chlorine treatment, as well as ecological and life-history studies. But eradication leaders express few regrets about the way things were done, and some outside observers agree. "The Californians chose to shoot first and ask questions later," quips Australian phycologist Alan Millar of Sydney's Royal Botanic Garden. "And I think in this case that was necessary."

Tension between eradication and research is "a recurring theme in biological control," says Edwin Grosholz, a University of California, Davis, biologist, who organized a *Caulerpa* conference last month in San Diego. "But you can eradicate at full speed [while] also learning something about what you've done."

Scientists believe that they already know enough to fear other species in the genus. A strain of *C. racemosa* with similar biological traits and impact on ecosystems is spreading rapidly in parts of the Mediterranean. Of the world's more than 70 *Caulerpa* species, invasive behavior has been documented in five, Williams says. But few species are well studied, and many are involved in the aquarium trade; Frisch and Murray's survey found 16 species in 26 California pet shops alone.

For this reason, and because identifying *Caulerpa* species can challenge taxonomic specialists, let alone enforcement officers, scientists had urged the California legislature to ban the entire genus. But the aquarium industry lobbied successfully to restrict Harman's bill to only nine species. Sure enough, shortly after the ban went into effect last September, inspectors in San Francisco let through a shipment of live rock from Indonesia containing "*Caulerpa* species," according to the state Department of Fish and Game. The inspectors apparently were unable to identify the algae to the level required under the law.

That's not good enough, says French phycologist Alexandre Meinesz of the University of Nice, who first sounded the alarm in 1989. Many countries with temperate coasts, from Japan to South Africa, should be preparing to confront *Caulerpa*, he says, noting that New Zealand is among the few that so far seem willing to step up to the challenge. Nations hoping to root out the invader will need a model of success, however, leaving all eyes on California.

–JAY WITHGOTT

Jay Withgott writes from San Francisco.

U.S. DEMOGRAPHICS

New Annual Survey Brings Census Into 21st Century

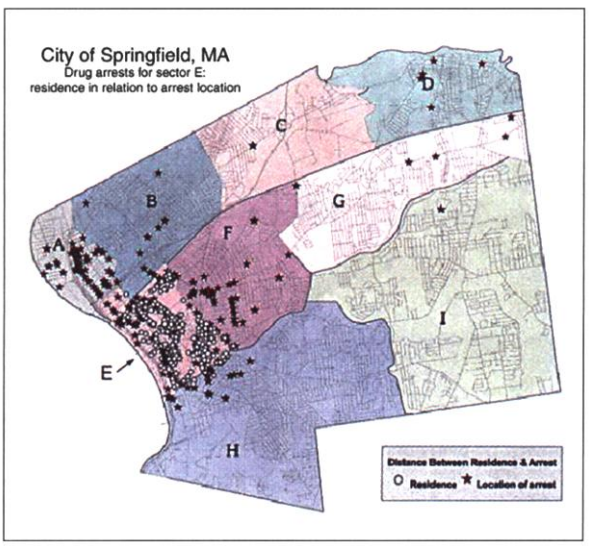
The new American Community Survey will let researchers and public officials get their hands on fresh data annually rather than having to wait 10 years

The U.S. census offers demographers a wonderful snapshot of the country's population. But snapshots are static pictures of an ever-changing world, and recent history has exposed their limitations. The longest economic boom in U.S. history went bust shortly after the 2000 census was conducted, for example. Then came the 11 September terrorist attacks.

Starting next year, the entire nation will begin to get feedback about dozens of social indicators on an annual instead of decennial basis. The exercise, called the American Community Survey (ACS), will, when fully implemented, be "the most important innovation [in census history] at least since sampling theory," says former census director Kenneth Prewitt.

Begun in 1790, the U.S. census has two purposes. The first is to determine the distribution of seats in the U.S. House of Representatives, based on population. The second—what Prewitt likes to call "the nation's longest continuous science project"—is to probe social and economic conditions through questions about topics such as income, race, education, disabilities, military service, jobs, and commuting time to work. For 150 years, every household received what was known as the long form. That changed in 1940 with the introduction of sampling; in 2000, the long form was sent to one in six households, covering some 30 million people.

Every piece of data is devoured by one government program or another: in planning transportation systems, zoning, schools, health care facilities, and housing as well as in targeting and budgeting social services. But whereas "business and commerce operate on instantaneous information," says Prewitt, "the federal government operates on 10-year-old data." It takes 2 years to process answers from the long form, and by the end of the decade the information can be more than a little stale.



Mapping drug traffic. ACS demographic data combined with where drug dealers live (white dots) and work (stars indicate arrests) helps Springfield, Massachusetts, officials tackle youth violence.

CREDIT: U.S. CENSUS BUREAU

The Census Bureau wants to jettison the long form forever and substitute the ACS, a continuous pulse-taking of 39,000 local jurisdictions. Using an approach called "rolling samples," the bureau each month will mail questionnaires to a different sample of households within each jurisdiction. Officials began testing the ACS in 1996. Next year it's expected to go into high gear, with questionnaires going to 250,000 addresses each month, or 3 million a year. By 2010, 30 million addresses will have been sampled, almost doubling the 16 million covered by the long form. Communities of 65,000 or larger will have fresh numbers every year, thanks to sufficient sampling size; smaller areas will take several years to accumulate meaningful data.

