DIVERSITY

Vol.16, No.4, 2000 *A News Journal for the International Genetic Resources Community*

First William L. Brown Award Goes to CIP's Carlos Ochoa

Honoring a Career Dedicated to Conserving and Using Potato Germplasm

DIVERSITY

A News Journal for the International Genetic Resources Community

DIVERSITY is an international quarterly news journal whose mission is to provide to the biodiversity community a broad range of views and information on people, issues, policies, practices, and activities relating to the preservation, conservation, and utilization of genetic resources.

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COVER PHOTO: Courtesy of the International Potato Center.

FROM OUR READERS

Dear Editor,

As co-author of the Global Environment Facility (GEF)'s Poland project that was profiled in *DIVERSITY,* Vol.16, No.3 (pp. 18-20) and the World Bank's senior forester on the project, I would like to provide additional information on it.

A major project concern was the lack of ecological sustainability in the Bialowieza National Park (BNP). Besides supporting scientific studies that led to a doubling of the park's size, the project also funded local NGO efforts to identify areas in need of protection that lie outside it. To date, 21 nature reserves and other sites of ecological and/or historical interest have been protected. Yet there is still pressure to preserve the entire original Bialowieza Primeval Forest. Most of this has not been virgin forest for the last 150 years and was often replanted with non-natives; some of the land added to the park is not of park quality. Because of the project, however, a restoration nursery was established and the park is being reforested with native species; planted stands of non-native trees are being removed.

The genebank at Kostrzyca in southwest Poland was established to collect and multiply key forest species (i.e., trees and shrubs) and promote reforestation of the Sudety Mountains. Funding and staff limitations precluded a broader collecting focus. A restoration nursery was established at the genebank and both native conifers and hardwoods are being grown in bare-root nurseries and in plastic greenhouses. These seedlings have been and will be planted at mid- to lower elevations to create mixed natural forest stands. There are no plans to restore the vast dead forests at the higher elevations, since the polluted soils cannot support normal, healthy forest stands.

The project established significant cross-border cooperation on biodiversity conservation. Early on, workshops were conducted to identify priority transboundary issues and a number of joint international activities have grown out of the pilot project, including pollution monitoring, identification of/seed collection from native trees and shrubs, wildlife monitoring, ecological restoration/protection, and forest management.

Essentially all of the project's major objectives were accomplished, and its effects are ongoing.

Stanley L. Krugman
McLean, VA

The editors welcome comments from all sectors in an effort to extend the forum *DIVERSITY* provides for debate and discussion of the many issues facing the global genetic resources community.

FROM OUR EXECUTIVE DIRECTOR

GRCS and *DIVERSITY* have undergone many changes in the past year, and we embark upon 2001 with a renewed sense of purpose. The following advances excite and energize us, and we hope you will consider them meaningful contributions to the genetic resources community.

We are proud to announce that the first recipient of the William L. Brown Award for Excellence in Genetic Resources Conservation is **Carlos M. Ochoa** of the International Potato Center (see pp. 4-5). We were delighted by the caliber of the nominations, and believe that Ochoa sets a standard for excellence that will encourage and challenge us all. Through the Brown Award, which will be granted each year, we aim to raise the profile of the essential work done within the genetic resources community. The formal award ceremony will take place in Washington, D.C. later this year, and we believe that this inaugural one is an especially fitting way to honor the memory of William L. Brown, founder of GRCS and *DIVERSITY,* in the tenth year following his death.

Also, we are in the process of converting the complete catalogue of *DIVERSITY* into an electronic archive, which will be available on CD-ROM in a few weeks. We hope that this archive will expand the impact of GRCS' nearly two decades of coverage of the field of genetic resources conservation and use. The archive will be priced to ensure that it is as widely accessible as possible to members of our community. Fully searchable, it will be a valuable summary of all of the twists and turns taken in the field of genetic resources, and one of our goals is to secure the funding needed to make it available to educational institutions around the world.

In addition, we are exploring ways to expand GRCS' electronic presence. We have started moving some information onto our Web site, but it is not yet fully operational. We are seeking foundation and other funding to effect this expansion onto the Web, which is imperative as the global reach of this electronic network grows. Eventually, we expect to be able to deliver *DIVERSITY* and other resources to your electronic mailbox instantly.

And we are proud to announce that **Ruth Batik** is our new managing editor. Ruth has been with us for most of the last year and we are overjoyed that she has agreed to help move *DIVERSITY* forward. We trust that her passion for language, affinity for the natural sciences, and wide-ranging interests and curiosity will serve the magazine and its readers well, and we encourage you to make her acquaintance.

We are also very pleased to welcome two new staff members: **Mary T. Stamatel** is *DIVERSITY*'s associate editor and **Keia Woodson** is GRCS' administrative technical assistant. Mary's journalistic experience and support for our mission is a valuable complement to the magazine, and Keia is already hard at work on bringing our new database up to speed. We are grateful to have found them and appreciate their skills, energy, and commitment.

Serving Our Readers Better

Following Bill Brown's lead, we have always viewed *DIVERSITY* and its subscribers as a community. That means that we need your help and feedback if we are to effectively meet your information needs. Enclosed is a survey form that we ask you to complete and return to us, to let us know how we can change for the better. We are testing a number of new ideas and areas of coverage, and we want to know whether our approaches suit your needs. You can respond by return mail or by using an electronic form on our Web site.

We also want to hear about other resources we could provide beyond *DIVERSITY.* We started out 18 years ago with the goal of providing balanced information to the global genetic resources community; however, both the members of that community and the issues facing it have changed, and GRCS must keep pace. As new technologies allow us to broaden the scope and style of information that we provide, we will evolve accordingly, with your guidance.

And with your support, too … . We are a nonprofit organization, and *DIVERSITY*'s subscription rates have not increased since the magazine was founded. The subscription fees have never fully paid for our operations and we have survived on donations from foundations, corporations, and individuals, as well as funding from the U.S. government and multinational organizations. But we cannot grow and serve you better if we are solely dependent on these sources, and thus will be raising the subscription rates in the near future to help cover our shortfall. I also hope that you will contact us if you would like to make a financial contribution in support of our renewal effort.

We deeply appreciate your continuing interest in—and support of—our efforts to fully inform policymakers, scientists, and field workers about genetic resources issues. We aim to prove in the coming year that we merit your support and are continually evolving into a better source of information.

Skip Stiles
Executive Director

FROM OUR EDITOR

As Skip Stiles indicated in his message, these are exciting days at GRCS/*DIVERSITY.* We face many challenges, but view these as opportunities to build upon the existing strengths of the organization and the magazine. The seemingly endless possibilities inspire in us both enthusiasm for the work at hand and optimism for the future.

One of our primary challenges is to get the magazine onto a regular, reliable production schedule. In the past, the staff and Board have greatly appreciated your patience and understanding when the vagaries of the nonprofit world made it difficult to publish consistently. However, we realize that as information sources proliferate and the world becomes increasingly complex, it becomes even more important to provide you with timely information—and we are committed to doing so. Our goal for the coming year is to get each issue into the mail within two weeks after the end of the quarter.

We are also addressing the scope and style of *DIVERSITY*'s coverage. Science is advancing with breathtaking speed, policy is evolving at a similarly rapid rate, and technology and economics are driving science and policy. How is a quarterly publication to keep pace and remain valuable to its readers? We believe the answer lies in adding value—in other words, in providing our readers with coverage that puts developments into a larger context and helps the reader make sense of a sometimes-overwhelming profusion of information.

To that end, two of 2001's four issues will be special-focus issues in which non-news coverage will revolve around a particular topic. Vol.17, No.1 will be devoted to medicinal plants and nutraceuticals; No.3 will focus on globalization's effects upon the genetic resources community. We believe that alternating special-focus issues with general-coverage issues is the best way to give our readers both depth and variety; as the year goes by, please let us know whether or not you think we're right about that.

We also intend to add continuing features and increase the number of contributing editors. A regular column about the relationship between small-scale husbandry and genetic resource conservation premiers in this issue (see p. 25), and a companion plant column will debut in the next issue. Our current contributing editors provide excellent coverage of science and policy, and we will add a few more in order to offer other perspectives on the conservation and use of genetic resources, such as that of business.

You also may notice some design and layout alterations in the coming issues. Although we do not intend to change for the sake of change alone, we do believe that some design changes may make the magazine easier and more pleasurable to read.

In short, *DIVERSITY* is alive and well and still growing. Like good breeders, we are always searching for better traits to incorporate into it, always trying to produce a magazine that suits our readers' needs. We need your help to do so, though—your feedback is essential if we are to breed a better magazine. Whenever something in *DIVERSITY* delights or dismays you, please pick up the phone or dash off an e-mail to let me know. Although we won't be able to please every subscriber all of the time, we will carefully consider every suggestion and make every attempt to meet your needs.

It is an honor and privilege to assume responsibility for *DIVERSITY,* and I look forward to the challenges that lie ahead. My most fervent hope is that the magazine will continue to evolve in ways that surprise, engage, and interest us all.

