and their students with geology majors gain firsthand experience in professional-level technical projects guided by principles for international development. © *2012 National Association of Geoscience Teachers*. [DOI: 10.5408/10-214.1]

Key words: service-research, Kosovo, community development, institutional partnerships

INTRODUCTION: GEOLOGY AND DEVELOPMENT

It is unfortunate but true that geologists are underappreciated for their role in comprehending and managing the planet's material resources. Biological scientists, social scientists, and engineers typically dominate discussions and practice involving environmental stewardship. Those of us trained broadly to recognize Earth's interdependent systems realize that such geoscience perspectives are necessary for a proper understanding of modern global problems. Signs-of-the-times include great political and economic turmoil caused, in large part, by resource issues, environmental degradation, and natural disasters. At least the world, that is, the global media and governments, now see that the need for clean, abundant freshwater is the single greatest health issue. Even so, organizations commonly without geological knowledge waste great time and funds mislocating water projects. One blatant example of geological success came because of drilling a high-capacity, high–water-quality well in Haiti (Dykstra and Adamson, 2009). A geological consulting firm prefaced drilling with basic, ground-truth geological mapping. They proved the contention, made by local nongovernmental organizations (NGOs), that a particular area of northern Haiti was "dry," was quite wrong. Community development initiatives without adequate geological input are potentially doomed to failure. For many years now, wonderful counterexamples have functioned under the guidance of distinguished geologist B. E. Vijayam in India. Vijayam's NGO creations, including PROGRESS and TENT (Strom, 2009), integrate geological principles into almost every aspect of holistic rural development. Many of the village-level projects under TENT are planned to consider improvements in the context of a unified watershed. Water sources, sanitation, erosion, agriculture, land-use planning, and energy provision are all analyzed and managed as components of a larger, single geological system.

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DEVELOPMENT ETHICS

International development practice is a continuing concern for the materially wealthier, one-third of the world. Motives underlying helping our less-affluent neighbors may or may not be altruistic. Neocolonial attitudes would suggest that, of course we want to avoid great dysfunction in our sources of minerals and bases of political influence. However, less cynical may be our sense of compassion and desire to elevate those people with more primitive lifestyles. All of these, as rationale for development outreach, are flawed. There is yet a better way.

Current best-practices philosophy among NGOs includes realization of reciprocal benefit (Glasbergen et al., 2007; Sumner and Tribe, 2008). This concept positions developing communities with the outside technicians as partners. The symbiotic nature of partnerships provide

mutual, but different, benefits to all participants. Total participation is essential, where no one is without contribution in the development process (see, e.g., *Waterlines*, 27(2), especially, Mulenga, 2008). Ideally, a humanistic, organic foundation is established to seek true sustainability in all development efforts. The partnership paradigm requires (1) moral commitment versus the desire for personal gain; (2) mutual respect and trust, necessitating certain time commitments; (3) adequate training preparation of all development staff; and (4) an ongoing depth of accountability among all participants. The four components are costly with respect to individual investment. It is much easier and more common for projects to be funding driven and relatively shallow with respect to relationships between communities and NGOs. Projects are expected to benefit the local people and environment, but what's in it for the outsiders? If benefit is strictly measured by material gain, then, by that standard, volunteer-based NGOs should be rare, but they are not. Some people may volunteer from a sense of guilt but, thankfully, that motive is dwarfed by a pervasive sense of compassion among most people. We serve because we care. Fundamentally, we who go and serve gain intangibles at the deepest level of our humanity, the "better angels of our nature," as stated by Abraham Lincoln.

Simply going to improve the lot of less-fortunate societies may seem like moral justification for service. However, too often, that is a benevolent misconception. Material prosperity does not ensure peace, joy, or any real sort of health. Yet, these virtues are among the highest goals of life. Even though apparently deficient by modern material standards, many "majority-world" cultures enjoy a measurably greater extent of contentment than that bought or constructed via technology. Services that elevate life above tenuous subsistence, such as potable water supplies, basic sanitation, adequate nutrition, safety from natural hazards, and opportunities for meaningful employment, however defined, should be the primary goal for development outreach programs. The outside partners can essentially contribute two things—material wealth (in the form of finances, supplies, and equipment) and professional expertise, the value of technical training. In return, the outside partners also have much to gain from these development associations. Among the possible benefits outsiders might find are cuisines, music and visual arts, and, above all, opportunities to observe and experience deep human relationships. As modern lifestyles tend to become more emotionally stressed and sterile, the simpler, more-humane patterns can be seen as gifts. Travel to exotic places with fascinating natural attributes is also an asset for geologists. The intangibles are significant. Consider these experiential benefits in addition to students' learning through various stages of problem-solving (initial assessment, data collection via natural- and social-science protocols, project-implementation planning, implementation, and finally, follow-up evaluation).

