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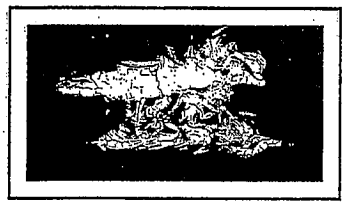


NO HUNTING!
SCIENTIFIC POACHING AND GLOBAL BIODIVERSITY
BY JACK KLOPPENBURG, JR.

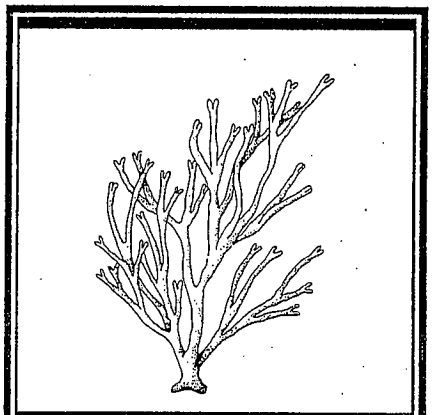
SALIENT SCIENCE

IN A RECENT article, the Mexican novelist Carlos Fuentes denounced the U.S. invasion of Panama as the Bush administration's declaration of its intent to hunt whomever, whatever, and wherever it likes in Latin America. Fuentes warned, "If we do not post 'No Hunting' signs, our lands will be poached on. We must set up our signs quickly and be prepared to enforce them with prudence and a firm will."

Of course, the United States has been stalking political prey in Latin America for many years now. But the high drama of the pursuits of Manuel Noriega and the Sandinistas should not blind us to the existence of economic as well as political quarries. The direct and indirect removal of Third World leaders and governments by the U.S. has often served to facilitate the extraction of raw materials—especially agricultural products—on terms favorable to North American business interests.

And the scope of the hunt for raw materials in Latin America and elsewhere in the Third World has been expanded in recent years. Molecular biologists now have cracked the gene as physicists had previously cracked the atom and have gained access to the very building blocks of life itself. We are poised on the edge of an era of production that will use DNA—genetic information—as one of its fundamental raw materials. According to biotechnology company executive Winston Brill, "We are now entering an age in which genetic wealth, especially in tropical areas such as rainforests, until now a relatively inaccessible trust fund, is becoming a currency with high immediate value."

The value of Third World genetic resources may appear high to corporate gene merchants, but that value is rarely captured by the nations in which genetic materials are being hunted. Genetic resources are now considered to be the "common heritage of mankind" and as such are freely collected—would Fuentes say "poached"?



"If we do not post 'No Hunting' signs, our lands will be poached on. We must set up our signs quickly and be prepared to enforce them with prudence and a firm will."

—by both academic and corporate biologists.

The World Resources Institute has suggested that genetic resources may well be the oil of the Information Age. And like oil, biotic diversity is unevenly distributed throughout the world. Indeed, genetic resources are even more highly concentrated in the Third World than is oil. Tropical forests, for example, cover only 7 percent of the earth's surface but contain over half the planet's species. In Mexico alone more than 30,000 species of plants have been identified. In contrast, the flora of the much larger United States includes but 18,000 species, while in all of Europe there are only some 12,000. If biotechnology "makes rummaging through nature's pantry become much more profitable," as University of Florida agronomist Hugh Popenoe puts it, rummaging about is likely to be much more profitable in Chiapas than it is in Minnesota.

Such considerations are an important part of the economic rationale behind the "greening" of the World Bank and the interest now being shown by many Northern development and conservation organizations in such programs as debt for nature swaps. But in addition to initiatives ostensibly intended to preserve Third World biological resources in situ, one also finds growing support for efforts that are fundamentally extractive in character. Government, university, and corporate scientists from the developed North are now busily engaged in the collection of tropical organisms of all sorts—plants, animals, insects, microbes, fungi, marine creatures—for the purpose of assessing their biochemical properties for possible use in agricultural, industrial, or medical applications.

This type of economic hunting has as extensive a history as its political counterpart. The developed countries have already realized enormous benefits from their access to Third World genetic materials. This is perhaps most clear in the case of crop plants. Few of the crops that today make the U.S. an agricultural power are native to North America. European colonizers found Native Americans growing maize, beans, tobacco, and squash. But these crops had been introduced from Central America and the Caribbean. A truly North American meal would consist only of sunflowers, blueberries, cranberries, pecans, and chestnuts. Northern Europe's original genetic poverty is only slightly less striking; oats, rye, currants, and raspberries constitute the complement of major crops indigenous to that region.

