

# Science for Nicaragua Newsletter

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Fall 1988

## SfN Renewed for Two More Years!



*SfN and friends in Managua, August 1988. From left to right: Tim Brown, Elisa Cortés, Tom Jackson, Linda Lemke, Roberto Trippini, Barbara Kritt (an SfN instructor in 1986, now a Fulbright scholar), Alan Archibald, Robert Fox, David Kattenburg.*

by Michael Harris

I returned to Nicaragua this August, for the first time since the program began in 1986, in order to sign a two year renewal of our official agreement with the Ministry of Education. After being subjected to 30 months of news reports about the disintegration of Nicaragua's economy, and although I should have known better, I was unprepared for the optimism and energy I encountered among my colleagues, Nicaraguans and foreigners alike.

After seven years of war, the universities continue to grow, to generate new projects, to experiment. A new university, a new research center, new buildings, new departments, new publications have come into being during those 30 months. Most of the projects described in this issue were just getting started during my last visit. The resources come mainly from abroad, but the ideas are home-grown. There continue to be more ideas than resources, making projects like SfN all the more vital. The Nicaraguans have asked us to expand our work in a number of new directions, some of which are described in the following pages.

This special issue of the newsletter is dedicated to Nicaragua's optimism and visions of the future.

### Who We Are This Fall

**Alan Archibald** studied parasitology at the University of Liverpool School of Tropical Medicine. He arrived in August and is giving seminars as part of the parasitology course at the Medical School of the UNAN-Managua\*, working in the parasitology laboratories, and teaching English in his department.

**Timothy Brown**, a graduate student in mathematics, on leave from the University of Alabama at Huntsville, has been teaching at UNAN-Managua since August 1987. He has taught a number of advanced courses in analysis, and is currently teaching the bulk of the courses for the fourth year mathematics majors. He is also advising the "monographs," or undergraduate theses, of the two fifth year mathematics majors. (Undergraduate education in Nicaragua lasts five years.)

**Robert Fox**, a recent Harvard graduate in sociology, has been coordinating the Technical English program at the UNI\* since March 1988. The program serves an average of 120 students, including professors and administrators at UNI who need English to communicate with foreign colleagues, and the entire first-year class in computer science.

**Thomas Jackson**, a hydrologist, was working as an environmental engineer in Baltimore before joining SfN in 1987. He is currently teaching courses in the UNI's civil engineering department and graduate program in Environmental Engineering. This year he has taught courses in Hydraulic Structures, Sanitary and Storm Sewers, and Water Supply and Sewage Disposal. He also gave a six-hour short course in September for professors, as part of a Symposium on Sediment Transport and Fluvial Hydraulics, and has been advising student monographs.

**David Kattenburg**, a biochemical pharmacologist, has been teaching courses in Molecular Pharmacology and Molecular Genetics in the UNAN-Managua Medical School since his arrival in July. The audience for his courses is a group of 10-15 instructors at the Medical School.

**Linda Lemke**, a German-born computer science student at Berkeley, spent August and September 1988 teaching Technical English at UNI, under the supervision of Robert Fox.

**Roberto Trippini**, an Italian national who recently obtained his Ph.D in Philosophy of Science at Boston University, began teaching at the UNAN-Managua in March 1988. He is giving courses in history and philosophy of science in the UNAN-Managua Physics Department, and courses in history of mathematics in the Mathematics Department.

### \*Glossary:

*UNAN: National Autonomous University of Nicaragua. Two universities have this name: one in Managua, the other in León.*

*UNI: National Engineering University (Managua)*

*UCA: Central American University (Managua)*

*ISCA: Higher Institute of Agricultural Sciences (Managua)*

## Robert Fox

*Robert Fox, a recent Harvard sociology graduate, is spending this year coordinating the UNI's technical English program. This description of his work, and of conditions at the UNI, is extracted from a letter he wrote last spring to his friends in the U.S. Rob will be returning to the States in December, but the UNI will still need English teachers. Please let us know soon if you are interested.*

I am teaching a pretty demanding load and really enjoying it so far. At the UNI there is a real shortage of English professors. They have a cooperative relationship with a Swedish engineering university, so many of the professors and advanced level students have gone or will be going there, where they will be expected to function in English. Many other foreigners also come and give seminars and such (mostly West Germans and Swiss—few Soviets, Cubans, etc.) and these are usually in English as well. And many of the engineering texts used are in English. A lot of people want to understand and be understood during meetings and things in their respective fields. So there are direct applications for my work, which is nice.

I have four classes per day that have mostly professors and advanced students in them: two beginning classes, an intermediate one, and an advanced group. Here, most of the professors have received only undergraduate degrees in engineering, and are therefore around my age or a little older—usually from about 22 to 26. In these classes I also have several of the directors of the UNI, including the President and the three vice-presidents, a fact which gives me access to different perspectives about things than just those of the students or professors.

I also have somehow been put in charge of organizing a class of 115 first-year computer science students, which has meant rounding up more professors from the internationalist community on short notice and gathering together course materials from scratch, essentially. These "freshmen" are from 17-20 years old, generally, and must learn to read English by their 3rd year, when nearly all of their computer science texts will be in English. If they don't learn now during their one and only year of English, they won't be able to keep up when they need to read for their other work. In this class, as in all the others, we have had to try to teach entirely without books or handouts or really anything for the students, which has been an interesting challenge—teaching people to read without anything to read! In the computer science course, we have partially remedied this situation by managing to set up a system by which we can mimeograph a collection of course materials that we got from a British guy who has written a 150-200 page program to teach computer reading (perfect for our needs). Thanks to some generous support from interested "cooperantes" back home (you know who you are!), I am planning to give this material to all of the students in the six computer science class groups. It is fortunate that I am able to do this because the UNI would be unable to afford the copying costs (into the hundreds of dollars), and either the students themselves would have to buy the stuff or we would be unable to use it.

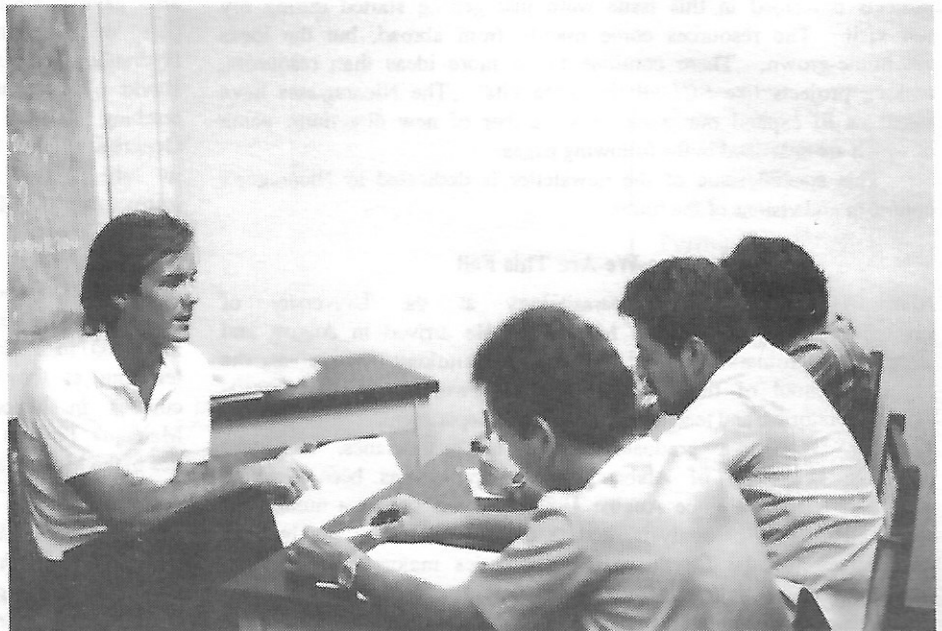
For the other four classes, I have concentrated almost entirely on oral exercises, partly due to the lack of texts and partly due to my newly-found belief in oral expression as the best way to learn to speak a language, even from the beginning. However, again thanks to the above-mentioned compañeros, we are using some