Outside assistance, of course, becomes essential during major disasters. The working paradigm then is for emergency relief and not longer-term development. Unlike medical workers and cleanup laborers, geologists are not much needed in most relief emergencies. As in the recent case of the Haitian earthquake, too many well-intentioned, but unnecessary, outsiders only got in the way of those bringing immediate help. Careful planning of development projects includes seeking the best time for implementation, without the urgency required for disaster relief.

Training of trainers (TOT) is another aspect of best practices for the development-professional community (Srinivasan, 1990). The theory is simple, and it works in practice. It takes the old proverb, "Give a man a fish and he eats for a day. Teach a man to fish and you feed him for a lifetime," and extends it one great step further: Teach a man to teach fishing to other men, and no one should go hungry. As realistically applied, agencies don't do development work for others, they train the others to do it and how to show still others the methods. This is a progressive transmission of valuable knowledge. We, as development professionals, must learn how to train in ways that are transferrable. If language is a barrier, we require talented translators as colleagues in the work. There are certainly technicalities of our geological expertise too complicated for easy communication, but much of what we do can be taught and learned through demonstration. The Kosovo project involves this educational component, directed toward our partners, as well as toward the education of our own geology students.

DEVELOPMENT: BIG D AND LITTLE D [Small Is Beautiful]

Judged by the number of personnel and material resources, the multitude of development NGOs can be divided into either major entities or much-humbler enterprises. The Kosovan partnership is a model in the smaller category. For at least two reasons, smaller can prove to be a more-effective strategy. It is more efficient to operate with less bureaucracy and closer accountability. When less financially driven, organizations may also operate "under the radar" of intense governmental scrutiny. For Kosovo, in particular, working at the village level brings us close to our local partners, without a lot of red-tape complications. The literature on international development describes many cases involving large organizations wasting huge amounts of financial and other resources. A typical scenario involves big NGOs in conjunction with major global funding, and government agencies spending millions of dollars for unsustainable, inefficient, and ethically corrupt projects (Easterly, 2006). Our experience at the more-grassroots level indicates the potential for an excellent return on the investment of time and quite-limited material resources. As explained below, the involvement of undergraduate students is a key component in the effectiveness of smaller, more-focused efforts. If donors to charitable causes could actually see the difference, perhaps funding to carry out smaller projects would allow many more to occur.

Bringing geological expertise to bear on the diversity of development problems should be a global priority. Unfortunately, professional organizations fostering such outreach have, themselves, not been very sustainable. Geology as profession is generally conceived in terms of resource exploitation and profit motivation. Efforts to serve without selfish motives are relatively rare, especially in relation to the altruistic "[fill in the blank] Without Borders" NGOs formed for physicians and engineers. The most recent geological attempt at this outreach is indeed termed *Geologists Without Borders*, formed primarily by geophysicists with support from Schlumberger (Houston, TX). We can hope this initiative grows to successfully increase the service involvement of a

broader group of geoscientists. Its predecessors, Association of Geoscientists for International Development and Geologos del Mundo, continue to exist, but because of extremely scarce financial support, these good organizations operate without much hope for expansion. The scale of the efforts contrasts with the magnitude of need all over the Earth.