Ruth Batik
Managing Editor

ANNOUNCEMENT

Genetic Resources Communications Systems, Inc.
The nonprofit publisher
of
DIVERSITY

CALL FOR NOMINATIONS

for

The William L. Brown Award for Excellence in Genetic Resources Conservation

The Board of GRCS, the staff of *DIVERSITY,* and the family of William L. Brown are pleased to announce the second annual award to an outstanding individual in recognition of contributions made in the field of genetic resources conservation and use.
— The award carries a cash prize of $10,000. —

REQUIREMENTS FOR AWARD NOMINATION

The William L. Brown Award for Excellence in Genetic Resource Conservation is open to men and women of all countries. To be considered, all nomination packages must include:

- A cover letter from a recognized professional or institutional official nominating the individual. Please provide contact information on the person being nominated (phone, fax, or e-mail).
- Full curriculum vitae and résumé of accomplishments giving the basis for the person's nomination
- At least two letters of support from individuals other than the person writing the letter of nomination
- Two additional references, with contact information (phone, fax, e-mail), from individuals other than those writing the letter of nomination and the letters of support. (Thus, a total of at least four additional references must be provided.)

All documentation should be received by GRCS no later than May 1, 2001.
The winner will be announced in Vol.17, No.4 of *DIVERSITY* (last issue of 2001).

This award is made possible through a generous contribution by
the Sehgal Family Foundation
to honor the work and memory of
William L. Brown
Distinguished scientist, businessman, humanitarian,
and founder of ***DIVERSITY***

Send nominations by mail, fax, or e-mail to:
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Carlos Ochoa Is Named First William L. Brown Award Winner

Intrepid Perúvian Plant Collector Has Discovered 80 Wild Potato Species

Genetic Resources Communications Systems, Inc. (GRCS) announced in late December that Carlos M. Ochoa, whose more than 40 years of genetic-conservation and plant-breeding work are marked by scientific achievement and the esteem of his peers, is the recipient of the first William L. Brown Award for Excellence in Genetic Resources Conservation. "We are proud to honor this man who labored for years in a developing country with limited resources and accomplished so much," said Selection Committee Chairman Don Plucknett.

Ochoa welcomed the award as "a great affirmation for someone who has dedicated his career to collecting and using genetic resources." Moreover, he said, the $10,000 cash prize will help underwrite publication of his works in progress. He lamented the difficulty scientists—particularly those in developing countries—face in trying to publish their work, and expressed his appreciation for such support.

Ochoa is currently senior scientist emeritus and consultant to the International Potato Center (CIP), one of the 16 worldwide Future Harvest Centers funded by the Consultative Group on International Agricultural Research (CGIAR). He helped establish CIP and officially joined in 1974 as head of the taxonomy department, becoming one of the major architects of CIP's World Potato Germplasm Collection. Over the course of his career, he conducted more than 100 plant-rescue expeditions—often financing them himself—in the central highlands of México, the Andean highlands of Bolivia, Colombia, Ecuador, Perú, and Venezuela, and the Chiloé Archipelago in southern Chilé.

CGIAR Chairman and World Bank Vice President Ian Johnson expressed delight at the recognition of Ochoa's work. "[He] has had to face incredible odds—not just the challenge of finding wild potatoes, but the realities of crossing paths with bandits, guerrillas, and foreign police," Johnson said. "None of this deterred him, and [his] vision and exceptional scientific achievements have had an enormous impact on the development of agriculture and improvement of rural life in Perú and the Americas … . This is a fine example of good science making a real difference in the lives of the poor."

Hubert Zandstra, director general of CIP, said that "[Ochoa's] life story is intimately tied to the potato, and to CIP. He has contributed immeasurably to the body of knowledge on this important crop as well as to the collection and use of valuable potato genetic resources."

Zandstra also characterized Ochoa as "part scientist, part research entrepreneur, and part adventurer." His research expeditions were often dangerous: Once, Perúvian bandits mistook him for a competing treasure hunter and tried to kill him by rolling boulders down a mountainside. Another time, he barely escaped the eruption of a long-dormant volcano in Colombia; although the eruption destroyed the population of the wild species he was collecting, he managed to get away with a few prize specimens.

Ochoa has discovered 80 wild potato species, about a third of those known to exist. These plants are important sources of genes that can be bred into cultivated varieties to make those varieties more resistant to significant potato diseases, such as late blight.

One of Ochoa's greatest satisfactions, however, was the rediscovery of a potato first described in the 1830s by Charles Darwin, the English naturalist who formulated the theory of evolution. Until Ochoa finally found the potato growing in a windswept cove of the Chiloé Archipelago, it had not been seen for 150 years. Once he found the live plant, he was able to prove that it was not a wild species, as Darwin had suggested, but rather an "escape" potato—a cultivated species that had reestablished itself in the wild, probably after being brought to the islands by fishermen or seal hunters for food. Aside from its significance as an historical scientific curiosity, the potato is valuable because of its tolerance to soil salinity.

The son of a wealthy landowner, Ochoa was born in the vicinity of Cuzco, Perú. He holds degrees from the University of San Simón (Cochabamba, Bolivia), the University of Minnesota (USA), and the University Ricardo Palma (Lima, Perú).

Preserving His Nation's Plant Genetic Heritage

Although Ochoa started his career by crossbreeding wheat in a Perúvian agricultural research station, he began to question why he was focusing on that crop when another essential one—the potato—had originated in the mountains nearby. He decided he had a moral obligation to collect and assemble in one place all of the different species of potatoes, before societal changes, development, and environmental degradation led to their extinction.

To that end, Ochoa founded and directed the potato-breeding programs of Perú's Ministry of Agriculture and the National Agrarian University (NAU). As a professor, he inspired a similar enthusiasm in his students, and at least a dozen of them now carry on his legacy at CIP. In a conversation with *DIVERSITY*, he said that he tried to challenge and encourage students "with all my heart and effort," and colleague Merideth Bonierbale testified to his infectious curiosity. After their first meeting, she said, "his follow-up to me by mail outlined a lifetime of queries, half to challenge technology, half to stimulate a new friend and decidedly naïve student, and certainly in the interest of probing scientific frontiers."

CIP Director General Zandstra describes Ochoa as "part scientist, part research entrepreneur, and part adventurer."

Photo by Alejandro Balaguer; courtesy of the International Potato Center.

Ochoa has collected and classified more than 12,000 accessions of wild and cultivated potato species, which are grouped in approximately 3,500 different morphotypes. Although he no longer takes an active role in collection and curation, he maintains a full work schedule and is now preparing documentation of his personal collection for donation to key Perúvian and U.S. institutions, such as the National Museum of Natural History in Lima and the Smithsonian Institution in Washington, DC.

Dieter Wasshausen, curator of the Department of Botany at the Smithsonian Institution's Museum of Natural History, has done field work with Ochoa in Perú and credits him with laying the foundation for genetic resources management in that country. "He was instrumental in bringing back [into use] these native species of potatoes and in introducing modern potato-breeding techniques," said Wasshausen, adding that a great many collectors and breeders the world over owe him a debt of gratitude. Ochoa has already

contributed a number of specimens to the Smithsonian's major research collection.

But as Wasshausen noted, Ochoa has done more than collect. He developed at least a dozen potato varieties—including such highly productive strains as 'Mantaro,' 'Tomasa Condemayta,' 'Yungay,' and 'Renacimiento'—that are now commercially cultivated on almost 70,000 hectares, approximately one-fifth of Perú's total production area.

A prolific author, Ochoa also has published more than 100 scientific articles on potato taxonomy and breeding, including "Selección de Híbridos de Papa." His books range from 1962's *Los Solanum Tuberíferos Silvestres del Perú* (Sect. *Tuberarium*, Subsect. *Hyperbasarthrum*) to *The Potatoes of South America, Vol.1: Bolivia*, which was published in 1990 (*Vol.2: Perú* is forthcoming).

Ochoa's contributions to science and agriculture have been acknowledged at home and abroad. Named "knight of the Order of Agricultural Merit" by the president of Perú and distinguished economic botanist by the Society of Economic Botany, he also was awarded the Bernardo A. Houssay Inter-American Science Prize by the Organization of American States (see *DIVERSITY*, Vol.8, No.4, pp.6-7), as well as other honors. Carlos Ochoa will receive the Brown Award in a formal ceremony that will take place in Washington, DC later this year.

Over 30 world-class scientists were nominated for the 2000 inaugural William L. Brown Award, and these names will be held over for the 2001 competition; GRCS welcomes additional nominations (see p. 3). Jitendra Srivastava, member of GRCS' Board of Directors and chairman of the Brown Award committee, thanked members of the selection committee—internationally recognized experts in plant genetic conservation—for their service in choosing the winner.

The William L. Brown Award for Excellence in Genetic Resources Conservation was established by the Sehgal Family Foundation in order to recognize Bill Brown's lifelong efforts to collect, preserve, understand, and share plant genetic resources. Brown was Pioneer Hi-Bred International, Inc.'s first Ph.D. research scientist, and later became CEO of that seed company, the world's largest. As the first chairman of the National Academy of Sciences' Board on Agriculture, he initiated a landmark global study on genetic resources and worked tirelessly to assure future food security. Brown also founded *DIVERSITY* magazine.

—RB

Change Was in the Air at CGIAR's International Centers Week

Federation Plan Said To Go Too Far, Not Far Enough

The future structure and direction of the Consultative Group on International Agricultural Research (CGIAR) was the main topic of discussion at International Centers Week 2000 (ICW2000). Held in Washington, DC on October 23-27, ICW2000 spotlighted the continuing work of the International Agricultural Research Centers (IARCs), the emerging challenges to food security (such as climate change and HIV/AIDS), and the outstanding achievements of CGIAR scientists and support staff. But the governance issues that will determine the system's future clearly dominated the meeting agenda and participants' thoughts.

CGIAR Chairman Ian Johnson opened ICW2000 with an overview of global environmental, political, and economic changes that affect the system's ability to fight hunger and poverty. If the CGIAR is to effectively fulfill its mandate in this rapidly evolving environment, he said, it must:

- maintain science and research at the IARCs at the highest levels;
- transform itself into a "new age" institution characterized by lightness, agility, responsiveness, and cost-efficiency;
- strengthen its position as a producer of global public goods;
- redefine a framework for partnerships;
- keep its funding stable and secure; and
- devise the most effective means of linking its research with that of national development programs.