texts I brought with me from San José [Costa Rica, Ed.]—both for the students themselves to use in class and for me as a source of exercises and grammar. Photocopying is difficult because of a lack of toner, paper, spare parts, etc., which makes any usable number of copies prohibitively expensive these days. (Thank you, U.S. blockade.) The teaching has therefore really been quite demanding for me, with each class being about an hour long. I usually spend at least an hour and a half total per day preparing the lessons (or at least worrying about them), and they seem to be getting better and more coherent as I gain more experience. A woman from the US who works here training Nicaraguans to teach English has sat in on a couple of my classes and then met with me, giving me more than a few much needed suggestions. But one of the main things seems to be just the ability to remain energetic and animated during your fifth hour of class in the 100% humidity.

Being a Professor with a capital P is a bit strange to me, honestly. I receive a status here that seems undeserved and that I never would in the U.S., with my background. Department heads treat me as a peer, the university directors accept me as a "professional," the students all reflexively call me "Professor." I've now spent a couple of long afternoons drinking rum with the President of the university and some of his friends—which, of course, is something I did regularly when I was a student.

The general environment of the university is inspirational as well. Since the revolution, education has been a top priority, and they do their best to educate many, many people on unjustly few resources. Over 1 million Nicaraguans are students right now, about a third of the population—surely some sort of record. At UNI there are classes from 7:30 in the morning until 8 or 9 P.M., so as to make maximum use of classroom space. An enormous number of people work full time and go to school full time from 5 P.M. onward—the ones lucky enough to get decent transportation stumble home exhausted each night at 10:00 or 11:00. In the computer science division, they are teaching upwards of 1000 students on about 30 donated PCs that aren't compatible, the time slots filled 18 hours a day, every day. Several students share a computer at one time. I often wonder whether I would have been able to confront such difficulties in my own education. Before the revolution, fewer than 500 students studied engineering in the whole country, only those who could afford the tuition. Now they teach more than 5000 just at UNI, all for free.

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*Robert Fox (left) at the UNI. The class consists of professors and administrators.*



# Reports from the Universities

During my three weeks in Nicaragua, I met with professors, administrators, and students at each of the five universities. What follows here and on pages 8 and 9 is a representative sampling of these interviews, one from each university.

## ISCA (Instituto Superior de Ciencias Agropecuarias)

I spoke with Rene Romero, the Academic Vice-Rector of the ISCA. Our only previous contacts with the ISCA took place in 1986, when two SfN instructors looked into the possibility of working at ISCA. Although ISCA has heard nothing from us since then, they are aware of our program, and more generally of SftP, which recently published an article by five ISCA professors. When I arrived at ISCA they were ready with two fantastic proposals. But first, a little background...

### History and structure of ISCA

In the beginning, there was the ENAG: the Escuela Nacional de Agricultura y Ganaderia. Following the revolution in 1979, the school was renamed the Centro de Agropecuaria, a part of UNAN-Managua. The school offered only one degree program, in "Agronomic Engineering," which, until about 1984, was divided into two orientations: Plant production and Animal Production. Around 1984-5 the school became the Faculty of Agricultural Sciences of the UNAN-M, and two new orientations were added: Forestry and "Sanidad Vegetal," translated as Plant Protection. These four orientations are still offered now.

In March 1986, the Faculty of Agricultural Sciences split off from the UNAN to form the ISCA, an institution which offers a full university education and grants degrees in its own right. Over the long-term, the plan is to group together all university agricultural programs into the ISCA, which will then become the Agrarian University. A similar process led to the creation of the UNI on the basis of existing engineering programs at the UCA and UNAN. (As we see below, the UCA still has a strong agricultural school). Whatever its name, the school has four fundamental objectives: teaching, research, advising, and technology transfer.

The ISCA's administrative hierarchy consists, as usual, of a rector, two vice-rectors (academic and administrative), and a general secretary. Academically, the institute is divided into four schools corresponding to the four orientations listed above, plus a school of basic sciences which provides the first two years of education for all students. Other departments within the ISCA include: The National Center of Agricultural Documentation (an archive and library for researchers and government agencies); the Direction of Research and Graduate Study (DIP); and the Methodological Direction.

There is also a new school of Agricultural Education and Communication, whose function is to train teachers for the agricultural institutes in different part of Nicaragua. These institutes are essentially agricultural high schools, so the new school is a specialized school of education. While we're on the subject of agricultural institutes, we might as well mention that they function on the basis of "professionalization of teachers" who are what the Nicaraguans call "empirical." In other words, the teachers come every two weeks for two days of theoretical training, to supplement what they have learned "in the field."

The ISCA began this year with 1600 students; by the end of the first semester this figure had dropped to between 1200 and 1300. The average entering class is about 600 students. The institute's faculty consists of 140 full-time teachers, 36 of them foreign; altogether, the institute employs 400 people.

There are 18 projects at the ISCA funded by international organizations. Holland is responsible for 3 of these, but there are

also Italian and Canadian projects, among others. ISCA has convenios with NGOs and other foreign organizations. Their convenio with NWAG recently expired, but they have convenios with HAPNICA, the Gesamthochschule Kassel, and groups in Mexico and Costa Rica. They also have an arrangement with Wisconsin which permits them to send one or two students there per year.

### Proposals

**The ISCA Journal:** The ISCA plans to publish a scientific magazine similar to UNI's NEXO. They like the look of SftP magazine, and they would like us to send an adviser who is a specialist in graphics, for a period of three months, to help them get started. To produce the magazine, the ISCA could use some material aid as well (graphic materials, paper, ink...).

**Convenio:** At the end of our meeting, Rene Romero whipped out a detailed *Convenio de Cooperación* between SftP and the ISCA. The document was almost in final form; all that was missing was the name of the SftP representative. The wording was somewhat different from that of the Ministry of Education and UNI *convenios*; in particular, ISCA proposed that the *convenio* remain in effect for three years, rather than two. However, the only essential difference was that the ISCA did not commit itself to providing a salary, limiting its offer to providing food "insofar as this is possible."

We hope the ISCA *convenio* can be signed—either in the U.S. or by one of the cooperants—within the next few months. The ISCA's primary need is for teachers in the basic sciences: mathematics, chemistry, physics, and statistics. They also need English teachers. For the time being, ISCA is *not* looking for people to teach advanced agricultural subjects.

## UCA Faculty of Agricultural Sciences

Oscar Miranda McNally, Vice Dean of the Faculty of Agricultural Sciences, is only 30 years old, but he speaks with authority. Our discussion of agricultural sciences at the UCA reinforced my impression that we are only beginning to learn something of the richness of scholarly life in Nicaragua.