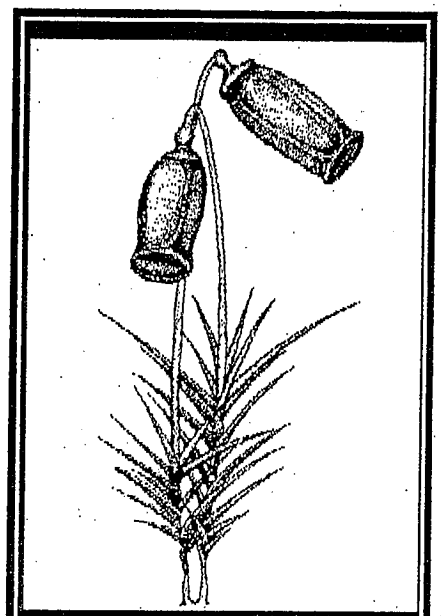
The crops that one associates today with the agricultural economies of the developed nations—maize, wheat, soybeans, potatoes, alfalfa, barley, sorghum, tomatoes, cotton, tobacco—originated in what are now the nations of the Third World. The agricultural development that has undergirded the industrialization of the rich but gene-poor North has been predicated on the appropriation of genetic material from the poor but gene-rich South.

The original transfers of plants and seeds occurred decades and even centuries ago, many of them under military auspices. Admiral Perry not only opened the harbors of Japan to U.S. trade, he also brought back the soybean. As a botanist of the time expressed it, "As long as our troops are there, science may as well profit by them." In the U.S., military responsibility for genetic imperialism was gradually ceded to the expeditionary activities of a nascent Department of Agriculture (USDA) which developed a systematic policy and institutional framework for plant introduction during what botanical historians call the "Golden Age of Plant Hunting" in the 1890s.

Nevertheless, because such initial transfers involved only a small portion of the total genetic variability available in any one species, plant scientists have continued to return to the Third World to collect samples from the thousands of genetically diverse "landraces" developed and maintained by peasant farmers. Rich in genetic characters providing protection against diseases, pests, and environmental fluctuation, these collected materials are stored in climate-controlled "gene banks," most of which are located in the industrialized world.

Access to such materials has been worth untold billions of dollars to the developed nations whose high-performing but genetically narrow cultivars must be frequently replaced in a "varietal relay race" against insects, disease, and weather. For example, the genes that protect the U.S. barley crop from yellow dwarf disease were obtained from an Ethiopian landrace. New soybean varieties developed by University of Illinois plant breeders using Korean materials may save U.S. agriculture $100-500 million in processing costs yearly. And just a few months ago University of Wisconsin scientists announced development of a new type of bean capable of supplying up to 60 percent of its own nitrogen needs. What made this advance possible was breeding material obtained from a research institute in Colombia which had collected bean varieties from the fields of Latin American peasant farmers.

The utility of Third World genetic resources for developed nation agricultures is being enhanced by the emergence of biotechnology. That the chemical structure of the genetic code is identical in all species makes the techniques of genetic engineering into a kind of biological Esperanto. According to Calgene executive Raymond Valentine, the plant biotechnologist's motto is "any gene out of any organism into plants." As both classical plant breeders and molecular geneticists learn to use their new research tools more effectively, demand for the raw material for their work is increasing. Accordingly, the USDA has developed a computerized database to provide information on the crop genetic resources available in any given country. And in order to augment the constant flow of plant materials already received yearly from the global network of international agricultural research institutions, the USDA's Plant Exploration Office will this year send 30 collecting expeditions to 17 different nations.



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As the international trade in heroin, cocaine, and marijuana clearly demonstrates, agronomic characteristics are not the only features of economic interest in Third World plants. But besides their best-known uses, these drugs also have important medical applications. And in fact over a quarter of all prescription drugs contain one or more active ingredients derived from plants. For cancer drugs the figure rises to 40 percent. In 1985 the global market for plant-based ethical drugs was about $43 billion.