Johnson stressed that changes in the CGIAR system must be holistic and participatory, and that the principle of subsidiarity (i.e., working closely with end users) must remain preeminent. However, he said, to remain relevant and productive, the CGIAR must eliminate redundancies and form creative partnerships with the private sector and civil-society organizations, as well as with other national and multilateral research organizations.

But a large, cooperative system such as the CGIAR does not change easily. Though stakeholders share the same overarching goals, they often disagree on means of achieving them or prioritize functions differently. A system-wide review was first done in 1976, with a second following in 1980; most of the modest recommendations arising from these were approved. The third review, however, was not completed until 1998. Although the latter's science and strategy recommendations were relatively well-accepted, its governance and finance proposals—which centered on the creation of a new, central body with legal status—were highly controversial. This raised a host of fundamental questions about the nature and aims of the CGIAR system.

Proponents believe that the federation model would preserve the strengths of the present system while eliminating some of its weaknesses.

At ICW1999, the Oversight Committee commissioned a Study Team on System-Wide Reviews in the CGIAR to report on concepts, options, and recommendations. The Study Team's report, which was presented at ICW2000, noted that a variety of the factors—including complexity of the system, composition of the review panel and subpanels, and inadequate preparatory work to identify issues and get stakeholder consensus—combined to dilute the effectiveness of the third review. Its value lay, the authors said, in setting the stage for the current round of evaluation, which included high-level meetings with donors and the IARC directors.

Federation Concept Gets to the Heart of the Matter

Charged with integrating the outcomes of these meetings, the Synthesis Group proposed a CGIAR federation with regional research programs that would translate into a global research agenda, which was approved by the Committee of Board Chairs (CBC) and the Center Directors' Committee (CDC). Under this model, the IARCs (16 at present, but the number would evolve over time) would form a federation with a unified legal structure and an independent board of 9-11 members. A small Federation Office would assume many of the responsibilities now held by the World Bank-based CGIAR Secretariat.

The IARCs would work together more closely under the terms of a federation "Code of Conduct" negotiated by them.

Future Harvest, the CGIAR's nonprofit public-relations and fundraising arm, would assume a greater role in creating a coherent public profile for the IARCs. The federation would collaborate more closely with the Food and Agriculture Organization (FAO) and the United Nations Development Program (UNDP). It also would develop "a suitable set of standards and possibly accreditation mechanisms" to assure the quality of the CGIAR's scientific work.

Proponents believe that the federation model would preserve the strengths of the present system while eliminating some of its weaknesses. Streamlining the coordination of the IARCs and eliminating redundancies and bureaucracy, they say, would enhance efficiency, strategic management, and cooperation across the system, without radically restructuring the existing IARCs or their modes of operation.

Others, however, see problems with the model. The Rural Advancement Foundation International (RAFI), for instance, says that the federation would preserve the status quo; it recommends a total overhaul of the IARCs. In RAFI's preferred scenario, the 16 IARCs would evolve into seven or eight regional organizations that would serve as "research provocateurs," identifying research needs and facilitating, rather than undertaking, research within their spheres of influence. RAFI joins many others in arguing for greater inclusion of developing-country perspectives and greater transparency and consultation.

> ***"Let this new century be Africa's century for agricultural development, and let CGIAR show the way."***
> **—Robert Picciotto**

U.S. Agency for International Development Research Advisor and Study Team member Dana G. Dalrymple, on the other hand, believes that the federation proposal moves too far, too quickly. In personal remarks prepared for ICW2000, he questioned the assumptions in the Synthesis Group's report about, among other things: increased efficiency ("Nothing is said about the direct or indirect costs of the intensified regional process"); streamlined decision-making (the elimination of mid-term meetings (MTMs) would make the system less representative and consultative); and the nature and role of the Technical Advisory Committee (proposed changes could dilute the committee's international and scientific focus). Overall, he favors a go-slow approach.

Mervat Badawi of the Arab Fund for Economic and Social Development was one of those who questioned whether the proposal's ultimate aim is clear, saying it is "still a moving target." She said she doesn't think that shareholders are agreed on the concept of federation, and many are concerned that the system will spend millions of dollars on governance issues yet still "end up at square one." India's Agriculture Secretary Rajendra Singh Paroda, among others, objected to the "corporate" model, and wondered whether its focus on efficiency and marketing was entirely consistent with the CGIAR's mission of providing public goods to help alleviate hunger and poverty.

Although some—such as Dalrymple and Tetsushi Kondo of Japan's Ministry of Foreign Affairs—felt that changes should not be made too quickly, many participants were concerned about the effects of a drawn-out change process on mission and morale. Stein W. Bie, director general of the International Service for National Agricultural Research (one of the IARCs), received a round of applause when he said that his staff is wary of the current uncertainty about the future and that "we need to have a clear direction set by MTM[2001]." A number of other participants urged that decisions about reorganization be made in a timely fashion, and Ian Johnson strongly agreed that "we need closure" and pledged to lay the groundwork for a decision at MTM2001 (which will be held in Durban, South Africa from May 21-25).

The presentation made on the final day of ICW2000 by Robert Picciotto, director general of operations evaluation at the World Bank and a close associate of Ian Johnson, underlined the impetus for change. He reported that the independent Operations Evaluation Department (OED) had just launched a review of global public

GOVERNANCE ISSUES DIDN'T ECLIPSE PLANT BREEDING AND GERMPLASM

Donald Duvick of Iowa State University presented the results of a plant-breeding review, which was requested by the Technical Advisory Committee. He said that traditional breeding accounts for approximately 75% of breeding expenditures within the CGIAR, with the other 25% going to biotechnology. (According to Duvick, marker-assisted selection (MAS), which accounts for most of the biotech expenditures, is at a satisfactory level of use within the system, but "we are still in a learning phase" regarding this technology.) He reported that the biggest concerns facing IARC scientists are intellectual property rights (IPR), biosafety (e.g., testing of transgenics), and public education (the IARCs should provide unbiased scientific information).

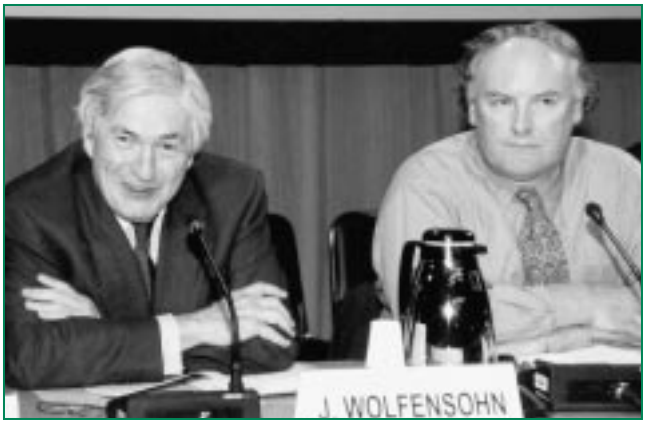
Duvick noted that there is a positive trend toward an increasing number of collaborations with advanced research institutions, both public and private. He said that there are tremendous synergies within the CGIAR—such as shared crops and breeding techniques, IPR issues, technical systems, and equipment (e.g., molecular)—and between the CGIAR and other entities, and that the latter should be explored to a greater degree. For example, in addition to working more closely with the private sector and the NARSs, IARCs might outsource the development of hybrids to small, indigenous seed companies, or might do work for other entities for a fee. He concluded that biotechnology is essential to future breeding success, and that collaboration may be the best way to exploit these technologies without investing substantial additional funds.

The Genetic Resources Policy Committee (GRPC) also submitted a report from its 11th session, which took place in early September. Concerning the FAO's International Undertaking, the GRPC strongly encouraged negotiators to include all of the main crops on which the CGIAR works, and warned of the dangers of not doing so: "Omission of any of these crops might send a signal that either the crop is not viewed as particularly important or that conservation and breeding work can effectively be handled solely by national governments without multilateral or CGIAR assistance." Research, the report says, shows that virtually all countries rely heavily on CGIAR germplasm.

The GRPC also cautioned against suggestions to combine the genebanks and impose a central management authority. It stressed the importance of managing the genebanks so as to achieve "maximum synergies" between their conservation work and the breeding programs of the IARCs, which continue to be the primary users of the conserved material.

Both the GRPC and the CDC reacted to concerns voiced by RAFI over the draft of the revised Guiding Principles on Intellectual Property Relating to Genetic Resources. The GRPC said that "the rapidly changing IP environment means that more decisive action is required to ensure that the products of CGIAR research with its partners remain in the public domain" and that CGIAR therefore "retains the right to defensive protection of inventions when this is in the best interests of the resource-poor." The CDC statement said that the IARCs "have and always will operate in full compliance with relevant intergovernmental agreements and national laws" and thus will advise recipients of pertinent protections, but expressed concern that the growing number of such agreements "may threaten the integrity of international public-sector agricultural research and the public goods resulting from that research." It urged all parties to work together to resolve these problems.

policies and programs "because of the urgent need to reverse global trends which do not appear to be sustainable." Although lauding the CGIAR's proud accomplishments over the years, he noted that "[a]ny partnership network needs constant realignment in a changing world, since context matters for collaborative relationships grounded in mutually agreed objectives, shared responsibility for outcomes, distinct accountabilities for results, and reciprocal obligations." In order to remain relevant, Picciotto said, the CGIAR must objectively examine its goals and procedures, make tough decisions, and be prepared to act and change.