### San Andres de la Palanca:

In 1986, a visitor from the University of Guelph (Canada) proposed financing a "Research and Action Project" on a "backwards community" in Nicaragua. Last year, the UCA, with financing from Guelph and with the participation of two Brazilian sociologists, experts in the development of "backwards communities", began a multidisciplinary study of the community of San Andres, in the department of Managua. All four school of the Faculty of Agricultural Sciences (Ecology, Nutrition, Animal Husbandry, and Agricultural Administration) are taking part in the study, as are the schools of Sociology and Social Work. The objective is to bring the community to define its own development priorities, to choose among their many needs (e.g. reforestation, a change in diet...)

The Schools of Nutrition and Animal Husbandry are sending 60 students, in rotation, to live in the community for periods of two weeks. During the week, the students work in the fields; on

*continued p. 8*

# The Problem of Human Resources for Scientific and Technological Development

## The NEXO Debate, Spring 1988

*We have translated the following article from the third issue of NEXO (April-June 1988). The "Debate of the Journal," a regular feature in NEXO, is a report on an actual, ongoing discussion of scientific and technological development priorities. This discussion takes place at regular intervals, with the participation of university administrators, representatives of government agencies with technological responsibilities (like the energy and water resources authorities), and government planners. This is the most important forum of its kind in Nicaragua, and we are pleased to be able to offer an excerpt to our readers.*

To establish a basis for discussion, some pertinent points of reference will be considered:

1. The historical evolution of science and technology in the country.
2. Existing infrastructure, and the anticipated direction of its development.
3. Characteristics of the necessary scientific-technological capacity.
4. The projected demand for human resources.
5. Prevailing mechanisms for the formation (training) of human resources.

We will treat a limited but significant fringe of the possible universe of human resources: that of engineers associated to the industrial sector. Even with this limitation, many of the emerging questions will be translatable to other areas.

**Evolution of Science and Technology:** At the end of the Middle Ages, Spain, busy expelling the Moors and establishing the counter-reformation, failed to notice that Europe was undergoing the Renaissance and the industrial revolution. This neglect had its consequences: in Latin America they were political and social backwardness; in Spain, succeeding once and for all to "be European" continues to be a component of the national dream.

In this way, Nicaragua remained situated in peripheral underdevelopment: exporter of raw materials and imported of added values, it passed through the pattern monotonously repeated throughout Latin America. In this pattern science and technology were not components of national evolutions, but rather more or less exotic articles of consumption relegated to university corners or institutes supported by some patron or other.

The postwar rise of the industrial economies induced a strong economic growth in the Central American region: between 1950 and 1978 exports increased by a factor of 13, markets were diversified, and a subsidiary industrialization took place. Nicaragua was among the countries with the highest annual indices of growth. In regional distribution, the country began to concentrate on the production of intermediate goods for industry, especially in the chemical sector.

This development generated a certain need for professionals, which led to the opening of certain careers which had not existed previously, and to the promotion of new technological specialties. In any case, their functions were secondary ones, basically those of installation and maintenance of industrial equipment, and totally lacked the components of an autonomous national development.

In this way, economic growth remained tied to the evolution of the central developed economies. When this impetus was lost, the regional model entered a crisis, and toward the end of the 70s the indices of growth had completely fallen, even becoming

negative in some countries: indebtedness replaced credit as the decisive factor.

The social transformation of 1979 in Nicaragua took place with this crisis as backdrop. The new national project had to take it over, along with the tensions generated by the aggression to which it was subjected; defense and survival became the first priorities, on top of a global productive structure in which imports were greater than exports by a factor which is currently about five. In these conditions the scientific and technological capacity available in the country is sufficiently insufficient that we can say that it had to establish itself on the basis of very little.

**Existing infrastructure, and the anticipated direction of its development:** The estimates of the Ministry of Planning in 1983 counted (without including agroindustry) some 1400 units of production, employing 50,000 people, for the most part small and semi-artisanal units. Of these, some 160 accounted for 80% of the work force and of gross production.

The metallurgical sector, in view of its importance, size, structure, and problems, is an appropriate point of reference for the problems which a policy of human resources for development will have to confront.

There are rolling-mills capable of producing tubes, rods, and sections. Aluminum, copper, and bronze are cast, and a steel foundry is being installed. Historically, 60% of production is intended for construction, and only 5% for agriculture (producing a little simple machinery). The most developed area is that of fabrication of metal structures (production with high consumption of imported materials and little added value), and experience shows that the sector has great difficulty reorienting its activity toward production that gets away from conventional and traditional dead ends.

It is a sector, like the others, developed within the schema of postwar economic growth: directed toward the most immediate market, deprived of technical capacity for development, dependent on the external sector. On the other hand, the sector has important contributions to make to the basic industrial infrastructure which the country needs, and to the necessary adequate mechanization of agriculture. One feels the strong scarcity of qualified human resources (mechanical engineering, for example, made its appearance in higher education only recently, in 1982, and is an option in little demand among students). For this reason, among others, the infrastructure installed is used far below its capacity.

Analogous considerations can be made for the other important sectors. All suffer from "obsolescence" to different degrees, which would necessarily lead to inefficiency if the adequate technical capacity were available. Presently the national capacity for development, such as it is, is strongly inhibited by the need to channel a large part of the national effort into defense; the immediate priority is to take maximum advantage of the existing productive system. Within the latter, the recovery of past productive capacity is a dominant priority, while the basis for a fundamental transformation is being felt.

**Characteristics of the necessary scientific and technological capacity:** The postwar "modernization" in the Central American region was accomplished through a certain technification of the agro-export sector, marginal industrialization, and a poor imitation of the central "market economies," without touching the traditional structure. At the time this was called "technology transfer;" no one cared to observe that what was being transferred least of all was precisely technology. Industrial production processes for the market are exceedingly rigid, and require no other technological practice than those of installation and maintenance. It was in this setting that the local demand generated for human resources was determined, to such an



extent that even today it is the administrative aspects of industrial management that predominate.

"Technology transfer" is a confused expression, because technology is much more of an object of "appropriation through practice" than of "transfer." Indeed, for the majority of productive practices foreseeably necessary for the country, the technology is public and accessible, and even relatively simple in the present context. What is lacking, principally, can be found in the mastery of the basic knowledge which underlies its rational use, and in the ability to select and adapt the most convenient alternatives. From this point of view, one can attempt to express a few "abilities" desirable for a body of human resources responsible for national scientific and technological development:

—Availability of up-to-date knowledge of the existing technological alternatives for problems of production and the ability to evaluate, select, and adapt.

—The ability to design and produce in the country processes and components which are presently being imported.

—The ability to generate alternative productive circuits which are able to cushion the effects of variations in the external sector.

—The ability to maintain research and development activity.

These elements can also be used as indicators to evaluate the activities of training [*formación*] of this body of human resources.

On a previous occasion [*in the founding document of the UNI, printed in 1984, Ed.*], we established some of the characteristics of a body of human resources required for national development. It is convenient to summarize them here, since they remain valid.

"In the development envisioned, which among other things aims to the greatest possible extent at technological independence, social objectives and requirements predominate, but there is also a more traditional component, of "market type," of production of goods and services.

"The traditional demand aims at professionals who, independently of the type of training they have received, fulfill a "practical" function (the word is not used in a pejorative sense). Productive investment whose principal objective is a secure profit, in a technologically limited environment, needs above all the installation and maintenance of processes already tested, in which there is not much room for creative innovation. This is not to diminish the importance of such activity, since the routine and efficient production of conventional goods and services is the indispensable support for more complex forms of development.