And, as was the case for agronomic species, most medically important plants have Third World origins. Much surgery relies on d-turbocurarine, a muscle relaxant isolated from an Amazonian liana. The steroid diosgenin, a principal component in birth control pills, is extracted from a wild yam native to Mexico and Guatemala. From Madagascar's rosy periwinkle is derived the vincristine and vinblastine used against Hodgkin's Disease and juvenile leukemia. Global sales of those two drugs total $160 million per year. And from the Asian rauwolfia plant comes the tranquilizer reserpine, which in drug form has an annual market of $260 million.

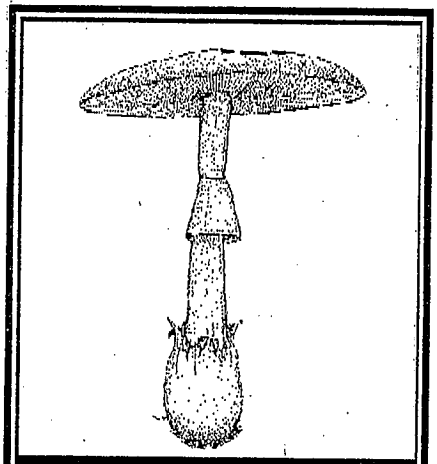
The 121 plant-derived prescription drugs now in use were discovered through the examination of about 35,000 species. Only about 5,000 of these were exhaustively analyzed. There are an estimated 300,000-750,000 plant species in the world. Clearly, there are many, many more medically useful compounds awaiting discovery. And most of them will be in plants native to the Third World, a large fraction of them to rainforests. Recognizing this, the U.S. National Cancer Institute (NCI) has initiated a multimillion dollar program designed to collect thousands of plant specimens from tropical forests over the next five years.

But the NCI is interested in more than plants. The active ingredients in 15 percent of prescription drugs are derived from microbes or higher animals. The antibiotic chloromycetin, for example, was isolated from a microorganism found in soil samples from Venezuela. Several million dollars will also be committed by the NCI to the collection of a wide range of organisms including marine invertebrates, microbes, blue-green algae, and fungi. Along with the plants that are collected, these organisms will be analyzed in a newly organized NCI laboratory designed to screen 10,000 substances per year against 100 cancer cell lines and the AIDS virus.

But how can what Cornell University entomologist Thomas Eisner calls "chemical prospecting" be most effectively undertaken? Of the vast and bewildering variety of organisms available, which ones should be collected and analyzed? One approach is to focus on organisms already being used by human populations. The peoples of the Andean cordillera cultivate more than 35 species of food crops. A single field may contain as many as 40 different types of potato, each recognized in folk taxonomy for its distinctive agronomic characteristics. In southeast Asia, traditional healers utilize some 6,500 plants. Worldwide, over 3,000 plant species are used by indigenous peoples to control fertility alone. Thus, among peasant farmers and traditional peoples, there exists an enormous reservoir of cultural information that can provide useful guidance as to which pieces of the natural world are worth a closer look.

Tapping this reservoir of knowledge has already proven effective. Three quarters of the plants that provide active ingredients for prescription drugs originally came to the attention of researchers because of their uses in traditional medicine. Accordingly, the NCI collection strategy involves close attention to indigenous medical practice and especially to the expertise of traditional healers and *curanderos*. Similarly, the USDA's crop germplasm acquisition policy now gives priority to obtaining samples for which the ethnic source of the cultivar is described.

The NCI and the USDA are public agencies. But private businesses also show growing interest in genetic and chemical prospecting. A company called MYCOsearch was formed to commercialize fungus collecting and a firm called SeaPharm was established to do the same for marine life. The biotechnology firm Native Plants, Inc. has begun to collect seed of indigenous Andean crop species such as amaranth and quinoa. The drug transnational Merck, Sharpe and Dohme, a leader in natural products chemistry, is now working to develop a new anticoagulant based on the *tiki-uba* plant used by the Urueu-Wau-Wau Indians of the Brazilian Amazon. And Monsanto has begun laboratory tests on *uruchnumi*, one of more than 1,000 species of plants collected over the last few years from the Jivaro Indians of Peru during



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expeditions led by Washington University ethnobotanist Walter Lewis.