Improved timing isn't the only advantage to the ACS, says Nancy Gordon, associate director for demographic programs at the bureau's headquarters in Suitland, Maryland. Administering the long form has gotten increasingly inefficient and expensive, she says. In 2000, for example, the bureau needed to hastily train nearly 1 million temporary workers to conduct follow-up interviews of people who didn't respond to the original mailing. In contrast, the ACS will be handled by a permanent regional staff of some 2000 to 4000 people who will contact nonresponders first by telephone and then, if necessary, in person.

The ACS arrives on the wings of 21st century technology that makes the long form superfluous. The heart of a census,

says Prewitt, is its address file. It wasn't until the mid-1990s that computer systems could carry out prompt and precise tracking of large populations. To do the job right, the Census Bureau links its master address file with a digital database of geographic features such as roads, railroads, rivers, lakes, and political boundaries, allowing the bureau to crosscheck its addresses against relevant physical features. By 2010, the bureau hopes to make databases compatible with global positioning systems, allowing fieldworkers to consult digital rather than paper maps and to update addresses instantly.

So far the results of the ACS have been heartening, says Gordon. Although the initial mail response rate of 52% is lower than the 58% for the long form—not surprising because the annual exercises won't be accompanied by the blast of publicity the decennial census generates—follow-ups have raised that to 96%. And the quality of the data is better, says demographer Joe Salvo of the New York City Planning Department. A professional staff skilled at eliciting information from reluctant citizens, he notes, has less need for imputation, the last-minute inferring of missing data.

The ACS is the linchpin of the Census Bureau's plans for "re-engineering" the census. With the long form accounting for 60% of the bureau's paperwork, Prewitt says that adoption of the ACS will hasten the day when the decennial census can be conducted via postcards and the Internet.

The ACS still must jump through a few hoops. The next challenge is winning approval of the $219 million it requested in the 2003 fiscal year to do the job right. Although that's a 77% increase over its normal off-year budget, Gordon says the new format won't cost any more in the long run: an estimated $11.25 billion, compared with $11.7 billion for the 2000 census.

Congressional reaction to the ACS has been largely favorable, although members continue to express concern about the "intrusive" and mandatory nature of the survey. The chair of the House subcommittee that oversees the bureau, Representative Dave Weldon (R–FL), has just asked the General Accounting Office to conduct an "independent investigation" of these issues as well as the ACS's cost-effectiveness.

In the meantime, Gordon says that local officials have already embraced the ACS. Salvo, for one, says efforts to help neighborhoods and businesses recover from 11 September could have benefited from more comprehensive and up-to-date workforce and employment data. "It's this kind of situation that makes the ACS so attractive to us," he says. "I really think the era of mass census-taking for the long form data is over."

In Springfield, Massachusetts, officials are already using ACS data to improve delivery of health and social services. When cancer registries at two hospitals showed a large number of women with late-stage breast cancer, health officials used the ACS to calculate rates for women over 40 for each police sector. Black or Spanish-speaking women in low-income areas turned out to have the highest rates, a preliminary finding that may help public health workers in designing information and screening campaigns.

Springfield is also using ACS to tackle teen violence. Combining data on where violent youths were arrested in 1999 with demographic data from the ACS allowed officials to map school dropout rates, work patterns, home ownership, single-parent families, and teens' work and educational status. Amy Pasini, a violence and injury prevention coordinator at Baystate Medical Center in Springfield, says all this will be useful in planning intervention strategies: "Using 10-year-old census data doesn't have much teeth to it. ... We see the ACS as a gold mine."

–CONSTANCE HOLDEN

ASTRONOMY

Unusual Venture Helps Make the Sky Affordable

High-tech, assembly-line techniques are putting professional-quality telescopes within reach for a global scientific community

LIVERPOOL, U.K.—Henry Ford had the big idea: Build automobiles on a production line, and they will be cheap enough for everyone to afford. The essence of that philosophy is one of the driving forces behind Telescope Technologies Ltd. (TTL), a start-up owned by Liverpool John Moores University (JMU). Its goal is to open up the international market for optical telescopes that can do real science.

TTL's instruments are not for hobbyists to set up in their back garden. Their mirrors are 2 meters or more across, and they stand more than 7 meters tall. Most professional telescopes of this class are one-off projects, designed and built from scratch. But TTL and its original partners at the Royal Greenwich Observatory (RGO) in Cambridge had a different idea: Come up with a robust design that can be scaled up or down, and make it robotic to reduce operating costs. Price it at a fraction of the normal cost, then build it again and again and again.

The result, which sells for about $3 million—less than half the cost of a similar one-off instrument—means that groups with a limited budget can now get their hands on a frontline professional telescope. Although TTL's first instrument is still waiting to be installed on the Canary Islands off Africa's Atlantic coast, the company has already completed one for a consortium of Indian universities and is building two for an educational foundation (see map). It has just won an order from China, and it has had more than 100 inquiries, including groups in Indonesia, Africa, and the Indian subcontinent.

"There are no others in the world like it," says British software entrepreneur Dill Faulkes, whose foundation is buying two 2-meter TTL telescopes that will be located in Hawaii and Australia. The instruments will be dedicated to students for real-time observations via the Internet. Robotics is the key for Chen Dong of the Yunnan Astronomical Observatory in China, which plans to install a 2.4-meter TTL scope in 2004 atop a remote 3000-meter-high mountain in southwestern China. "This is a great advantage for the [Gaomeigu] observatory," he

A new vision. This robotic, 2-meter optical telescope can serve students and professionals alike.

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