"Projects directed at social objectives, on the other hand, necessarily demand a more sophisticated professional practice. In some cases, this is because, being large physically and financially, they are not simple repetitions of things already done and proven; in others, because they imply the reformulation of traditional processes in more efficient ways; in all cases, because original and appropriate technological innovation is the viable route to escaping the rut of dependency.

"Faced with an undertaking of this type, empirically-trained professionals, adept though they may be in the use of manuals, objects, and production lists, find themselves disarmed. Because the characteristic of a situation like that of Nicaragua is that it poses new problems, without tabulated solutions. It demands, above all, the ability to identify unconventional problems and solutions; this ability is situated above all in the knowledge and mastery of the basic areas of modern technical training.

"It is certain that Nicaragua does not have as its next objective a violent industrial expansion, and therefore its engineers are not going to design or build skyscrapers, power

plants of thousands of megawatts, or aircraft engines. For this reason, specializations and theoretical-practical formulations at this level are not a priority.

"But it is also certain that they will have to confront, on a smaller scale, complex problems of technical innovation. The reduction of scale shows up in the size of the objects or of the investments, but not in the required intellectual capacity. The improvement of an agricultural machine, for example, or the reformulation of an industrial chemical process, are questions which go well beyond empirical and semi-artisanal effort. This has to do with the well-known characteristics of technological knowledge which, like any knowledge, is based in concrete reality and returns to it to transform it, passing en route through the ineluctable and qualitatively distinct plane of representations and abstractions, of symbols and formalism, of hypotheses and appraisals. This is the plane of a professional training of quality, and to neglect it would lead to the narrowing of the horizon of possibilities of contribution to national development."

*Space limitations prevented the inclusion here of Sections 4 and 5, dealing with the projected demand for human resources and mechanisms for training. Photocopies of the original article are available at cost from SftP in Cambridge.*

## PRIORITIES, continued from p. 11

### Mathematics:

Applied (for UNAN-M); Basic mathematics (ISCA); With engineering applications (UNI); all levels (UNAN-L).

### Mechanical Engineering:

Emphasis on mechanical technology and machine construction (UNI).

### Occupational safety and health:

To design and install a laboratory for occupational safety and health (UNI).

### Physics:

Experimentalists—gas film, vacuum, optics (for UNAN-M); basic physics (ISCA); with engineering applications (UNI).

### Sociology, Social Work:

With research experience, for the San Andres de la Palanca project (see Agricultural Sciences).

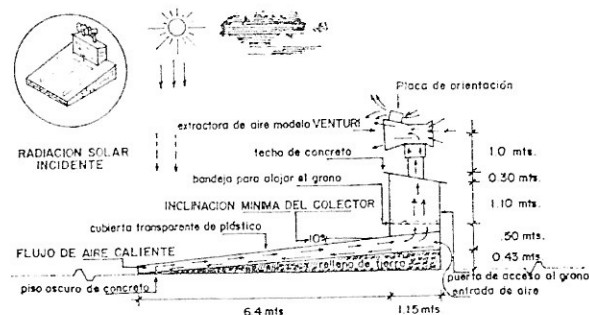
### Statistics:

All levels (for UNAN-M); basic statistics (for ISCA).

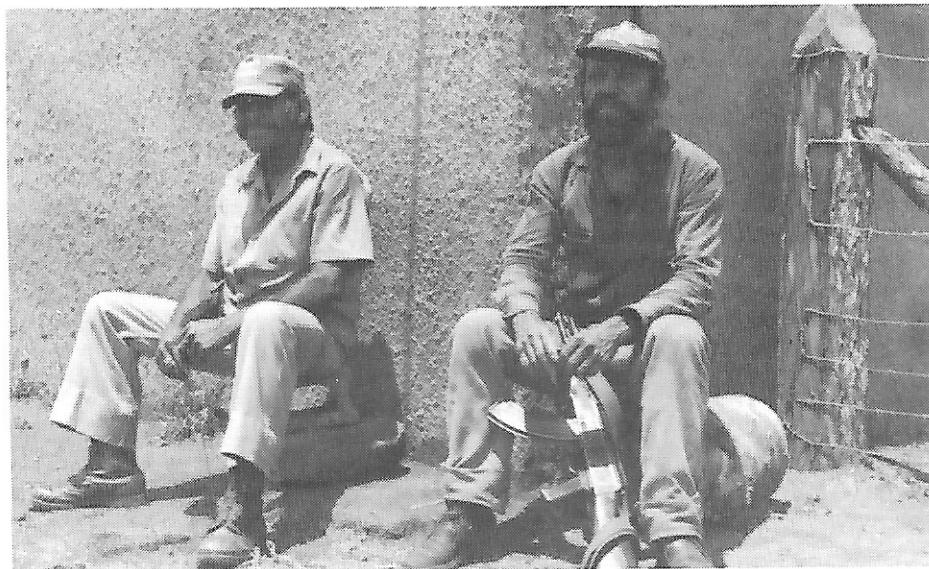
### Veterinary Medicine:

For a proposed new veterinary school (UCA).

SECADORA SOLAR DE GRANOS BASICOS



## La Fundadora: A Small-Scale Hydroelectric Project



*Reynaldo Ceveda Ponce and Róger Lewis Cárdenas of La Fundadora's militia, on duty during our visit.*

Shortly before returning to the States, we had the opportunity to accompany DINOT director Rafael Acevedo and several of his colleagues to the Department of Matagalpa, where DINOT (see sidebar) has been installing and restoring small-scale hydroelectric generators. DINOT's projects are located in three coffee plantations (fincas): La Fundadora, La Palestina, and Las Camelias, all part of the state-run Empresa Juan Martínez, about 20-25 km north of Matagalpa. We had hoped to visit Las Camelias, where the first microgenerator is already in operation. However, the fincas are isolated, all on a dirt road running off the main road from Matagalpa to Jinotega, and Contras were spotted passing through the nearby hills just one week before. Two days before, a Contra massacre took place at a cooperative at Monterrey, 50 km north of Jinotega. Although the Contras have never succeeded in attacking the Empresa Juan Martínez, it was considered too risky to go all the way to Las Camelias, and we stopped at La Fundadora, well-protected by Sandinista troops and local militia, and a common destination for foreign work brigades.

The road to the fincas is unmarked and veers off suddenly from the highway, through a lush mountain landscape made especially beautiful by the abundant rains. Before turning, Rafael stopped to ask a few people waiting by the road whether they had heard of Contra activity along the road. Everyone assured us that nothing was happening along the road, even beyond Las Camelias. Nevertheless, on the way to La Fundadora, Rafael joked nervously about how we were following in the path of Ben Linder, who was killed near another generator in Matagalpa Department. He later told me he was only doing this to see my reaction...

We were greeted at La Fundadora by the director of the Empresa Juan Martínez, Juan Pablo Villagra, a man who is clearly used to dealing with foreign visitors. (During a few free moments we visited a day-care center built with a Swiss donation and named after a Swiss internationalist who was killed by the Contras.) The microgenerator project represents a partnership between DINOT and the Empresa Juan Martínez. In preparing this report, I have drawn on the words of both Villagra and Acevedo, in order to illustrate what DINOT means by "projecting the university on the social reality." The dialogue presented below was actually based on two separate interviews, but it could easily have taken place.

*Juan Pablo Villagra:* Before and during World War II, groups of Germans, Swiss, and other Europeans began settling in the area

around Matagalpa, which reminded them of home. They bought land in the region and imported technology: canals, turbines, and small scale hydroelectric plants. These modern haciendas soon attracted the attention of Somoza, who initiated a campaign to expropriate the land and expel the owners. In this way, much of the land around here came into the hands of Somoza and his associates. After the revolution, this land became state property; this is how the Empresa Juan Martínez was formed. La Fundadora is one of the 9 fincas that make up the Empresa Juan Martínez.