World Bank President James Wolfensohn and CGIAR Chairman Ian Johnson speak on the opening day of International Centers Week.

Photo courtesy of CGIAR.

Picciotto paid particular note to the 40% of resources allocated to Africa, and said that the CGIAR system should reexamine that continent's needs and aims to ensure optimal use of those resources. "Let this new century be Africa's century for agricultural development," he said, "and let CGIAR show the way."

Similarly, a report submitted by a group of leaders of African National Agricultural Research Systems (NARSs) expressed enthusiasm for a leaner, more strategically oriented CGIAR system. It said that IARC scientists should add value to, rather than duplicate, the work of the NARSs, but also that there is an invaluable role for the IARCs in providing specialized services (particularly in terms of facilitating the public-sector research community's relationship with the private sector). The report endorses the "non-political, international character" of the system and says it should remain under one institutional and organizational umbrella. It also suggests that "[t]he CGIAR and IARCs in Africa should be reorganized into two regional centers—one for western and central Africa and the other for eastern and southern Africa"—and diplomatically recommends that an "independent management company/organization should be appointed to design a new structure."

Although no consensus was reached on organizational restructuring, ICW2000 did yield agreement on some general goals that will lay the foundation for long-term change. These include working more closely together and pooling common services whenever it is cost-effective to do so, implementing the proposed bottom-up priority-setting approach in at least one region, and reviewing the composition and procedures of the IARCs' Boards. CGIAR also will explore the feasibility of holding only one meeting per year, initiating electronic means of keeping stakeholders informed and engaged between meetings, and conducting those meetings more efficiently.

In line with the last of these "quick-win" aims (i.e., implementing a coordinated public-awareness and resource-mobilization program), the role of Future Harvest will be expanded and the IARCs will now be known as *Future Harvest Centers.* The Finance Working Group recommended that Future Harvest be "restructured, staffed, and funded" at a level that will allow it to form the foundation of an enhanced public awareness/resource mobilization initiative. Cost of the initiative is estimated at $2.1 million in year one, which would grow to $2.6 million by year five.

In order to fulfill Johnson's pledge of action at MTM2001, a Change Design and Management Team—charged with generating concrete proposals for improving the CGIAR's governance, organization, and structure—will report to an ad hoc Steering Group. Empowered at ICW2000 to coordinate the change process on CGIAR's behalf through MTM2001, the 22-member Steering Group is composed of four IARC directors/board members and 18 representatives of cosponsors, contributors, developing countries, foundations, and partnership committees.

Building for the Future

Throughout ICW2000, there was sustained emphasis on increasing the developing world's participation in the system, both in practical and financial terms. Eliseo Ponce, director of the Philippines' Bureau of Agricultural Research, urged the developing world to see the CGIAR as an investment in its future, and encouraged developing countries both to increase their financial contributions and work more closely together within the system. México's Jorge Kondo-Lopez agreed, but said that developing countries must feel like owners and partners in the system if they are to fully participate. Joseph Mukiibi, director general of Uganda's National Agricultural Research Organization, urged participants to assess needs and priorities at the grassroots level; if this is done, he said, local agendas will build into a global agenda and developing countries will be more involved.

Financial considerations were another major issue reviewed at ICW2000, and the Finance Working Group's report proposes a three-tiered strategy of stabilizing official development assistance (ODA, which declined by 50% from 1987-97), increasing financial contributions from developing countries, and attracting non-traditional (i.e., private-sector and philanthropic) support. IARC financing plans were endorsed at identified levels and an overall CGIAR research budget of $340 million was approved. The World Bank will contribute $45 million and will resume the chairmanship of the Finance Committee.

Participants also paid tribute to Roberto Lenton, who left his post at UNDP to join Columbia University's International Research Institute for Climate Prediction, and CGIAR Executive Secretary Alexander von der Osten, who is retiring in February. Von der Osten will be succeeded by Francisco Reifschneider, formerly head of international cooperation at the Brazilian Agricultural Research Corporation. Reifschneider has extensive national and international experience, as well as a long history of working with the CGIAR, FAO, and World Bank.

Although uncertainty and some tension were in the air at ICW2000, the winds of change blew strongly. Timothy Reeves of CIMMYT, the International Maize and Wheat Improvement Center, may have offered the best reason to adapt to new ways of doing business: "The biggest risk is that science and technology will bypass poor people. As a community of the caring, we can't let that happen."

—RB

For further information, visit the CGIAR Web site at *www.cgiar.org.*

U.S. Public Plant Genetics Research Wins Big Increase in Federal Funding

Plant genetics conservation and research emerged as a big winner in the scramble for federal funding for Fiscal Year (FY) 2001. Recently signed agriculture appropriations legislation contains an increase of $3.6 million for the U.S. Department of Agriculture (USDA)'s National Plant Germplasm System (NPGS), the largest rise for any specific research program within the agriculture appropriations bill. Of the new funding, $3.0 million will support the core program of the NPGS, the largest annual increase in the NPGS budget in 20 years.

In separate FY 2001 appropriations action, funding for the National Science Foundation (NSF's) Plant Genome Initiative grew by $5 million to $65 million. Project 2010, a new 10-year initiative addressing plant functional genomics, received $25.5 million in funding for FY 2001.

USDA's Fiscal Year 2001 budget contains an increase of $3.6 million for plant germplasm research, the largest rise for any specific research program within the agriculture appropriations bill.

"We are quite pleased with the increase in funding for the NPGS," commented Joe Garbarino, budget officer for USDA's Agricultural Research Service. Henry Shands, director of the National Seed Storage Laboratory, also applauded the increase. Although he noted that the $3.0 million won't support the hiring of needed scientists or the undertaking of additional initiatives once it has been distributed among the 15 NPGS sites, he said it will enable them to make crucial building repairs and other mundane-but-essential improvements that have been deferred due to budgetary constraints.

The seed industry, too, was gratified by the budget results. Kellye Eversole, lobbyist for the American Seed Trade Association (ASTA), hailed the rise as a major victory, and attributed it to an aggressive and consistent lobbying presence over the past two years. ASTA and a 26-member coalition of supporting organizations assembled by the association were able to secure Administration support for substantial new funding of NPGS for the first time.

"Support from the Administration was the crucial factor in more than doubling the annual increase in NPGS funding, from a $1.675 million increase in FY 2000 to the $3.6 million rise achieved this year," Eversole noted. The lobbying coalition included industry associations for major crops such as barley, corn, cotton, rice, soybeans, sugar beets, and wheat. Also supporting the effort were scientific bodies such as the Crop Science Society of America, the American Society of Agronomy, and the Soil Science Society of America.

Shands lauded Eversole's efforts on behalf of the coalition. "She's educated a lot of people and worked hard on the Administration side to retain that type of money in the budget. That's been a very positive thing."

Besides the $3.0 million rise in core NPGS funding, an additional $912,500 was approved for "germplasm evaluation and enhancement," of which $600,000 is slated for allocation to the NPGS budget for use in germplasm acquisition and maintenance. (The remaining $312,500 is expected to be applied to non-NPGS-related plant-breeding and germplasm-enhancement efforts.) The total FY 2001 NPGS budget stands at just under $29.2 million.

(Another beneficiary of increased appropriations for plant germplasm work is the National Turfgrass Evaluation Program (NTEP), which is not a part of the NPGS. Executive Director Kevin Morris reports that the legislation provides for funding of a new turfgrass scientist position at NTEP, the first full-time turfgrass research position created within USDA since 1988. The new scientist will be charged with, among other things, collecting grasses growing in harsh environmental conditions in order to find new genetic resources for improved tolerance of drought, heat, cold, insects, diseases, and wear. For further information on NTEP and other turfgrass research, see the special-focus turfgrass issue of *DIVERSITY,* Vol.16, Nos.1&2.)

Plant Genomics Also Receives a Major Funding Infusion

A sustained lobbying presence should also be credited, Eversole said, for the marked rise in federal plant-genomics funding. The National Corn Growers Association (NCGA) has led the charge in lobbying for funding increases for the Plant Genome Initiative (PGI), which supports DNA sequencing research on economically significant plants, including maize. The NCGA has made the PGI budget its highest priority appropriations issue for the past five years. Initially funded at $40 million in FY 1998, PGI appropriations have grown rapidly, reaching $50 million in FY 1999 and $60 million in FY 2000.

This year's increase of $5 million for the PGI was accompanied by an additional $25.5 million for the new Project 2010 initiative. Project 2010 will be a ten-year effort to elucidate the functional genomics of *Arabidopsis thaliana*, a relative of the mustard plant, which has the smallest genome of any flowering plant. An understanding of its functional genomics will serve as a shortcut to locating and understanding the function of genes in higher plants. The sequencing of *A. thaliana*—which was completed four years ahead of schedule due to the PGI, according to Eversole—laid the foundation for Project 2010.

The outgoing Clinton Administration has been very supportive of plant genomics research, Eversole commented. Within Congress, she noted in particular the support of Senator Christopher Bond (R-Missouri), chairman of the relevant Senate appropriations subcommittee.

Looking forward to FY 2002, Eversole expects funding for plant genomics and conservation of plant genetic resources (PGR) to be a priority for the Bush Administration, given strong industry support. In August and September, ASTA committed to continuing its support of lobbying on behalf of the NPGS budget, acknowledging the value of a consistent voice on these issues.