INTENSIVE LEARNING AND SERVING

Smaller-scale projects are ideal for the exchange of knowledge between locals and the NGO team. In the case of the Water For Life (WFL, Kailua Kona, HI), the Wheaton (Wheaton, IL) team and geoscience undergraduate majors became highly involved in many aspects of education. Thus far, students from Wheaton College and Colorado State University (Fort Collins, CO) completed eight research-internships in Kosovo (Greenberg, 2009; Greenberg et al., 2010; Greenberg, 2011a; Yates et al., 2011). All of the physical types of labor, including data collection and construction, have occurred in Tushile Village, Kosovo. Interviews with government and other agencies took place about 45 km from the village in the capitol of Pristina, Kosovo (Fig. 1). The WFL staff and Wheaton faculty supervised student team members. These young people were selected for participation by their academic, social, and motivational potential. Their actual coursework preparation was limited to six or fewer geology classes. However, after many hours of technical and cultural preparation, the students essentially carried out all onsite facets of the project. The accomplishments by the geoscience students have been impressive. The broader significance of their great success is discussed below and summarized in Fig. 2.

Specific educational benefits the students accrue can only be estimated. This is because many gains are truly intangible. Among those academic, applied, and character acquisitions recognized are the following:

- A concentrated engagement with a very different culture in individual relationships as well as the institutional level;
- The study and practice of development philosophy (careful planning, accountability, project management, relationship building, and maintenance);
- The addition and practice of specific technical and scientific skills;
- An experience in conducting open-ended, multivariate investigations with all the ambiguities involved;
- The joys, difficulties, and necessities of working in cooperation with an international team and partners (including learning how to negotiate and compromise);
- Mentorship relationships with experienced professionals;
- The complete sequencing of project stages from planning, through data collection and research, to data interpretation, and finally, to project implementation;
- The ability to take knowledge and share it with partners, so that they, too, may be able to transmit expertise to others (the TOT philosophy);
- The gains in new knowledge specifically associated with the features of a particular case study (geological characteristics and history, as well as other natural features and human history);
- Publication of the development experience through internal reports, professional talks, posters, and articles.

It must be added that the other team members involved in leadership receive many of the same benefits, with the addition of the satisfaction of participating in the growth of young colleagues. As mentioned above, all team participants ought to be edified by the emotional-spiritual (moral) devotion to an effort done for human and environmental needs beyond our own.

THREE YEARS IN TUSHILE

The village of Tushile, in the Skenderaj Municipality, is a tiny microcosm of the land of Kosovo. A very abbreviated history of one of the newest nation on Earth begins with an ironic observation. Few areas of this world have a more-complex history. That complexity includes a surprising diversity of geological terranes as well as human activities. The currently dominant Kosovan culture is ethnically Albanian, defining about 90% of the population, in a total area of 11,000 km^2 (a little larger than the Big Island of Hawaii; Fig. 1). Before the 2008 declaration of independence, Kosovo was a disputed land, with ongoing battles between the Albanian majority and the Serbian-dominated government. Still earlier, the land was under communist Yugoslav authority, temporarily unifying regions with Muslim, Roman Catholic, and Greek Orthodox heritage (Malcom, 2002). Conflicts of religion, language, folk culture, and politics have been common in this region for many centuries.

The present societal and environmental conditions in Tushile are fairly typical of those for the nation. There are no functioning water-treatment facilities, and the only such facility (built by the European Union in 2004) never began operations. Even though the region receives abundant precipitation each year, virtually all streams are badly contaminated, particularly by wastes from people and domestic animals. There is a stream that flows entirely through Tushile's resident valley of slightly more than 100 households and about 650 total inhabitants. It is the recipient of great amounts of solid waste and sewage piped directly from households [Figs. 3(a) and 3(b)]. Most household water is supplied from hand-dug, open wells, averaging about 9 m deep. In winter and at other times of decreased precipitation, water is collected for household use from the stream. Toilet facilities vary from outhouses and indoor pits to the buried troughs that pipe the sewage to the stream. Each household includes animals, from a few chickens and dogs to several cows, hogs, small sheep herds, and goats. Most animals are housed in close proximity to houses and wells. In contrast to the degraded conditions around homes and in the stream, the surrounding hillsides are generally well wooded. Kosovo overall contains a nice variety of plants and animals, likely preserved by the many years it was "underdeveloped." The ecological state is relatively healthy compared with most of Europe (Ackermann, 1997).

Water For Life, in association with Wheaton College, was invited into Tushile by an expatriate couple and their friends in the village. Tushile was one of the subjects of a

FIGURE 1: Map of Kosovo (modified from a map by the United Nations Department of Field Support, Cartographic Section).