Three thousand people live in the Empresa. We have a doctor and a dentist who work full-time in the zone; they serve the cooperative, state, and private sectors.

The Empresa as such was founded June 1, 1986. Between 1979 and 1986 these lands had seen no technological development. Our fundamental objective was to apply all scientific and technical changes possible in the region with the existing material and human resources, and with the solidarity of fraternal countries.

In fact, our local experts were not up to the task, so we turned to DINOT, and discussed the need of transforming areas of the Empresa. We needed electricity for development, and DINOT needed a site in which to carry out its research. This Empresa presented the right natural conditions for their work.

*Rafael Acevedo:* The UNI people who arrived at the Empresa found vestiges of WWII era technology: canals and small scale hydroelectric plants, mostly old Pelton models. We're talking about microplants—no more than 100 KW, often as little as 5-10 KW, produced by a single small waterfall. A plant like this corresponds to a very specific demand. For example, in Las Camelias, a lot of people show up for the coffee harvest. About 20 families live here permanently, but the population grows to 500 during the harvest. In addition to powering the processes involved with coffee production, the plant also has to provide these people with power for electric lights.

When electricity is introduced into a region, people think of electric lights, radios, maybe a television. But in the future we can think about building small factories—a furniture industry, for example—that can generate production.

Until the 1940s the purpose of technology in Nicaragua was to provide comfort for those who had access. Electricity was developed mainly in the cities of the Pacific belt, around the coffee



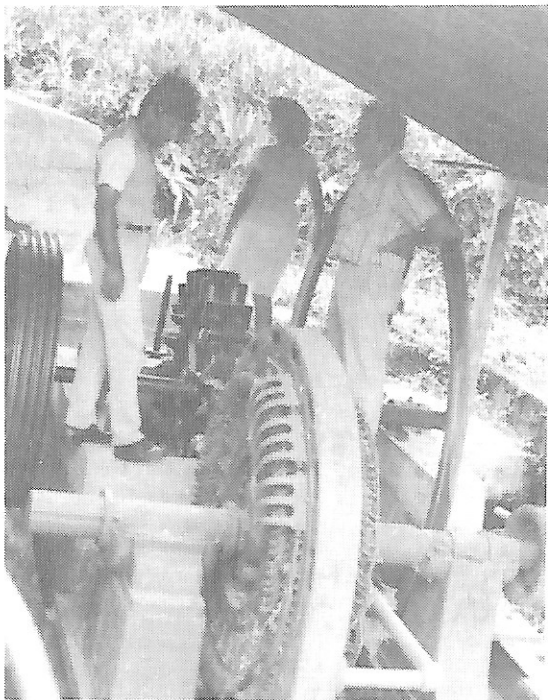
industry, and then just here and there. Interesting things happen when a small amount of electricity is supplied to a community like Las Camelias, or El Cuá, where Ben Linder was working. DINOT is studying these changes. People are moving down from the mountains into the towns that have light. This poses a dilemma. El Cuá has doubled its population since the generator was installed, and they've had to impose limits on consumption. Las Camelias, where we've installed a 20KW microplant, has one central kitchen and one central corn mill, and light for everyone. But what happens when someone buys a stove?

*Villagra:* We have been working with DINOT for over two years. Demand generated through the Las Camelias project led to another project at La Palestina, which belonged to a Somoza associated who let it run down shortly before it was expropriated. An old Pelton hydroelectric plant there needed to be reactivated. Meanwhile, although the national electric grid comes up to La Fundadora, it represents a major expense for energy, and we also have an old Pelton plant that could be restored. The three projects have different characteristics, but they share the same objective.

We've signed other accords with DINOT on technological development, including one to study ways to use coffee pulp to produce coffee fertilizer. Later we'll try to develop other joint projects.

*Acevedo:* We have a complete team working in this project: a mechanical engineer, a hydraulic/civil engineer, and an electrical engineer. Our objectives include training technical experts and developing technology to serve national needs; in this case this means designing new microgenerators, as well as restoring old ones that are out of service. As a model, we chose an artesanal turbine—Mitchell-Banki—which is not complicated to design and build.

The waterfall here at La Fundadora is diverted to run through a tube, which divides in two. One stream is for the old Pelton generator, and will provide electricity for the finca. The other is for a testing site, where we plan to install a Mitchell-Banki-type generator constructed in Nicaragua, on which UNI students can run experiments. We lose some efficiency this way, but because of our lack of resources, we have no choice. In the future, we hope to replace the testing site with a comparison site, which can serve



*Turbine at La Fundadora, with Rafael Acevedo (right) and DINOT staff.*

as a standard for other turbines to be constructed. We may also hold conferences here.

Since the project began, we have had many joint meetings with the Alternative Energy Division of INE [the Nicaraguan Energy Institute, the public utility, Ed.], as well as with ENABAS [the basic grain institute] and MIDINRA [the agrarian reform ministry]. It cost roughly \$70,000 to build and install the microgenerator at Las Camelias, but the price would go down if more were built. In the long run, this decision has to be made by INE, which is responsible for satisfying local energy needs.

*Villagra:* A Contra group, dressed as civilians, tried to infiltrate the Empresa recently, with the objective of blowing up the hydroelectric plant at Las Camelias. This is the same group that attacked the cooperative at Monterrey a few days ago. Their objectives in the region are to destroy projects, to destroy roads, and to destroy housing. At this moment they might be 30, 40, or 60 km from here. There have been many attempts by the Contras to infiltrate the zone, but they have never succeeded.

### DINOT: The UNI's Research Wing

The hydroelectric projects described here were devised by DINOT, the UNI's Department of Research and Technological Orientation. DINOT was established with money from the Gruppo di Volontariato Civile, a Italian private non-governmental organization. Their work is concentrated in three areas: electric power generation (mainly small-scale hydroelectric generators), solar energy, and biomass. In keeping with Nicaragua's development priorities, most of their work is in the rural sector.

**Solar energy,** the specialty of DINOT director Rafael Acevedo, is primarily being studied for application to the drying of grain. Often up to 50% of a Nicaraguan producer's grain crop is lost due to the lack of drying facilities. DINOT is trying to improve on the traditional use of the sun by campesinos by designing small-scale solar dryers, suitable for drying the small quantities of grain sown by campesinos. We were shown a model of a grain dryer now in operation in San Jorge (Rivas), which consists of a standard diesel-powered dryer (used to heat air to begin drying) and a solar dryer, the latter designed and manufactured in Nicaragua, and using a plastic cover developed by DINOT. The solar dryer cuts down on fuel use by up to 50%.

**Biomass,** mostly in the form of wood, accounts for 55% of Nicaragua's energy consumption, and is in most areas the only fuel available for cooking. Deforestation, which can lead to severe flooding during the rainy season, is a serious problem. Recognizing that wood will remain the fuel of choice in Nicaragua, DINOT is designing more efficient wood-burning stoves. Several prototypes have been developed, using different materials: brick, mud and sand, and ceramic. The improved wood stoves, which cost about \$25-\$30 apiece, increase efficiency to 40%, as compared with the 15-20% efficiency of traditional models. DINOT also hopes to improve the ovens used for baking bread and for the production of bricks.