Eversole also is heartened by the support for public plant breeding and conservation of PGR expressed by the USDA's Advisory Committee on Agricultural Biotechnology (ACAB) at its November meeting. (See article on p. 10.) Having the support of a high-level advisory board such as the ACAB is always helpful to the cause, she said.

—KH

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Bioprospecting Debate Polarized International Congress of Ethnobiology, but "Call to Dialogue" Sets Stage for Further Discussion

The 7th International Congress of Ethnobiology (ICE)—hosted by the Department of Anthropology at the University of Georgia (Athens, GA, USA) from October 23-27—almost became a battleground as participants focused on the hot topics of ethnobioprospecting and benefit sharing. Increasingly relevant to researchers collaborating with local communities in research and product-development projects, these subjects raise a host of potential cultural, economic, and scientific conflicts.

The biennial congresses of the International Society of Ethnobiology (ISE) have historically provided an important forum for the deliberations, debates, and dialogue that shape the evolving field of ethnobiology (which incorporates various disciplines focusing on the relationships between humans and their environments). Dialogue, in particular, has played an essential role, serving as a safety valve that can help release tensions arising from interactions among indigenous peoples, local communities, and the outside parties interested in studying or utilizing local knowledge and plant genetic resources. In the past, members of the society have used the congresses to share information, develop standards, and forge declarations in order to advance ethical research relationships with local and indigenous communities.

The commercial sector must be more sensitive to the critique of current research practices and utilize better models of working with local communities.

The meeting has grown since its inception in 1988 in Belém, Brazil; this year, more than 600 delegates came from 35 countries, and these included representatives of 16 indigenous organizations. (Representation from the Americas was particularly strong this year, though the U.S. venue made it difficult for many participants from other countries to obtain entry visas.) The voices of indigenous groups contribute to the uniqueness of this congress, and it was formally noted that increasing the representation of indigenous groups and developing countries is one of the major tasks that still lies ahead for the ISE.

The pharmaceutical and agricultural industries, however, were not represented at ICE. Many participants made note of this and said that the commercial sector—key actors in bioprospecting agreements—must be more sensitive to the critique of current research practices and utilize better models of working with local communities.

Participants Struggled to Find Common Ground

The search for consensus on ethnobioprospecting was the main topic of both the Ethics Committee meetings and the two-day Conference on Bioprospecting and Benefit Sharing. (The latter preceded the congress and was hosted by Brent and Elois Ann Berlin of the University of Georgia.)

In previous years, the Congress has forged statements such as the Declaration of Belém (1988) and the ISE Code of Ethics (1998), which focus the international community's attention on equity and ethical conduct. Though non-binding, these declarations provide important guidelines to ethnobiologists and other researchers on the technical aspects of collaboration with local communities (e.g., collection of materials and development of databases and publications). They also establish general principles for reducing the adverse effects of research and development projects on local communities, and recognize the rights of indigenous peoples, traditional societies, and local communities.

According to Ethics Committee Chair Maui Solomon, past debates have focused primarily on access and have used Western conceptions of rights and resources. He said that new protection systems must be developed that include "an understanding and appreciation of the local and indigenous values that underlie the relationships between communities and their resources."

The Ethics Committee meetings were monopolized by debate over the Maya International Cooperative Biodiversity Group (Maya ICBG), which collects and analyzes plant samples in order to develop commercial pharmaceutical products for local, national, and international products. The debate revealed the current polarization on bioprospecting and raised concern over whether it can be practiced in ways that do no harm to local communities. Many participants agreed with 7th Congress President Maurice Iwu, who warned that this form of applied ethnobiology must not become caught in "paradigm paralysis," and that "the greatest threat to communities is their exclusion from the global economy." Others, including representatives of the Rural Advancement Foundation International (RAFI), supported the idea of a moratorium on bioprospecting that would remain in effect until legislation is developed to protect communities and their resources, or until communities draft their own agreements to regulate access to knowledge and resources.

While acknowledging that bioprospecting is a global reality, many participants worried that current systems might not adequately protect community ownership of resources. Tom Carlson, an associate professor at the University of California-Berkeley, said that bioprospecting agreements must take into account a series of societal levels, "from the local community, to groups of local communities, to entire ethno-linguistic groups." Carlson and Onel Masardule of the Indigenous Knowledge Program agreed that this type of negotiation and consensus is an important precondition for research and a necessary part of respecting communal rights and local ownership regimes. Both also agreed that the implementation of Prior Informed Consent is one of the most important elements of any bioprospecting agreement. Masardule emphasized that, "before starting research, there need to be clear agreements and mutual respect between scientific investigators and indigenous communities."

A number of key points related to the current practice of bioprospecting were discussed in the workshop's "Call to Dialogue," a draft that outlines a set of recommendations resulting from the pre-congress bioprospecting workshop and the Ethics Committee meetings. The document, which will be open for comment on the Web and slated for discussion in the Congress of 2002, reflects the wide divide over bioprospecting—even at the level of arriving at common terms of discussion. (One example noted in the text is disagreement over the use of the term "stakeholder," which "assumes an equity among interested parties which is inappropriate.") The document recognizes the need for legal support of indigenous peoples' institutions and community regulation of research in order to assure transparency and accountability.

It also reaffirms the rights of indigenous peoples and communities to refuse access to bioprospectors, as well as to receive equal benefits resulting from resource development where such development is permitted. Other recommendations include the development of "mechanisms to value the contribution of traditional knowledge to research and product-development processes as a condition that must precede the sharing and allocation of benefits."

ICE Is an Invaluable Forum for Open Discussion of Diverse Topics

In addition to providing a space to discuss contentious issues, the congress showcases contemporary work in ethnobiology. ICE plenary sessions focused on topics such as women and biodiversity, patenting and protection of cultural property, and linking traditional knowledge to ecosystem management. Poster presentations and concurrent sessions considered subjects ranging from medical ethnobotany, ethnoecology, and ethnoentomology to resource management and knowledge ownership and protection. These sessions simultaneously reaffirmed the importance of ethnobiological research as a means of promoting conservation and raised the problems associated with the development and application of collaborative research.

Despite—or perhaps because of—the serious conflict over bioprospecting, all participants seemed to agree that the ICE must continue to provide a forum for open discussion of issues related to the practice and application of ethnobiology. Darrel Posey, one of the founders of the ISE, said that bringing diverse actors together to work through controversial issues is one of the congress' most important functions. Though this year's open confrontation risked widening the divide among researchers and representatives of indigenous groups and communities, the dialogue that took place around it also helped participants find some common ground.

However, with respect to the creation of a model of bioprospecting that not only respects the rights of indigenous peoples and local communities but also shares the benefits of research and product development with them, it seems there is still a lot to talk about.

—AK

For further information, visit *http://gualart.dac.uga.edu/ISE/.*

In Rare Show of Unanimity, U.S. Biotech Advisors Back Funding Hike for Public Plant Breeding—But Will ACAB's Progress Be Short-Lived?

At their third meeting, held November 29-30 in Washington, DC, members of the U.S. Department of Agriculture (USDA)'s Advisory Committee on Agricultural Biotechnology (ACAB) endorsed increased public support for plant breeding and conservation of plant genetic resources (PGR). Participants were struck by the degree of consensus on the importance of public plant breeding research that emerged among ACAB members, who represent diverse perspectives and interests. ACAB also took up the more controversial issue of gene flow between genetically modified (GM) and conventional crops, but the November discussions were preliminary and did not develop any definitive recommendations for action by USDA.

The statement on public plant breeding approved by ACAB members is as follows:

In order to reverse current and projected trends, and to better serve the public good, the USDA's Advisory Committee on Agricultural Biotechnology (ACAB) recommends that USDA take steps, through budgeting, planning, and requests for proposals, to greatly strengthen U.S. capacity in public-sector plant breeding and conservation of plant genetic resources. The ACAB will provide suggestions or priorities and justifications.

The wording of the statement was intentionally vague, in order to enable all ACAB members to sign on, despite disagreements on some of the details of what constitutes research that is "truly in the public interest." "As with many of these things, the devil is in the details," remarked ACAB member Michael Hansen of the Consumer Policy Institute.

Chairman Dennis Eckart appointed seven committee members to an ACAB working group on public plant breeding. They are: James Cook, Washington State University; Charles Johnson, DuPont (retired); Mary Howell-Martens, organic farmer; Marshall Martin, Purdue University; Cal McCastlain, attorney; Margaret Mellon, Union of Concerned Scientists; and Michael Sligh, Rural Advancement Foundation International. The group's charge was not finalized due to time constraints, said ACAB Executive Secretary Michael Schechtman. Proposed goals and guidelines are being distributed to all committee members for comment.

Meeting participants expressed diverse views on the subject of public-sector plant breeding, according to ACAB member Marshall Martin, professor of agricultural economics at Purdue University. Representatives of land-grant universities tended to emphasize the inadequate funding of genebanks as well as the importance of training more graduate students in traditional plant breeding methods (to stanch the flow of talent into private-sector, molecular biology research). Those representing the interests of organic farmers stressed the need for more research on so-called minor crops and on the development of varieties meeting the needs of farmers who choose not to go the GM route. "Despite the diversity of views, it was easy to reach agreement on issues requiring further thought," Martin observed.

"I entered the discussion with some skepticism," noted Rebecca Goldburg of Environmental Defense, "but there was much more consensus than I anticipated. Industry and NGO [nongovernmental organizations] interests were really not that far apart. There was clear agreement on the need for greater funding of public plant breeding that does not duplicate research being done in the private sector, as well as more funding for conservation of plant genetic resources."