STAGE	PRELIM. 2008	ONE, Summer 2009	TWO, Summer 2010	THREE, Summer 2011	2012-
OBJECTIVES	Establish relationships, Recruit local students, Form local water committee	Community mapping, GIS mapping, Household survey, Stream study, Trash audit,	Water chemistry, Soils study, Stream analysis, Well rehab, Cistern design	Well rehab, Recycling study, Planning future direction	Stream cleanup, Village seminars (training), School surveys (?)
METHODS	Government and village meetings, Tour the area	Sketches, ArcGIS & Quantum GIS, Stream-flow meter, HH survey instrument	YSL multimeter, Soil probe, *E. Coli* tests, Perc tests, Stream-flow meter, Fabrication	Fabrication, Interviews, Retesting	Microbe study, Village and school event, Geosurvey of schools
PERSONNEL	WFL and Wheaton College staff, Kosovar staff	Staff plus two Wheaton Geology majors and one local college student	Staff plus four Wheaton students, one Colorado State Univ. and two local students	Staff plus one Wheaton Geology student and two local students	Staff plus students from Wheaton College and Kosova
GAINED (student gains underlined)	Relationships, Initial project plans	Basic planning data, Planning expertise, GIS facility, mapping skills, Statistical methods, Surface-water monitoring	Improved water quality and quantity, Geochem analyses, Soils testing, Design and building low-tech utilities, Cultural and relational benefits	Improved water quality and quantity, Helping train others, Work with public officials, Build low-tech utilities	Restore stream health, Train trainers (TOT), Help Schools, Stream Ecology, Basic geological surveys

FIGURE 2: Timeline grid for each season and stage of the Kosovan engagement.

documentary on the lack of adequate water supplies in smaller Kosovan communities. Outside assistance was solicited to help rectify the situation. In 2008, two Wheaton professors accompanied the WFL project coordinator on a trip to assess the potential for involvement. The newly formed team decided to undertake a longer-term relationship with the local people to improve the Tushile life situation and environment holistically. Work was planned in at least three stages, dependent on minimal financial and personnel requirements. The team also needed a firm agreement with the village specifying all aspects of a partnership. In this first encounter, the objective was to bring the community's men together to choose a five-person Water Committee (even though it would oversee more than just water projects). All details of the cooperation needed ratification by both the outside team and the local committee, representing the entire village. This was a big change for a village that had seldom known the linked freedoms and responsibilities of self-governance.

The development team planned the stages of the Tushile project to begin in spring 2009. The first stage continued the effort to build friendly, trusting relationships between community members and the development team. More was accomplished than anticipated while sitting on floors or the ground, drinking strong Turkish coffee. This was a critical time in problem analysis. Stage one, therefore, involved data collection and research. Two geology majors from Wheaton College were trained to perform several key research tasks. Before leaving for Kosovo, the students met with J.K.G. once a week for 1–2 h during the spring

FIGURE 3: (a) Trash hanging in brush along the stream. (b) Sewage piped directly into the stream from a house. (c) A.E. and K.A. collecting stream data.

semester. The meetings served as mentoring sessions, covering discussions of pertinent reading, demonstrations of data-collection skills, consideration of the many personal issues anticipated to arise on site, and strategies about the students' roles as the team's agents. The particular components of the research were compiled and studied to direct the implementation process for the development improvements. Every action had to comply with three principles: that the project work would be supported by strong science, that everything would be done in cooperation with the village leadership, and that everything would be designed with low-technology and for relatively long-term sustainability.

THE "REAL DEAL" OF RESEARCH-BASED PROBLEM-SOLVING

Project planning required data collection, including several categories of valuable information. Most of that information was collected during 2009, except for water and soil sampling and associated testing, which was done in parallel with the first development of construction jobs (stage two).

Community Self-Mapping Exercise

The Water Committee and several others in the village were given large paper sections and pens so that they could sketch out details of their environment. The results ranged from very child-like and primitive to relatively accurate and sophisticated (Fig. 4). This exercise is commonly done, not to gain technical information but to get a better idea of the community's self-perception (Glockner, 2004). The social psychology involved serves to show outsiders both the subtle and more-obvious relationships in the community dynamics. For example, where property rights are not well defined, are there potential conflicts between families over development decisions? Discussing the variations produced in the maps was quite educational for both the development team and the residents.