**Coffee waste disposal** is another branch of biotechnology studied by DINOT. During the coffee harvest, waste products enter the mountain streams when the coffee is washed, polluting the drinking water of cities below. DINOT's main project is the development of an anaerobic filter, which removes most of the waste, producing methane gas and material for fertilizer as useful by-products. DINOT is also looking into ways of using the mountains of coffee pulp generated each year to produce livestock feed, methane, cooking fuel, and a substitute for plywood.

Most of these projects have been featured in past issues of NEXO. Readers interested in learning more about DINOT should write to the Cambridge office of SftP (address on p. 12).

## UCA AGRICULTURE, *continued from p. 3*

weekends they organize piñatas and other activities aimed at gaining the trust and the interest of the community.

The person responsible for the project has no research experience, so the UCA needs an advisor from the outside. They are looking with people with research experience, but who can work with their hands!!

### Centro Nacional de Diagnóstico y Investigación Veterinaria (CNDIV)

The UCA has a convenio with MIDINRA (the Ministry of Agrarian Reform) to provide veterinary services. But MIDINRA wants to break the convenio, and is preparing another center. MIDINRA has two veterinarians, UCA has the rest. Now Miranda's faculty is preparing a proposal to open a school of veterinary medicine. The UCA has labs, classrooms, and professors; they need foreign cooperants.

The diagnostic center will have the following areas: pathology, microbiology, virology, serology, and parasitology. In two months they may be opening a veterinary clinic (for small animals). A veterinarian was sent by the UCA to prepare a master's in pathology in Holland; he will be returning in December.

Discussing the problems of staffing the new center inspired Miranda to a digression on the question of human resources. "Many teachers use the university as a trampoline to get better jobs in production," where they might have access to a car and a better salary. "All we can offer is a poor salary." The universities need foreigners, "but to prepare Nicaraguans to teach. We're up to here in needs," he said, holding his chin for emphasis. "We need everything. We're making convenios with everyone."

Sending Nicaraguan professors abroad to study creates other problems. One mentioned by Miranda is that the UCA often finds itself providing a fellowship to someone who isn't there. Thus the position is vacant, but the funds for filling it are not available. However, in case of real need, the UCA can usually find a salary somewhere.

### National Herbarium

The purpose of the herbarium is to collect specimens of Nicaraguan flora. At present they have 90000 specimens. As for staff, the Director has a master's degree, and everyone else is a student! Together with the Faculty of Medicine at UNAN-L, the herbarium is studying the medicinal properties of native species.

Miranda mentioned that the area of the Rio San Juan, in the south of Nicaragua, was considered by UNICEF to be a "patrimonio mundial" for its plant species.

### Centro de Investigación Zootécnica (Center for research in animal husbandry, or CIZ)

The CIZ, which will concentrate on livestock breeding, will be inaugurated in November. All installations are already in place in a farm 22 km from Managua. The CIZ was built by the Federal Republic of Germany. A meeting will be held in November for the faculty, on the occasion of its inauguration. The CIZ wants SfN to send people to work exclusively on research.

### Mathematics at UNAN-Managua

César Rodríguez, the head of the School of Mathematics, studied at the University of Alabama at Tuscaloosa from 1981 to 1983. He was happy to talk shop with a fellow mathematician, and complained that mathematics remains unpopular among Nicaraguan undergraduates. The MED has been organizing an

annual Mathematics Olympiad at the high school level; Rodríguez sees this as the best way to promote mathematics in Nicaragua.

The department which Rodríguez heads is responsible for statistics and computer science, as well as mathematics. The following table indicates the relative weight of these subjects. The mathematics and statistics curricula were introduced only 5 years ago, whereas the computer science major is only three years old. Thus the 5th year classes in mathematics and statistics, and the 3rd year class in computer science, consist of the first students to take these subjects at UNAN-M.

Year	Mathematics	Statistics	Comp. Sci.
5th	2	12	none
4th	4	8	none
3rd	5	5	30
2nd	10	20	unavailable
1st	12	15	100

Computer science majors obviously have the greatest range of job opportunities. Statistics majors can expect to go to INIES (the Economic and Social Research Institute) or MIDINRA (the Ministry of Agrarian Reform). It is expected that mathematics graduates will teach in the universities. After one year of teaching, the UNAN plans to send mathematics graduates abroad to do graduate work. Rodríguez was proud to announce the imminent graduation of the 2 fifth year math majors.

The School of Mathematics has 8 faculty members with Masters' degrees, including 2 in mathematics, 3 in statistics, and 3 in computer science. Most of the faculty is from the German Democratic Republic, the USSR, and Cuba. On the other hand, the school presently has two faculty members in Cuba studying computer science, a third on the way, and a fourth studying mathematics in East Germany.

The teaching load is 12-16 hours/week for those with no administrative responsibilities, 6-8 for those with administrative responsibilities.

### The UNAN-León

Located in León, a city 90 km north of Managua, the National Autonomous University of Nicaragua at León is Nicaragua's oldest university. SfN's contacts with the UNAN-León have been limited; our first instructor, a chemist, is scheduled to arrive there next spring. This August, SfN spoke with Dr. Ernesto Medina, the UNAN's Academic Vice-Rector, and with Carlos Salazar Pereira, Dean of the Faculty of Sciences.

#### Structure of the UNAN

Until 1982 the UNAN was a single university, with administration in León and campuses in León and Managua. When the Managua campus obtained its own administration and institutional autonomy, it already accounted for 75% of UNAN students. The UNAN-M has continued to grow since then, adding many new degree programs and numerous new activities. In contrast, the UNAN-L has not changed at all since 1982, except for the addition of a new undergraduate program in Food Technology, and the master's program in Integrated Pest Management (IPM).

Today there are about 4000 students at UNAN-L. Health is the most important sector, accounting for some 1800 students. Within the medical faculty, there are 1000 students of Medicine, 400 of Dentistry, and 400 in what is called "Chemical Sciences," divided between food technology and pharmacy. The other faculties are: Natural Sciences, divided into the Schools of Mathematics (with 36 students), Chemistry (112 students), Biology (170 students), and Statistics (85 students); Education (500 students); Law (250 full-time students). The law school also



includes 400 part-time students, called "*trabajadores*," or workers; they come to León only on weekends, and in between study from a guide. Most of the *trabajadores* are working with the police and with the various branches of the judiciary; a few come from the supreme court and other institutions.

Except for the *trabajadores* in the law school and a few students in the Faculty of Education, all students at UNAN-L are there full-time. The UNAN-L is the only university in Nicaragua with real chemistry and biology departments, as well as the country's oldest mathematics department. The latter department is reasonably well-staffed but, like its counterpart at UNAN-Managua, is grossly undersubscribed; the pressing shortage in Nicaragua of undergraduate mathematics professors is thus likely to persist in the short run.

The faculty at UNAN-L consists of 370 professors, of whom 300 work full time. It is a young, relatively stable faculty, with an average teaching experience of 9 years. This year the UNAN-L lost 30 professors, but the problem at UNAN-L, as at the other universities, is that many of the most qualified professors took state jobs after 1979. The principal task of the faculty is the "superación," or advanced training, of professors. The vast majority of professors at UNAN-L have only bachelor's degrees: only 3% have Ph.D.'s, and 15-17% have master's. Presently 50 professors are doing graduate work abroad.