Richard Lotstein of Syngenta echoed the sentiment, commenting, "I continue to hold out the hope that ACAB members can work together to make progress on these issues. There are people who want to reach middle ground, but it is hard to move if there are even a few who don't." (Syngenta is a recently formed company resulting

from the merger of Novartis' agribusiness concerns with the agrochemicals division of AstraZeneca.)

Hot Buttons: Gene Flow and StarLink

A second substantive focal point for the meeting was the issue of gene flow. Discussion centered on two questions: the impacts of gene flow from GM to conventional crops on farmers, shippers, and processors, and the role of USDA in addressing these impacts. (Although "gene flow" usually refers to cross-pollination between GM crops and non-GM cultivated or wild relatives, the ACAB discussions taking place under this rubric also touched on co-mingling of GM and conventional varieties in agricultural commodities.) The discussions were preliminary in nature, owing to uncertainty over the Bush administration's positions on these controversial issues.

Regarding co-mingling of GM and non-GM commercial seed, representatives of the American Seed Trade Association (ASTA) noted that "zero flow is not possible," and described the ASTA proposal for a standard of non-contamination equal to some fraction, e.g., 1% or less. Purdue's Marshall Martin noted that USDA has not embraced the ASTA proposal, but ACAB members informally encouraged USDA to work with industry and others on related issues, such as the purity and sourcing of seed and guidelines for international trade.

Some other themes that emerged from the discussion, according to Schechtman, were farmers' concerns about liability, the changing of ground rules during the growing season, and farmers' ability to meet end users' specifications. Representatives of food-processing concerns stated that, in the wake of the StarLink incident (see below), they were already spending considerable sums on testing products such as breakfast cereals for co-mingling. ACAB members concurred on the need for internationally agreed-upon standards for gene flow, but there was no discussion of who would set and enforce such standards, Schechtman said.

Three quarters of an hour on the second day was reserved for discussion of the StarLink case. StarLink is a GM variety of corn, approved in the U.S. for use in animal feed but not for human consumption. It was detected earlier this year in several brands of taco shells, forcing extensive recalls and testing of products containing corn flour.

The three federal agencies most actively involved in the response to the StarLink case—USDA, the Environmental Protection Agency, and the Food and Drug Administration—made presentations to the committee. Michael Schechtman characterized the proceedings as "largely an update" on the ongoing investigation of and response to the matter.

However, ACAB members representing environmental and consumer-protection groups expressed frustration with the short shrift given to the issues raised by the StarLink debacle. To them, StarLink was arguably the most important issue taken up during this meeting, and they viewed the paucity and lateness of discussion as "absurd."

"I entered the discussion with some skepticism, but there was much more consensus than I anticipated. Industry and NGO interests were really not that far apart."
—ACAB member Rebecca Goldburg

Whither ACAB?

With the departure of the Clinton administration, ACAB's fate is uncertain. USDA officials stated at the November meeting that they have funding for at least one more meeting, which they hope to hold in early spring 2001. However, any further meetings will be contingent upon the support of the incoming Bush administration (see box). The most influential people behind ACAB are on their way out—not only Agriculture Secretary Dan Glickman, but also his key aide Keith Pitts (a political appointee) and his former congressional colleague and current ACAB Chair Dennis Eckart. Glickman opened the November deliberations with an "impassioned plea," in the words of one observer, for continuation of the committee regardless of a change in leadership.

When asked in interviews with *DIVERSITY* to speculate on the committee's achievements and how these might persuade a new administration to keep it alive, ACAB members talked about concrete advances and intangible value.

Purdue's Marshall Martin outlined the significant impact ACAB has had on research in its short life. At the first ACAB meeting (held in March 2000), participants identified several areas in which the committee should make recommendations to USDA regarding research priorities. These recommendations were further developed and finalized at the second meeting in July (see *DIVERSITY,* Vol.16, No.3). At the November meeting, Kitty Smith of USDA's Economic Research Service reported that

Bush Names California's Ann Veneman as Agriculture Secretary

In late December, U.S. President George Bush nominated Ann Veneman to serve as U.S. secretary of agriculture. The only woman to have served as California's agriculture secretary (1995-99), Veneman is an attorney who specializes in food, agriculture, environment, technology, and trade issues. She has worked at USDA in a variety of capacities, most recently as deputy secretary of agriculture in the administration of Bush's father, George Herbert Walker Bush.

"I look forward to working with Ms. Veneman," said U.S. House Agriculture Committee Chairman Larry Combest (R-Texas). "She knows policy and the way things get done in Washington. All of us will be tested as we continue to strive to solve the problems that have been facing agriculture for several years, and her experience will be very important."

Veneman has strong trade credentials. In her role as U.S. deputy undersecretary of agriculture for international affairs and commodity programs, which she held from 1989-91, Veneman managed issues such as trade policy, trade negotiations, food aid, and other international issues. She was actively involved in the Uruguay Round of GATT negotiations, NAFTA, and the U.S.-Canada Free Trade Agreement. During her California term, she undertook trade missions to Asia and South America looking for new markets for California's agricultural products.

The Associated Press (AP) quoted Carol Tucker Foreman, director of the Consumer Federation of America's Food Policy Institute, as saying that the selection "was a really good start" for the Bush administration insofar as food and agricultural policy are concerned, and that Veneman understands that the USDA deals with more than just farming. She "will bring a modern view of the Department of Agriculture into that job," said Foreman. In California, Veneman was applauded for supporting the development of food-safety quality-assurance plans.

Insiders tell *DIVERSITY* that Veneman strongly supports biotechnology, and the AP story quotes her as having told participants in an agricultural biotechnology conference last year that, "We simply will not be able to feed the world without biotechnology." In California, she overhauled the Department of Food and Agriculture's strategic planning process to include a complete review of technology integration as well as business practices and organizational structure, and she advocates the use of high technology (including e-commerce) in agriculture. *—RB*

her division is moving ahead with ACAB recommendations regarding data collection and analyses of agricultural statistics related to biotechnology. Similarly, Glickman announced that funding is in place for the collaborative research between USDA and the National Academy of Sciences recommended by ACAB.

Martin stressed that the diversity and large size of the group have slowed the process of members getting to know one another and learning how to get along and make progress. Nonetheless, service on ACAB has been "a remarkably good experience so far, especially given the controversy and contentiousness," he said.

Michael Hansen credited ACAB's organizers for having achieved that broad representation of viewpoints and perspectives. "They made it a real point to get critics as well as boosters," he explained. Rebecca Goldburg was surprised at the number of industry representatives who wanted to take part in ACAB. She speculated that the committee's relatively large size was attributable both to USDA's positive response to industry interest in participating and a commitment to secure additional NGO representation in order to balance the membership.

Over the nine-month life span of ACAB, real-world conflicts over biotechnology issues—exemplified by the Terminator and StarLink controversies—have escalated, commented Mark Lipson of the Organic Farming Research Foundation. This tension has been reflected and even magnified in ACAB interactions. Yet Lipson continues to view ACAB as having "significant potential to build bridges between opposing camps." Only time and the political vicissitudes of Washington, DC will tell if those bridges will be built or burned.

—KH

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At Tri-Society Annual Meeting, U.S. Crop Scientists Grapple with International Issues

At the Crop Science Society of America's recent plant genetics symposium, T.T. Chang (see p. 27) set the tone with an impassioned plea for recognition of the importance of irreplaceable genetic resources, particularly as a means of providing for the world's poor. "Let us join hands and care for our only common biological heritage," said the retired principal geneticist of the International Rice Research Institute (IRRI) and 1999 Tyler Prize laureate, and everyone in the meeting hall affirmed that goal. But as other speakers pointed out, the real challenge lies in deciding how that will be done.

"Prospects for Genetic Resources: Stewardship or Neglect?" was held on November 7 in Minneapolis, MN. Organized by Stephen Smith of Pioneer Hi-Bred International, Inc. and Henry Shands of the U.S. Department of Agriculture's National Seed Storage Laboratory, the symposium was the centerpiece of a number of sessions addressing plant genetic resources conservation and use at the 2000 annual meetings of the American Society of Agronomy and the Crop Science and Soil Science Societies of America.

Several presenters addressed the policy complexities and funding shortages that plague global efforts to collect and conserve plant germplasm. Much of the discussion focused upon continuing attempts to reconcile the Food and Agriculture Organization (FAO)'s International Undertaking on Plant Genetic Resources (IU) with the terms of the Convention on Biological Diversity (CBD) and the operations of the multilateral and national germplasm collections.

The Devil Is in the Details

Henry Shands opened the symposium with a review of the political events shaping international discussions on plant genetic resources important to food and agriculture (PGRFA). Efforts to reconcile the inconsistencies between the IU and the CBD—the two major international agreements governing PGRFA—have been underway since the early 1990s. The major conflicts revolve around farmers' rights, intellectual property rights (IPR), and the list of crops to be included in the Multilateral System of Facilitated Access to PGRFA (MS), which will be listed in Annex I of the IU. Various laws enacted to implement these provisions at the national level further complicate the deliberations.

There was considerable discussion of the negotiations over the Annex I listings and the possible outcomes of the then-upcoming negotiations in Switzerland (see box), mostly dealing with future support for crop improvement. Henry Shands and a subsequent speaker—Cary Fowler of the International Plant Genetic Resources Institute (IPGRI)—worried that some countries were seeking to hold back crops from the Annex I listing in expectation of better treatment under bilateral exchange agreements for genetic material. Both speakers concluded that this strategy would lead to decreased donor support for crop improvement outside of the MS and could also negatively affect the Consultative Group on International Agriculture Research (CGIAR)'s genebank-improvement efforts (i.e., if CGIAR's funding were to decrease because of the uncertainty and controversy over the issue and workloads were to increase). Chang illustrated the problem by noting that Thailand's national rice collection is essentially closed to outside researchers, but is duplicated in IRRI's genebanks. Consequently, IRRI bears the expense of maintaining and distributing that collection's accessions.