Mapping and Foundational Attributes

Student researchers, P.B. and F.W. established a comprehensive geographic information system (GIS) framework for all data. The attributes for each spatial "station" (homes, stream, springs, fields, roads, etc.) were stored and made available for processing. Some three-dimensional drafts of the preliminary GIS map (Fig. 5) were helpful in estimating slope aspects and regions susceptible to hillside erosion. The GIS program technologies used were both from industry-standard ESRI (Redlands, CA) products and the freeware Quantum GIS (http://www.qgis.org/en.html).

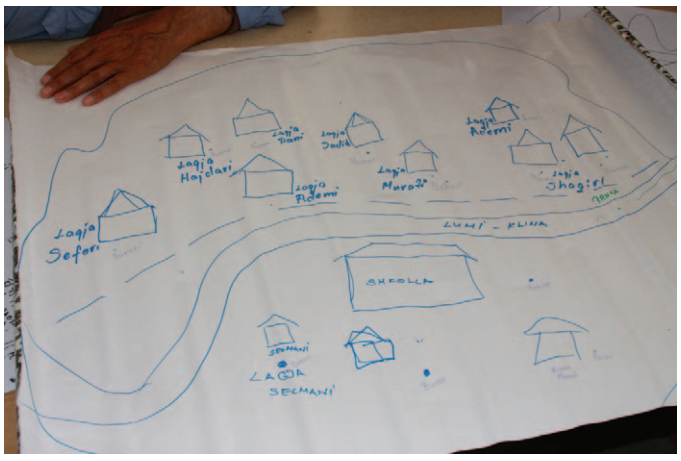

FIGURE 4: Example of a community map.

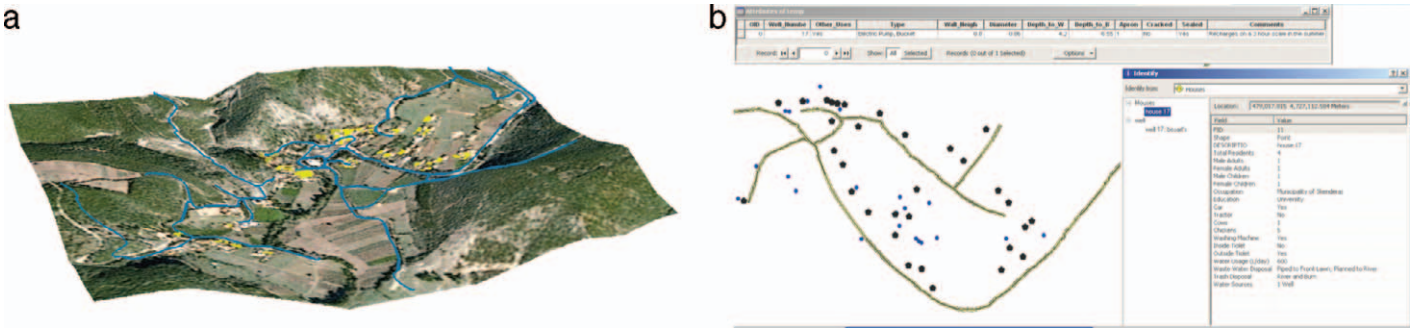

FIGURE 5: GIS three-dimensional view and household base with an example of an attribute table.

Geological Field Investigations

The same students performed a geological survey of the entire village area, recording structural, petrologic, and surface hydrological data. The information provided significant clues about the availability and dynamics of water in the region. Because groundwater movement in the area was directed by a folded and fractured turbidite strata (Fig. 6), simply drilling a community well would not prove a solution to the water-supply problem. Thick (0.5–1.5 m) beds of hard greywacke makes drilling expensive, and the variation in bedding-plane attitudes indicates that locating fracture-facilitated springs would be difficult.