#### Foreign assistance

Apart from their support from Oxfam-England and SAREC (the Swedish Agency for Research Cooperation), the UNAN-L has signed convenios with dozens of universities in Europe and Latin America. Among the socialist countries their principal relations are with the USSR, which sends professors of philosophy, economics, and Russian language, and with Cuba, which sends professors of dentistry and a few in medicine and education. Medina also named universities in Mexico, Venezuela, Ecuador, Spain, France, England, Sweden with which the UNAN-L has convenios. However, few of the convenios are consistently productive. Most of the cooperation comes in the form of individual volunteers who already want to come to Nicaragua. At present there are 40 foreign professors at UNAN-L, from France, Canada, the U.S., Mexico, Spain, Belgium, West Germany, Sweden, and England.

In the United States, UNAN-L has sister university relations with Yale and the University of Minnesota. Some students from the U.S. have done work at the UNAN, including one from Yale who studied at the UNAN Law School, and a Berkeley graduate student whose Ph.D. was based on work in the IPM program.

#### Research Projects

The priorities of the UNAN-L are to raise the level of teachers and to promote scientific research. Research priorities are divided into two areas:

**Health:** There are research projects on infectious diseases and occupational health. The former include epidemiological and etiological studies; a report on one of these research projects was translated in the *SfN Newsletter*, Vol. II, No. 4. The occupational health projects include studies related to insecticides and a health study of gold miners, carried out with support from SAREC.

**Integrated Pest Management:** SftP has reported extensively on this program. An article by Donna Perdue appeared in the *SfN Newsletter*, Vol I, No. 2. The UNAN-L has begun work on a new program to find natural insecticides; the project is financed by the OAS, Oxfam-England, and CARE.

In addition to these longstanding research priorities, there is a new project in analytic chemistry, and the Law School has begun a preliminary study of new regulations, abortion and agrarian reform.

## The UNI School of Computer Science

When our friend Rob Wilson visited the UNI in 1986, he learned from Cornelius Hoffman, the dynamic West German director of the School of Computer Science, that only 30 minutes of computer time was available to department students each semester. This remarkable statistic was reprinted in Vol 1, No. 2 of the *SfN Newsletter*, and was frequently used in our presentations as a way of dramatizing the differences between conditions in higher education in Nicaragua and the U.S. We can now report that, thanks to a series of donations (from both Germanies, Switzerland, and the USSR, as well as from individuals working with projects like TecNICA), students working in groups of 3 now have 16 hours/semester of computer time. One result of these donations is that the department has outgrown its space; during my visit, a brigade of West German professionals and students was spending 5 weeks at the UNI building new space for the department.

Hoffman's current objective is to raise the time allotment to 20 hours/semester, for students working individually. In order to achieve this goal, the department needs 30 more microcomputers. They will accept any computer, from 1978 computers with the CPM operating system (e.g., old Kaypros) on up, including computers based on Apple-DOS. The basic criterion is that students are programming in Pascal, so any computer using standard Pascal can be used.

They also need a machine with file security and disk space of 100 megabytes to deal with administrative matters. Micros are out, as are old mainframes and minis which require special installation. They'd like something like an IBM 34, 36, PDP 11, or PDP 11-70. An IBM AT with two 70 megabyte hard disks could work. Hoffman mentioned that "some well-intentioned people have proposed the use of PC's for tasks including record-keeping for the Nicaraguan Supreme Court, with disastrous results."

The computer science department at UNI, unlike other departments, can tell instructors a year ahead of time what they will teach. This makes it feasible to plan a sabbatical in the department. Generally speaking, instructors are only needed for 4th and 5th year courses, including the courses listed on p. 11. The curriculum given at UNI uses the same texts as Berkeley or Stanford. Instructors should preferably have M.A.'s, but computer scientists with B.A.'s and many years of professional experience are also welcome.

A parting word from Hoffman: "I won't be giving away state secrets if I tell you that next week the banks will stop accepting checks from UNI. And nevertheless there are more projects at UNI now than ever. The reason is international solidarity."

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## Documents Obtained

The following is a list of periodicals (and one book) obtained during the editor's August trip to Nicaragua. The list is by no means an exhaustive survey of literature produced in Nicaragua, and reflects a compromise between what is available in bookstores (or from universities) and the limitations of the editor's suitcase. Shortages of paper and ink have apparently interfered with the publication of most of the periodicals.

**Scientific Research in a Revolutionary Context: The Case of Nicaragua:** This is a bound book, in Spanish, of about 100 pages + 10 pages of tables, divided in two parts. The first part is the article whose name is given above; it is a 72-page survey of scientific research in Nicaragua, based on an exhaustive series of interviews with directors of research institutes. The author of the study, Carlos M. Vilas, is an Argentine who has also written a widely-read account of the first five years of the Sandinista Revolution. The second part, by Enrique Ganuza, is entitled "Scientific Cooperation between Sweden and Nicaragua."

The book was produced as a research survey for the series "SAREC Documentation," and cannot be found in bookstores. SAREC is the Swedish Agency for Research Cooperation with Developing Countries. The book may be available in English.

**Encuentro (UCA):** Identified as "The Magazine of the UCA," this may be the oldest university publication in Nicaragua still being produced. SfN obtained three issues: one from 1978 (Agricultural Sciences in Nicaragua), one from 1982 (The UCA after Three Years of Revolution), and the most recent one available, from May-August 1987 (3000 Days of the Sandinista Revolution). *Encuentro* is officially published every four months, but may have fallen behind schedule. All articles in the last issue were prepared by the Instituto Historico Centroamericano, which also publishes *Envío* (see below).

**Envío (UCA):** Considered by many to be the best magazine of news analysis in Nicaragua, featuring three long articles per issue. It appears every month, without fail, and is available in English translation from the Institute of Human Relations at Loyola University.

**Habitat (UCA):** Also published by UCA, in this case by the School of Ecology and Natural Resources in the Faculty of Agricultural Sciences. The January-June 1987 issue (with full color cover) is the most recent, and was printed in 1800 copies in Guatemala, with the sponsorship of the Spanish agency ICI Panamericana. SfN also obtained the May 1985 and June 1986 issues. The magazine features short research articles and news stories from the School of Ecology and elsewhere.

**Cuadernos Centroamericanos de Historia (CIRA):** Published by the Center for Research on the Latinamerican Reality, in Managua, with an editorial board consisting of one historian from each Central American country. SfN obtained the May-August 1988 issue, the second to be published. It is a journal of Central American history, and contains articles covering all periods.

**Cuadernos de Investigación (INIES):** A series of in-depth studies of contemporary social and economic problems, published by the Nicaraguan Institute for Economic and Social Research. The issues do not appear according to a fixed schedule, but there has been one per year since publication began in 1986. No. 1 contains articles on three different subjects, No. 2 is entitled "Trade Union Federations and Economic Policy." and No. 3 deals

with "Accumulation and Transformation: Nicaragua 1979-1985.

**Boletín Socioeconómico (INIES):** A bimonthly publication of INIES, which seems to be appearing on schedule; SfN purchased the last two issues (May 1988 and June-July 1988). The *Boletín* deals with issues of immediate importance, featuring articles on the recent monetary reform and the growth of the informal economy, for example.

**Revista Nicaragüense de Ciencia Sociales (ANICS):** This is a scholarly social science journal, published three times a year by the Nicaraguan Association of Social Sciences. The editorial board consists mostly of university professors, and the articles have a somewhat more academic character than those in the two INIES journals. The most recent issue SfN could find was No. 3, published in December 1987.