Fowler noted that although some of the political and economic issues that are key to reconciling the IU and the CBD have been cast as developed- vs. developing-world conflicts, they are in fact more complicated. His reviews of requests for genetic material from the CGIAR system showed both that a great deal of germplasm is exchanged among developing countries and that developing countries are highly dependent on the international genebanks.

IPR issues—particularly differing definitions of "germplasm," "genetic resources," and "genetic material"—have greatly complicated these negotiations. John Dodds, who heads an IPR law firm, addressed some of these in his presentation, saying that resolution of definitional conflicts is

critical to both progress in the IU negotiations and efforts to secure private-sector support for the IU, the CGIAR, and national germplasm systems. Dodds cautioned that without public-sector involvement in IPR agreements on PGRFA, the private sector will go it alone.

These knotty problems aside, challenges exist even in more traditional spheres, such as budgetary appropriations. Kellye Eversole described her efforts, on behalf of the American Seed Trade Association, to boost funding for the U.S. National Plant Germplasm System (NPGS). Though the NPGS appropriation increased from $20 million in 1999 to $29.2 million in 2001, additional funding hikes are needed to maintain and operate a fully functional NPGS. To this end, Eversole reported, the number of groups supporting stepped-up NPGS funding has grown to 26 major food and agriculture organizations. (See related article on U.S. federal budget appropriations for plant genetic research on p. 8).

The Effects of Global Gridlock Are Already Evident

Participants were left with the impression that international wrangling over politics and legalities has resulted in a globally deteriorating situation. Chang noted that the pace of crop improvement in the public sector has slowed as the old hands of the Green Revolution are retiring and not being replaced. Shands reminded participants that funding for the CGIAR centers has been flat and the expected funding for the FAO's Global Plan of Action has not materialized. And since the private sector is not involved in the IU discussions, it has no incentive to provide financial support.

Fowler expressed concern that the lengthy negotiations have slowed essential work in the developing world. He said that between 1972 and 1990, for every crop and plant sample that entered the CGIAR system from a developing country, four went out. Currently this ratio is 1:60, due primarily to a drop in collection work in developing countries.

Conversation in the corridors during breaks confirmed the dire effects of this deadlock, as major-crop breeders discussed their inability to get samples from countries with whom they had longstanding agreements. One person obtained the samples he needed only through informal arrangements, and when the Cartagena Biosafety Protocol is fully implemented, these informal exchanges will be subject to penalties so that even this common practice between colleagues will cease.

Chang urged participants to do whatever is necessary to improve the situation. "As users and curators, we must put our hearts into our work," he said. The other speakers clearly shared his view that a rededication to the conservation and equitable management of PGRFA will be imperative in the coming months and years.

—SS

International Negotiators Backpedal on Open Access to Plant Genetic Resources

The rocky road of international negotiations on IU revisions got even rougher at the Fourth Intersessional Meeting of the Contact Group of the Commission on Genetic Resources for Food and Agriculture (CGRFA), which took place November 12-17 in Neuchâtel, Switzerland. The progress that was thought to have been achieved at the Contact Group's August meeting in Tehran quickly unraveled when a group of developed countries sought to revisit contentious issues (see *DIVERSITY*, Vol.16, No.3, pp. 3-4 for a report on the Tehran meeting).

The key area in which provisional agreements came undone was Article 14 on commercial benefit sharing. In Tehran, developing-country negotiators had tentatively agreed to compromise text calling for holders of IPR or other commercial protection restricting the use of materials accessed through the MS to pay royalties to an international fund. Several developed countries had agreed in principle, but said that final approval extended beyond their negotiating mandates and further consultation within their governments would be required. In Switzerland, four countries—the United States, Canada, Australia, and New Zealand—backpedaled on the issue and wanted the compromise text to remain in brackets, signaling that they consider the issue unresolved.

Also on the agenda at Neuchâtel were issues arising under Article 12 (Coverage of the Multilateral System), Article 16 (Financial Resources), Article 17 (Governing Body), and Annex V (Conditions for Participation of International Institutions in the MS and Placing of International *Ex Situ* Collections in the MS). Lengthy discussions were held on Article 16 and agreement was reached on most issues. Articles 12 and 17 were touched on only briefly.

The stalemate in Switzerland dashed hopes that the negotiations could conclude at a CGRFA meeting that had been planned for late January 2001. At the annual meeting of the FAO Council in Rome in late November, Contact Group Chair Fernando Gerbasi told the Council, "The only way to conclude our negotiations relatively rapidly will be through political commitment to conclude by a fixed date, not subject to more changes. … [T]hose countries that participate in the negotiation process need to send delegations at a sufficiently high political level that allows them to take decisions at the negotiating table itself."

It is now thought that Contact Group negotiations will resume sometime in early 2001, probably in February, with the CGRFA itself to meet in April. *—KH*

International Biodiversity Initiative Welcomes Participation of Genetic Resources Community in Public Outreach, Scientific Cross-Collaboration

As the International Biodiversity Observation Year (IBOY)'s January 2001 launch date approaches, organizers encourage members of the genetic resources community to get involved and share their knowledge, perspectives, and concerns. The initiative aims to bring together scientists, informatics specialists, media, and educators to focus attention on the status of and trends in biodiversity conservation, as well as to facilitate informed decision-making by making accurate scientific data more accessible.

IBOY is predicated on the notion that integrated science is necessary for understanding the relationship of biodiversity to ecosystems and social concerns such as global change, economics, and health. Its goals are closely connected to those of the Convention on Biological Diversity (CBD), especially Article 13a on promoting outreach and understanding, though the ties between the CBD and IBOY are informal in nature. (A number of leading scientific experts on biodiversity serve as advisors to both the CBD and IBOY.)

As noted above, one of IBOY's principal objectives is to encourage cross-fertilization between related disciplines, primarily

by initiating dialogue and facilitating the creation of informal networks of scientists from different disciplines. The Internet, especially the IBOY Web site, will be an important tool for cross-collaboration among biodiversity scientists.

The second principal objective is to educate the media and the public, making the scientific case for increased concern about and action on biodiversity losses. A workshop is planned for June 15-17, at which scientists and media professionals will come together to identify the scientific information on biodiversity that is most needed by decision-makers. An outreach program will be developed based on these discussions, with a view to establishing a basis for long-term partnership between scientists and communications specialists.

IBOY is an initiative of *Diversitas,* an international scientific organization promoting biodiversity research and the integration of its various dimensions and relevant disciplines. Modeled on the International Geophysical Year (IGY), which took place from July 1957 to December 1958, IBOY is intended to be a unifying force for the various scientific disciplines describing the biotic world, in much the same way that IGY helped integrate various related sciences to enhance understanding of geophysical phenomena.

Sponsors of IBOY include several international scientific organizations active in *Diversitas*, such as the International Council for Science (ICSU), the International Geosphere-Biosphere Program (IGBP), the International Union of Biological Sciences (IUBS), the International Union of Microbiological Sciences (IUMS), the Scientific Committee on Problems of the Environment (SCOPE), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Scientists and other IBOY participants are self-funded (secretariat services for IBOY are funded chiefly by ICSU and an anonymous private U.S. foundation).

Core Projects Highlight Exploration, Education

The focal point for IBOY's cross-fertilization and public-outreach efforts is a diverse portfolio of international biodiversity projects, currently numbering about 40. These projects provide information on biodiversity status and trends, distribution, goods and services, and conservation efforts. Projects range in scale from patch to landscape.

Some projects are exploring the frontiers of biodiversity, such as remote parts of Antarctica and the deep oceans. One project will explore anchialine habitats, i.e., flooded inland marine caves and groundwaters that lack any direct surface connection with the open sea and are inhabited by fascinating, poorly known organisms of ancient lineage. Other core projects aim to combine previously fragmented data sets; these include the development of a comprehensive database on soil macro-invertebrates as well as a global database on migrating species. Two core projects directly involve genetic resources.

In one, researchers are developing an electronic database that will bring together scattered information on wild crop relatives worldwide. The database will contain information now held nationally, regionally, and internationally on distribution, ecology, conservation status, and breeding relationships. Led by Vernon Heywood of the University of Reading (United Kingdom), the project was developed in conjunction with the International Plant Genetic Resources Institute (IPGRI), the United Nations Food and Agricultural Organization (FAO), *Diversitas*, the World Conservation Union, and the World Conservation Monitoring Center.

A second genetic resources project centers on DNA banking for endangered animal species. Led by Anne McLaren of the University of Cambridge (UK), the project will support coordinated worldwide efforts to store, for every endangered animal species, samples of DNA or frozen cells or tissues that could readily yield DNA. The project will collect information on existing DNA banking efforts and establish a Web-based method of registering DNA banks. The registry will include information on taxonomy, location of collection and/or pedigree information, and information on institutions and/or individuals responsible for the collection.

Although outreach and cross-fertilization activities will center on these core projects, other, smaller-scale local, regional, and national efforts will be highlighted in IBOY. Such "satellite projects" also are being publicized via the IBOY Web site, which contains project descriptions, links to Web sites with further information, and an interactive map showing project locations. (Project managers can apply directly from the IBOY Web site to have their projects accepted as a core or satellite project.)