Household Survey Instrument

Best practices in community development now include comprehensive (although not necessarily sufficient) input from the social-sciences. Outside teams must work to learn the hearts and minds of their partners within the community. A worst-case scenario is the old and, sadly, still extant, habit of development experts making unilateral decisions with inadequate knowledge. Nothing promises a non-sustainable result like naïve or arrogant ignorance of local, human realities. What are the real needs? The students spent hours interviewing household residents to find out.

The Wheaton College geology department prepared a survey instrument (Fig. 7), which solicits a wealth of data available only through interviews. The WFL translator, A.H., a Kosovan undergraduate from a nearby village, was invaluable in facilitating the interviews. In 2009, the surveys were conducted with household men because the interviewers were male. In 2010, female students greatly extended our knowledge with the addition of responses from the village women. The ethnic and cultural mores in the village required that most interactions be gender specific.

Data on the existing wells were added to the interviews for each household. The researchers recorded the well location, diameter, depth to water, total completed depth, and physical condition. Eventually, the well data will be incorporated into the GIS and help establish a qualitative groundwater net.

FIGURE 6: Tilted sequence of turbidite shales and greywackes.

Stream and Solid-Waste Characterization

Initial analyses of stream flow and morphology, along with an audit of the trash in the stream (types, volumes, etc.) were the final studies performed by the two researchers in 2009. They measured streamflow at three stations during 2 mo, mapped the basic shape of the stream channel from upstream to downstream of the village boundaries, and mapped the flood plain. Trash, especially the ubiquitous plastic bags lodged in vegetation, helped define the height of flood stage [Fig. 3(a)]. Overall, the trash study will help in cleanup operations, with or without recycling.

STAGE TWO

Water Chemistry

No analyses of water were attempted until the summer of 2010. Five undergraduate team members were added in 2010, including one longer-term intern serving with Wheaton College's Human Need and Global Resources (HNGR) program. Technicians from the Kosovo Institute of Public Health (IPH) had previously completed analyses of the Tushile wells. Those results were similar to results on national scale; the data indicated severe contamination of the wells with fecal coliform bacteria. Levels of related chemical species, such as nitrates, ammonium, chlorides, and sulfates, were found at levels that far exceeded any health standards. The HNGR intern, A.E., and her colleague, K.A., were trained to use an ion-specific multimeter with a cable long enough to reach the bottoms of all wells. A regular sampling protocol measured data for nitrate, ammonium, dissolved oxygen, temperature, and conductivity in all wells, in addition to the data for the stream stations. Bacteria counts were completed for some of the wells, the stream, and a large, streamside cistern. All results conformed

HOUSEHOLD SURVEY (Water-For-Life, Wheaton College and Tushile):

1) Location (GPS and described/mapped)
2) General description (# rooms, exterior size, construction type, condition, etc.)
3) Land description (slope, basic rock/soil, drainage, area, uses, etc.)
4) Inhabitants:

- Number, ages, sex, relationships, names, education, employ?, skills
- Family stories?
- Income, expenses (self produced vs. purchased needs/wants)
- Illnesses

5) Sanitation (how, where, condition and proximity to water source, gray water?)
6) Water source (how, where, more details below)

- Volume available/used
- Quality from tests*?
- Regular uses, seasonal variation
- Drainage other than sanitary
- Irrigation, where and volumes
- WELLS (full description of location, construction, water depth, collection methods, available volume per set time and recovery rate)
- Other water sources (pipes, hoses, etc. from where? storage containers and extraction pumps, from stream or spring?)
- WATER needed/desired beyond available? EXPECTATIONS?

7) Solid waste/trash types, amounts and fates
8) Other buildings, vehicles
9) Fuels and other chemicals (agricultural?), storage and fates
10) Electrical service
11) Animals (locations, types, numbers, wastes on site and disposal?)
12) Gardens (locations, descriptions including plants and treatments)
13) Trees/shrubs (locations, types)
14) OTHER:_____,_____,_____,etc.

15) Notes on relationships with the team, including villagers advice, knowledge, wisdom!! TAKE PICTURES, MAKE SKETCHES OF EVERYTHING!!!!

NOTE THAT VARIOUS BITS OF THE DATA MAY BE PERSONALLY AND CULTURALLY SENSITIVE. COMPLETE DATA MAY ONLY COME AS RELATIONSHIPS OF TRUST AND RESPECT DEVELOP.
The above categories are in present form (April 5, 2009). Final form ought to be crafted on an MS Access template or some equivalent for efficient data collection, manipulation, interpretation and storage.