Whether collected by government, university, or corporate scientists, the genetic and cultural information extracted from the South is ultimately intended to be applied to some useful purpose—a new drug, or seed of a new crop variety. But in capitalist society such innovations are made available as commodities—they must be purchased. Monsanto is interested not just in developing a drug from *uruchnumi*, but in developing a marketable drug. And if it can, Monsanto will strengthen its property rights in that drug by taking out a patent. Business interests in the developed nations have worked very hard over the past ten years to put in place a legal framework that ensures that genetically engineered materials—whole organisms, tissue cultures, cells, DNA sequences—can be owned.

There is an important asymmetry here. Genetic and cultural information extracted from the Third World is processed in the academic and corporate laboratories of the developed nations for the express purpose of producing new commodities for private profit. Yet when that information is collected from Andean peasants and Amazonian indians, scientists consider it to be the "common heritage" of humanity, a public good for which no payment is appropriate or necessary. According to University of Massachusetts biologist Garrison Wilkes, "The major food plants of the world are not owned by any one people and are quite literally a part of our human heritage from the past."

It is ironic that the Third World resource that the developed nations have, arguably, extracted for the longest time, derived the greatest benefits from, and still depend upon the most is one for which nothing is paid. The South has in effect been engaged in a massive program of foreign aid to the North. Genetic and cultural information has been produced and reproduced over the millennia by peasants and indigenous people. Yet, like the unwaged labor of women, the fruits of this work are given no value despite their recognized utility. On the other hand, when such information is processed and transformed in the developed nations, the realization of its value is enforced by legal and political mandate.

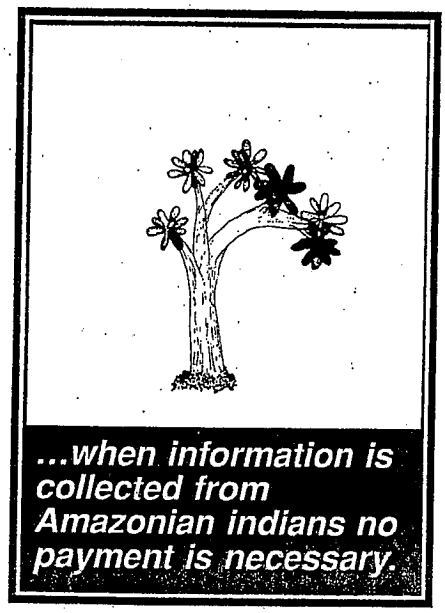
Thus, I can read an article about the traditional uses of an Asian tree in the academic journal *Economic Botany* ("Potential of the Neem Tree (*Azidarachta indica*) for Pest Control and Rural Development") and a year later find an article in the Madison, Wisconsin, *Capital Times* titled "State Man's Pesticide on Road to Fame." The latter article describes how "Businessman Tony Larson has impressed industrialists and government officials with his one man campaign to provide the world's farmers with a pesticide made from seeds of an Asian tree." Somehow Asian farmers' pesticide has become "state man's pesticide." And not just rhetorically, but quite literally, since Larson has a patent on his formulation of neem extract which he calls "Margosan-O." Margosan-O has been approved for certain uses by the EPA, is now commercially available, and has been licensed to W.R. Grace for further research and development. Should Monsanto develop a profitable drug from the *uruchnumi* plant, there is no reason to expect that the Jivaro—or Peru—will be rewarded for their contribution to this advance any more than the people of Madagascar were

rewarded for the development of vinblastine and vincristine.

Let us be clear about this. There is no denying that academic and corporate scientists are adding value in their manipulation of the genetic and cultural information acquired from the Third World. But what needs to be recognized is that value already exists in the collected materials. In a world in which the Jivaro have precious little to sell except their labor power, is it ethical to fail to provide them with some reward for their contribution of genetic materials and information that are unambiguously useful and potentially exceedingly valuable? If access to these raw materials results in benefits to companies or consumers, isn't an ethical obligation incurred to see that the donors are benefited as well?

But if ethical behavior were all there was to it, Fuentes wouldn't have had to write about the invasion of Panama. As it is, he is quite right to observe that if "No Hunting" signs are not posted, Third World lands will continue to be poached on. Third World nations and peoples have the right to insist upon an end to the unrecompensed extraction of genetic and cultural information and to require that genetic and chemical prospecting be undertaken in accord with well-defined rules that assure the donors of such resources a reciprocal flow of benefit.