**Boletín Informativo (UNAN-M):** The UNAN administration was extremely proud to present SfN with two copies of the UNAN's new newsletter, the *Boletín Informativo*, whose first issue was printed this July. This eight-page newsletter contains a wealth of statistical information and university news which is not available elsewhere.

**NEXO (UNI):** The only general scientific journal in Nicaragua, whose articles are regularly translated in this newsletter. An order form for subscriptions to NEXO is on p. 11.

**Economía y Revolución (UNAN-M):** Published by the UNAN's Faculty of Economic and Social Sciences and edited by the dean of this Faculty, Verónica Rojas. The purpose of this magazine, which features beautiful photographs of pre-Columbian artworks as well as contributions from leading Nicaraguan social and economic thinkers, is clear from its title; the theoretical framework is quite explicitly Marxist. However, only one issue has appeared thus far (October 1987), and this only "with the economic contribution of the Free University of Amsterdam." Interestingly, this 72-page issue contains long interviews with the UNAN's Academic Vice-Rector William Genet and with leaders of student and faculty organizations, discussing the prospects of the Nicaraguan university eight years after the revolution.

**Pensamiento Proprio (CRIES):** Published by the Regional Coordinator of Economic and Social Research, *Pensamiento Proprio* features mostly short articles on current events in Central America and the Caribbean; its editorial board includes representatives from Haiti, Puerto Rico, and Mexico, as well as the Central American countries. A bimonthly.

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### ROBERT FOX, continued from p. 2

I've been trying hard to avoid playing the role of the Great White Chief or the wise colonialist in class by attempting to develop more participatory teaching methods, trying with mixed success to encourage a more cooperative or critical approach to managing class time. To begin with, the professors and directors are older than I am. And in my classes with students, most of the men have already been in the army for two years, fighting the Contras up in the mountains. One of my first-year students volunteered for the BLI [Nicaragua's specially trained "irregular" brigades] and spent the last five years fighting. Now, at age 25 or so, he is beginning his first year of college. Other than English reading skills, what do I have to tell this guy, or anyone else here for that matter? What I'm trying to say is that awareness of one's position as an outsider and what it can signify doesn't necessarily come automatically. Having students take over the class themselves and correct each other seems to me like a good place to begin.



## Priorities of Nicaraguan Universities, August 1988

### Agricultural Sciences:

Someone with research experience is needed to advise an interdisciplinary research project organized by the UCA in the village of San Andres de la Palanca, in the Department of Managua. See p. 3 for more details.

### Agricultural Engineering:

Emphasis on repairing and operating agricultural machinery, hydraulics applied to agricultural machinery, rural electrification, operation of agricultural irrigation and drainage, irrigation and drainage techniques, pumps and pump stations, and irrigation structures and hydraulic works (UNI).

### Animal Husbandry:

Specialists in livestock breeding are needed to work on research projects at the UCA's new Center for Research in Animal Husbandry (CIZ), which will be inaugurated in November.

### Anthropology:

With research experience, for the San Andres de la Palanca project (see Agricultural Sciences).

### Biology:

All levels (UNAN-L).

### Chemistry:

Basic (for ISCA); all levels (UNAN-L).

### Computer Science:

All levels (UNAN-M)

Fourth and fifth year courses at UNI, including the following topics: Discrete Systems, Machine Architecture, System Simulation, Software Engineering, Data Bases, Graphics, Formal Lang-

uages & Automata, Modeling of Technological Processes, Digital Systems, Implementation of Languages, Expert Systems, Economic Engineering, Operating System Architecture, Efficiency and Quality of Algorithms, Evaluation of Computing Systems, Communications & Networks, and several courses on control (Automatic Control, Measurement & Control Interfaces, and Computer Control of Systems)

The UNI school of Computer Science needs 30 PC's. They will accept any computer, from 1978 computers with the CPM operating system (e.g., old Kaypros) on up, including computers based on Apple-DOS. The basic criterion is that any students are programming in Pascal; any computer using standard Pascal can be used. They also need a machine with file security and disk space of 100 megabytes to deal with administrative matters.

A specialist in communications, to write a proposal for the UNI for donation of a computerized data base network to allow universities in Nicaragua to share data. Six month minimum commitment, basic Spanish sufficient.

### English:

Coordinate program in technical English for computer science students; teach sections in this program (UNI).

All levels of technical English (UNAN-L, UNI).

### Graphics/Magazine Production:

Help ISCA design and produce a scientific magazine. Three month commitment.

### Industrial Engineering:

Teaching courses with emphasis on study of the work process, design of productive systems, and operations research (quality control) (UNI).

*continued p. 5*

Please send me a subscription to NEXO, the Spanish language journal of the UNI. Enclosed is an international money order for U.S. \$25, payable to NEXO-REVISTA CIENTIFICA

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## UNI's School of Industrial Engineering

Founded in 1968, this school has, from the beginning, suffered from a shortage of qualified full-time staff and from a total absence of laboratories. The school, which has to provide 32 classes, has only seven full-time professors, of whom five are themselves students; the whole school has to squeeze into an office of 20 square meters. This August the UNI began circulating an "Informational Document on the School of Industrial Engineering," with the objective of obtaining international assistance in expanding and modernizing the school. What follows is a translation of parts of the document which may be of interest to friends of SfN. Anyone interested in working to help build the school is encouraged to contact us as soon as possible.

### Objectives of the School

In Nicaragua, the principal functions of Industrial Engineering are the following: (a) To apply quantitative and qualitative techniques to increase productivity of existing productive systems, maintaining or improving quality of products and services; (b) To design and implement systems of maintenance; (c) To apply the techniques of industrial safety and health to guarantee the physical integrity and health of the workers, and to reduce levels of environmental pollution; (d) To select technologies, processes, and equipment in accordance with the new industrial development of the country (to formulate and evaluate investment projects).

### Collaborative Projects

The following projects, in line with the long-term development plan of the school, will need the assistance of friendly countries: (a) Publication of a technical journal on Industrial Engineering; (b) Design and installation of a laboratory for study of the work process; (c) Design and installation of a laboratory

for Industrial Safety and Health (see below); (d) Publication of booklets for 14 subjects; (e) Design and implementation of a Master's program; (f) Preparation of teaching personnel at the Master's level (at least), preferably without leaving Nicaragua, because of the scarcity of staff; (g) Design and installation of a quality control lab; (h) Design and installation of an electronic computing center (a simulation laboratory).

### Proposal: The Laboratory for Industrial Safety and Health and Ergonomy

The working class in Nicaragua has always worked under highly unpleasant conditions, due to tiring work methods and to an unhealthy, unsafe, or polluted work environment. With the Sandinista Revolution, the government established as one of its objectives the gradual improvement of these working conditions, which will reduce the number of accidents, the proliferation of occupational illness, and the excessive fatigue of workers.

Since 1984 engineering students have been taking courses in Industrial Safety and Health and Ergonomy, but we feel that there is not enough qualified staff to guarantee the level of these courses.

Objectives of the proposal: (a) To familiarize students with work conditions in Nicaraguan industry; (b) To select and provide equipment in industrial safety and health and ergonomics, which will identify and resolve problems in the industries as well as carry out laboratory research and practice at the UNI; (c) To design the physical layout of the laboratory; (d) To design laboratory experiments and propose research topics; (e) To train professors in the School of Industrial Engineering in safety, health, and ergonomics, in particular in the use of laboratory equipment; (f) To provide the necessary bibliographic material for research, teaching, and laboratory experiments; (g) To collaborate in the preparation of a textbook for teaching a course in the subject.

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