FIGURE 7: Household survey instrument.

to those from the IPH for Tushile; that is, they indicated unsafe levels of contamination.

A.E. continued chemical data collection in addition to monitoring precipitation patterns and its relationship to streamflow over 6 mo time. Her work was greatly supported when she gained a translator-assistant from the village, K.A., also a student at Pristina University. K.A. is being trained to do much of what A.E. has done during her data collection [Fig. 3(c)]. K.A. and A.H. joined the team with many evenings of project debriefing. These two are being prepared by the TOT process to multiply the educational benefits of partnership with others in Kosovo.

Soils and Sanitation

The poor sanitation in Tushile (considered the cause of the poor water quality, until proven otherwise) is a major issue for a sustainable future. Team members began simple soil testing in 2008 and 2009, but more focus was given to the possibility of establishing septic systems with testing in 2010. Initial plans required the elimination of the sewage drains into the stream. Two alternative models were evaluated during the soils study: Either small, household systems could properly manage sewerage or larger systems could be constructed to accommodate clusters of adjacent houses. The GIS map was helpful in finding larger areas

FIGURE 8: (a) Large, ferroconcrete cistern. (b) Trenching work for burial of the well and sewage pipes.

potentially suitable as leach fields. Simple percolation tests and soil-depth and texture estimates were made to measure the soil's effectiveness for filtration. Preliminary interpretations of the data suggest many complications, and more planning is needed before decisions can be made.

The increased student participation and a modest working budget allowed the 2010 team to initiate projects for six households while data collection for the first stage continued. The entire team, including students and the Water Committee partners, decided on priority households. Two homes on a high hillside received large catchment-storage cisterns [Fig. 8(a)] because they were too far above groundwater levels to obtain adequate well infiltration. Two households headed by widows were also chosen as priority projects. In these cases [Fig. 8(b)], the wells were relatively near the stream with the potential of adequate groundwater resources. Our labor during these priorities was to (1) repair the well structure to eliminate surface contamination from open tops and cracked concrete pads, (2) install inexpensive electric pumps to eliminate rope and bucket collection, and (3) install 1,000-L, plastic tanks under roofs for immediate storage capacity. At one of the houses, a toilet drainage line was installed into an adjacent field. Each household that benefited from the improvements was responsible for contributing some labor and 10% of the supply costs if that household could afford it. The community voted to have those with more financial resources help cover the costs of others with less. Pristina University and Wheaton College students acted as supervisors during construction of the six water projects. The general goal of sustainability in all improvements was satisfied in each case.

THE THIRD STAGE AND BEYOND

In one sense, the Kosovo development strategy has no foreseeable end. That is, it is hoped that what begins in Tushile, which will probably be completed after 4 y total project involvement, will spread across the country. The vision for Tushile could become multiplied with the aid of the TOT process. Our students, in sharing their skills with the local population (especially university students), will, ideally, enable Kosovans to plan and implement their own environmental projects at the village level. A more-official initiative to train trainers commenced in summer 2011. This is one critical aspect of the final stage in the total program. More specifically, stage three includes increased training, directed by our students and translated by the Kosovan students, for selected individuals, primarily from Tushile.

The educational emphasis will hopefully extend to more village activity after 2012. Research on the stream and trash conditions could guide a cleanup campaign, again coordinated by student team members. The model for a similar community campaign was drawn from projects in Jeffreys Bay, South Africa, in 2005 (Greenberg et al., 2007): A particular day is established as a celebration (for a healthier village). Children and adults gather at the local school for a sort of pep-rally, where basic instructions are given. Nicely crafted visuals are used to show why the clean stream is a healthy stream. Then the children are divided into teams, each with a certain color T-shirt (gifts). Protective gloves and trash-collection bags are issued. One or more adults accompany the teams during a friendly competition to collect the most trash. After several hours, a free lunch and a final gathering, prizes are awarded to all teams for a job well done. The South African experience proved to be a fantastic success. Adults learned as the children were instructed in such an important exercise. Community pride was established or enhanced. It is hoped that a new stigma might be attached to the practice of tossing trash into the creek and other common areas. A before-and-after study of stream microecology may be conducted if we can find a scientific advisor for that purpose. The final destination for trash represented another problem for the team to consider in stage three. Kosovo currently has little or no functioning recycling programs for most solid waste materials (Kawada, 2009; Ramadani et al., 2010). An observation of the countryside and all streams is that trash is ubiquitous in large volumes. Kosovo's high unemployment rate begs for innovative job creation. A study of a potential recycling enterprise could help solve two desperate problems. Preliminary analysis by Yates (Yates et al., 2011) indicates some real hope in the possibility of such a project, but there