A necessary first step toward this goal has been the building of awareness of the issue among Third World peoples, activist organizations, scientists, and governments. It is, after all, these groups that will ultimately be responsible for making decisions about whether to post "No Hunting" signs, what the signs say, and how they should be enforced. With the leadership of such organizations as the Rural Advancement Fund International and Genetic Resources Action International, much progress has been made over the last decade in raising the global visibility of the issue. In developing nations there is increasing agreement with the point of view recently expressed by Chilean agro-ecologist Miguel Altieri: "Developing countries should have their own reasons and motivations for preserving crop genetic resources. These resources are their national property, so developing countries are entitled to develop autonomous conservation strategies and to demand compensation from the north for the use of their genetic resources. Crop genetic conservation at the national level is crucial to protect national sovereignty, ensure food self-sufficiency, and develop a sustainable agriculture that decreases dependence on imported inputs by relying on local resources that meet the needs of the rural and urban poor."



But how might an institutional framework for compensation be structured? Bilateral agreements will tend to produce a market for genetic information. Certainly it would be possible for nations or communities to set exploration fees for genetic prospectors, or to set a price on the materials collected. But because useful genes are a very small and indeterminate proportion of total genetic variation, prices that would attract collectors would necessarily undervalue the resource. Moreover, a market-oriented approach might isolate Third World nations and press them into their traditional roles as competing suppliers of a raw material. Regulatory reliance on a host of national bureaucracies might also tend to prevent the benefits of compensation from reaching farmers and indigenous peoples. A multilateral approach that builds upon the Third World's growing willingness to confront the issue of genetic resources as a North-South issue has more promise.

And such an alternative is now being developed within the Food and Agricultural Organization of the United Nations (FAO). Informed and encouraged by the activities of activist groups, emerging Third World dissatisfaction with the prevailing international regime of plant genetic resource exchange found political expression in 1983. At that year's FAO Conference the developing nations passed an International Undertaking on Plant Genetic Resources. This Undertaking reaffirmed the concept of "common heritage" for plant germplasm but mandated the inclusion of the proprietary varieties of the North under that rubric. This de facto decommodification of the seed industry was vehemently opposed by the industrial capitalist nations—and especially the United States—as a direct and unacceptable assault on private property.

The unwillingness of the North to support the Undertaking angered militant Third World countries. In what *The Wall Street Journal* has called "Seed Wars," some nations went so far as to suggest that, in the absence of free exchange of all genetic resources, no germplasm should be exchanged freely. There was talk of a "Genetic OPEC." Several nations closed their borders to the export of plant germplasm and there was a general chill on collection and exchange globally. The prospect of a reduction or stoppage of the flow of plant germplasm from the periphery was a sobering prospect for academic and corporate breeders in the North. On the whole, materially recognizing the value of Third World germplasm should prove more palatable to the developed nations than continued conflict over what is a strategic raw material.

And there now appears to be a rapprochement underway. Out of the last FAO Conference in November 1990 emerged an "agreed interpretation of the Undertaking." This agreed interpretation explicitly recognizes the legitimacy of "plant breeders' rights" and the expression of those rights in the legal protection of patented varieties. Balancing this concession to the developed nations is language specifying that "farmers' rights" will also be recognized. Just as plant scientists are entitled to a reward for their labor in creating breeding lines and elite varieties, so farmers have a right to a reward for creating and maintaining landraces and other "raw" plant genetic resources. Further, just as the reward for plant breeders is material, so should

farmers be entitled to material reward for use of the fruits of their labor. In order to provide a mechanism for the realization of such reward, the FAO has created an International Fund for Plant Genetic Resources.

The FAO's agreed interpretation is a signal advance inasmuch as it represents the first concrete recognition by an international body of the value of the many forms of knowledge production that take place outside the walls of formal knowledge-producing institutions such as universities and corporations. From this FAO initiative may emerge a mechanism for providing material reward to the vast but largely unacknowledged innovative activities of farmers and indigenous peoples. More than this, it may provide a model for application not only to the extraction of other types of genetic materials but also to other sectors such as the creation of tacit or craft knowledge by workers in the industrial and service sectors in both the developing and developed nations.