are many political, cultural, and economic hurdles before sustainable programs can occur.

Training seminars and stream rehabilitation are projected as Tushile's final challenges for the team. The leaders envision the continuation and perhaps completion of all household improvements to take through 2012. The timetable greatly depends on donations from friends, churches, and charitable foundations to provide the needed supplies. The future support of municipal officials and other influential people may be needed in addition to the desire of the villages to take part in the development. Fortunately, the program requires few financial resources beyond those necessary for supplies, so few funds are transported into Kosovo. This austerity ought to keep the WFL–Wheaton College program relatively safe from corrupt politics and administrative red tape.

Throughout Kosovo, water and sanitation improvements are needed. It is unlikely that enough effective actions will take place to change that state. Unfortunately, smaller communities, with a populace used to its contaminated water, have grown somewhat immune to its hazards. Even so, a waterborne disease epidemic could break out at any time. We have found that convincing people to seek clean water supplies, not just abundant water, is a rather difficult part of the needed education.

CONCLUSIONS

International service and outreach is not one of the activities commonly associated with geoscience, a situation that should and can be rectified. In particular, larger, resource-wealthy organizations ought to be more engaged in sharing their advantages with the lands and people that made them wealthy. Our work in Kosovo and other such global endeavors show that "small is beautiful" (from the title of Schumacher, 1989). Smaller, modest teams of professionals and students are more than capable of helping local communities through development partnerships. Overhead capital is minimized, and measurable, beneficial outcomes are readily apparent. However, even humble projects require adequate funding to be effective. Small-d development is not (yet) popular and finds few potential financial backers. Instead, large government and charitable NGOs continue to attract larger finances, often without justifying the investments with proven results.

We hope to make a strong case for holistic development done with geology at its core and with educational exchange as its primary methodology. Our experience now indicates that the participation of undergraduate geology majors has great value for many reasons. First, the students are available at small expense. When chosen carefully, such students are devoted, hard workers with a powerful, moral motivation to change the world for good. The students are surprisingly easy to train and prepare for real research and cooperative project labor. At the Geological Society of America (GSA) annual meeting in 2008, an industry–academia forum discussed and lamented the lack of enough talented students to replace retiring professional geoscientists. Faculty from Wheaton College and other 4-y, liberal arts, geology programs commented that industry is greatly to blame for the lack of younger leadership. Industry virtually ignores relationships to cultivate undergraduate geologists. One executive officer from a petroleum company defended its policy of only providing scholarships for graduate students. The counterargument was asserted that the important time to support students begins before graduate school. The difference between an upper-class undergraduate and a new master's student is trivial. The geoscience profession loses gifted recruits to other disciplines. We need better ways to attract and keep talent. Industry support would be a fine boost to the limited number of National Science Foundation Research Experience for Undergraduates (REU) opportunities each year. More specifically, funds invested in global development projects to employ undergraduate geologists would pay great dividends. New initiatives by the GSA (via the Geology and Society Division) and the American Geoscience Institute (the YES Network) offer the ability to expand the influence of geoscience toward more-global outreach (Greenberg, 2011b). We can hope that these organizations will include the role of undergraduate students and their faculty mentors.

Distinctive themes in the Kosovo partnership include relationship building with reciprocal benefits. There is no better way to effectively advance human and natural conditions than a one-on-one, grassroots project. Sustainability of such projects is an important goal. The TOT philosophy makes longer-term benefits more likely than do other NGO development practices. In our case, both our own students and those from Kosovo received the best education onsite. We have no doubts that this partnership model can work elsewhere, for other institutions and in other nations, with satisfactory results.

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