Still, there is much yet to be done to ensure that the FAO Undertaking and the Fund achieve a real redistribution of the flow of benefits between North and South and not mere rhetorical recognition of abstract "rights." Certainly, contributions to the Fund must be mandatory. Commercial plant breeders do not accept voluntary compensation for their activities with germplasm, nor should farmers or nations. Tying payments to the Fund by the advanced industrial nations to access to global collections of plant genetic materials collected and stored by national governments in cooperation with the FAO seems a plausible means of seeing that money follows rhetoric. The size of these payments could be determined by considering a number of factors such as size of national seed industry, value of national agricultural production, and frequency and size of drafts upon the FAO's network of cooperating gene banks. Should the Fund attract significant financial support, much thought must be given to how those moneys will be disbursed. There will be great temptation for the government bureaucracies of Third World nations to turn allocated funds to their own unproductive purposes. One way of reducing this temptation would be to mandate the uses to which Fund moneys could be put. At least two areas ought to receive priority.

First, there must be a mechanism to see that farmers do indeed benefit from the funds collected on behalf of "farmers' rights." Not only is this ethically imperative, but there will ultimately be no effective long term conservation of genetic resources without support for those who know them best and use, produce, maintain, and reproduce them each day. Certainly there must be some provision for directing funds to popular groups and nongovernmental organizations involved directly in support of sustainable development initiatives among such groups. Second, real control of genetic information is knowing what it is and how it can be used, and it is in these areas that most developing nations are sorely deficient. The Fund should support the development of Third World scientific capabilities, including especially construction of gene banks and the training of plant breeders and molecular biologists.

Creation of a compensation mechanism for the appropriation of genetic information would redress a significant inequity in the relationship between advanced capitalist nations and less developed countries. But it may also provide us with guidance in dealing with genetic prospectors in the U.S as well.

Certainly the issues apply to Native Americans and their lands. But they may have a very personal application to all of us, as the example of California resident John Moore illustrates. Moore consented to the removal and disposal of his spleen as part of treatment for his leukemia. Moore's physician at the University of California-Los Angeles subsequently used the spleen as part of his research, developing a purified cell-line from the diseased tissue.

This cell-line, christened the "Mo" line, was found to be capable of producing pharmaceutical substances whose value may run to several billion dollars. The doctor then patented the cell-line on behalf of UCLA and entered into commercial arrangements with the biotechnology firm Genetics Institute and with Sandoz Pharmaceutical Corp. for the production of those substances using the "Mo" line. As part of these arrangements, UCLA received $400,000 in research funds from the companies and Moore's physician was appointed to the scientific board of Genetics Institute, receiving stock options in that company which came to be worth $3 million.

Learning of these activities, Moore sued to gain the rights to a portion of the proceeds being enjoyed by the individuals and institutions who had gained ownership of his namesake cell-line. He argued that while he had consented to have his spleen studied, he had not been informed of the possible commercialization of cells that—since they were taken from his body—he regards as his tangible personal property.

In a decision that one would like to think might well have been the International Court upholding the rights of the Jivaro to an interest in their plants, the California Court of Appeal upheld Moore's complaint and commented, "Defendants' position that plaintiff cannot own his own tissue, but that they can, is fraught with irony. Apparently defendants see nothing abnormal in their exclusive control of plaintiff's excised spleen, nor of their patenting of a living organism derived therefrom.... Absent lawful authority, medical researchers are no more free to impose their priorities over the unconsented use of cells than any intruder of any other property."

Alas, in July this decision was overturned by the California Supreme Court. The genetic poachers do not in fact see anything abnormal in their exclusive control of human genetic resources from California any more than they see anything abnormal in their exclusive control over plant genetic resources from Peru.

Moore's lawyers may appeal this latest decision to the U.S. Supreme Court. Meanwhile, it is clear that Fuentes was writing not just for Latin Americans but for all of us: If we do not post "No Hunting" signs, our lands and even our bodies will be poached on. We must indeed set up our signs quickly and be prepared to enforce them with prudence and a firm will. Z

Jack Kloppenburg, Jr. is a rural sociologist at the University of Wisconsin. He is the author of First the Seed: The Political Economy of Plant Biotechnology *(Cambridge, 1988).* *His research is supported by an SSRC-MacArthur Foundation Fellowship in International Peace and Security.*