Core projects are designed to peak—i.e., generate and publish new data and assessments via both scientific and popular media, broadcast television and film documentaries, etc.—during the IBOY period (2001-2). In late 2002, organizers will convene an international summit meeting, which will serve as IBOY's principal integrative event. Core-project leaders will make formal presentations on the scientific advances made during IBOY. Meeting participants then will identify areas of intersection between disciplines, gaps in knowledge, and research priorities. In this way, IBOY organizers hope to catalyze research efforts that will last beyond 2002.

An Initiative Still in Search of a Few Good Ideas

IBOY Chair Diana Wall (a soil scientist at Colorado State University) and IBOY Program Officer Gina Adams say that the initiative's emphasis on biodiversity at the species and ecosystem levels reflects both the approaches of most organizations associated with *Diversitas* and prevailing trends in the study and conservation of biodiversity. However, they stressed that they welcome greater participation from the genetic resources community. The process of selecting core IBOY projects is ongoing, and Wall and Adams urge scientists to propose genetic-diversity projects. Such projects might concern genetic tools for tracking invasive species, measurements of genetic diversity at (species-based) biodiversity hotspots, investigations of the relationships between genetic diversity and ecosystem resilience, and assessments of the potential impacts of genetically modified organisms on ecosystems.

In addition to their call for proposals for core projects, Wall and Adams seek input from the genetic resources community for IBOY outreach activities. "We want to understand what scientists think the public needs to know about genetic diversity. We want scientists' help in identifying areas that need further research and the stumbling blocks to increased knowledge," they commented.

Wall and Adams also encourage members of the genetic resources community to take advantage of the opportunities for informal networking afforded by IBOY. Such networking can help generate ideas for cross-collaboration with biodiversity scientists working in other disciplines and help researchers identify and gain access to scientists in different disciplines for collaboration.

—KH

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Cutting-Edge Conservation Techniques Are Tested in the Cradle of Ancient Agriculture

GEF Turkish Project Is a Global Model for in Situ *Conservation of Wild Crop Relatives*

At Aspendos, on Turkey's southern Mediterranean coast, rises an ancient Roman amphitheater whose splendor rivals that of the Colosseum in Rome. Constructed from local limestone and marble during the reign of Marcus Aurelius, the theatre at Aspendos holds up to 20,000 spectators. The secret of its perfect acoustics—the sound of a coin dropped in the orchestra can be heard distinctly in the highest galleries—died with its architect, a local man by the name of Xeno.

Modern visitors to Turkey marvel at its cultural riches. They are struck, too, by the country's abundant natural endowments, such as the beauty of the landscape surrounding the theatre at Aspendos. There the Taurus Mountains form a majestic backdrop to the Mediterranean coast and its lush fields of cotton, watermelons, citrus trees, vegetables, and flowers. The adventurous few may venture a few kilometers northeast of Aspendos to the spectacular Koprulu Canyon National Park, where a Roman bridge spans a picturesque canyon formed by a river of tumbling, milky turquoise. Hikers trek through a forest of Mediterranean cypress and small paths lead off toward the remains of long-abandoned temples to Greek gods and goddesses.

Turkey Is Rich in Plant Genetic Resources, Too

Archaeological sites are by no means the only treasures found in Turkey: For thousands of years it has been rich in plant genetic diversity as well, largely due to its geography and climate. Turkey lies at the confluence of three phytogeographic zones (Euro-Siberian, Mediterranean, and Irano-Turanian) and is home to two of Vavilov's Centers of Origin (Near Eastern and Mediterranean). Agriculture was born ten thousand years ago in the Fertile Crescent, which encompasses modern-day southeastern Anatolia, the Asian part of Turkey. And since Anatolia forms a bridge between Asia and Europe, peoples migrated through the region and brought with them many plants and crops originating elsewhere.

Today more than 8,700 species of vascular plants are found in Turkey, about 30% of which are endemic. The country also has many unique adaptations of woody species occurring at the extreme geographical limits of their distribution.

In the early 1990s, a pioneering project was developed to help conserve Turkey's wealth of plant genetic resources (PGR). Turkey had long been active in *ex situ* conservation and indeed had served as a source of many traits that had been used to breed improved agricultural crops for use around the world. However, the new project—funded under the auspices of the newly launched Global Environment Facility (GEF)—was instead aimed at conserving PGR in their natural habitats (i.e., *in situ*). *In situ* conservation had come to be seen as an important means of overcoming a key weakness of *ex situ* collections—namely, evolutionary stasis. Proponents of *in situ* conservation argue that maintaining interactions between plants and their natural pests, predators, and environmental conditions is crucial to efforts to provide resistance to new pest and pathogen mutations as they arise.

A Groundbreaking Approach to Conserving Wild Crop Relatives

For several reasons, designers of the project focused their attention on wild relatives of crop plants rather than landraces. They judged that *in situ* conservation of landraces (i.e., traditional crop varieties generally maintained by small farmers) raised complex biological, social, and policy issues that would sorely test the limits of a pilot project. Also, landraces had been the focus of more conservation efforts than had the wild relatives. At the time, there were few active, national programs aimed at conserving wild crop relatives *in situ* and these focused on a single species. The GEF project in Turkey was the first of its kind in the world to protect multiple wild crop relatives—both woody and non-woody—using an integrated, multi-species, multi-site approach intended to serve as a model applicable in other parts of the world. (See *DIVERSITY*, Vol.11, Nos.1&2, pp.64-67 for a review of the project in the early stages of implementation.)

According to Stan Krugman—a retired official of the U.S. Forest Service, consultant to the World Bank on this and other GEF biodiversity-conservation projects, and former member of the Board of Directors of *DIVERSITY*—the project (which was completed in March 1998) broke new ground on several fronts. "The project successfully established the concept of *in situ* conservation of wild relatives; it translated this philosophy into an action program; and it upgraded the skills of Turkish researchers and developed Turkey's research infrastructure," he said. Moreover, two or three new species of wild wheat relatives were discovered during the course of the project and are now being evaluated for their potential to provide useful attributes to modern varieties of cultivated wheat. "This alone more than paid for the project," Krugman commented, noting the commercial importance of the global wheat crop.

Establishing "Gene Management Zones"

Selecting Candidates

A key feature of the project was the establishment of Gene Management Zones (GMZs) based on ecogeographic surveys and inventories of state-owned land. Protected areas with specific management requirements adapted to individual plant species and environmental conditions, GMZs serve as reserves for one or more endangered or economically important plant species ("target species") and are large enough to encompass considerable genetic variation within populations. These areas are managed to maximize maintenance of broad genetic diversity while allowing for continued adaptation to changing environmental conditions. Krugman said that although the GMZ concept was first used in California in the 1960s, it was a new concept to the Turks and most of the rest of the world.

The target species selected for the project were wild relatives of globally important non-woody crop species (such as

wheat, barley, chickpeas, and lentils) and some woody crop species (such as chestnut and plum), as well as forest species (fir, cedar, and pine). For these species, researchers identified three diverse priority areas (see Fig. 1) to survey and inventory:

- Kazdagi National Park of the northwest Aegean region of Turkey, which contained wild relatives of several fruit, nut, and forest tree species;
- Ceylanpinar State Farm in southeastern Turkey, which was rich in wild crop relatives, including wheat, barley, chickpeas, and lentils; and
- The Anatolian Diagonal-Bolkar Mountains of south central Anatolia, which contained sites at the extreme geographical limits of distribution for several significant wild relatives of wheat, barley, chickpeas, lentils, and forest trees.

Originally, sites in the Karacadag Plateau of southeastern Anatolia and the Amanos Mountains of south-central Anatolia were to be included, but later these were dropped due to security considerations. (Even at selected sites in southeastern Turkey, paramilitary guards often accompanied researchers.)

Surveying the Sites

The ecogeographic surveys were conducted in several phases. Project staff received training in advanced survey and inventory techniques in 1993, and the first phase of surveying began in spring 1994 in the Kaz Mountains and Ceylanpinar State Farm and in spring 1995 in the Bolkar Mountains. Initial surveys sampled target-species populations and documented: their locations within the survey area, abundance, and density; surrounding associated species; soil type; topography; and morphological variation between and within populations of the target species. Also noted were grazing pressure, distance to human settlements, and suitability for *in situ* conservation. Multiple surveys were conducted in different seasons, and later surveys documented changes in population density, variation at each site from year to year, and habitat factors that could explain the variation in population density within and between sites.

The results of the surveys were used to select the most promising sites for *in situ* conservation, where detailed inventory studies were performed starting in 1995. (For example, in the Kaz Mountains, 15 sites were initially surveyed for potential use as GMZs, and five of these were selected for further survey work.) Plant counts were made along permanent transects, along with soil samples and spatial and topographical information. Samples were taken for isoenzyme and pomological studies as well as for *ex situ* conservation.

Based on the surveys and inventories, candidate GMZs were selected. Priority setting was an essential element of the process, as it was impossible in the course of a project designed as a three-year pilot study to designate a GMZ for every wild relative of every cultivated crop. The multi-year survey results provided valuable indicators, such as the appearance and disappearance of target species from a given site due to changing environmental conditions. Some sites were selected based on their potential to cover several target species with sufficiently large populations.

Isoenzyme analysis of the genetic variation within and among populations of the target species strongly influenced final decisions on GMZs. Based on the findings on genetic diversity, project planners designated 22 GMZs (see Table 1). Kazdagi National Park was home to 10 GMZs covering five target species, including wild plum, chestnut, Turkey red pine, Anatolian black pine, and Kazdagi fir. Three of the 10 GMZs were multi-species, and the rest were single-species.

Seven GMZs were designated at Ceylanpinar State Farm, containing five species of wild wheat relatives. Four of the seven were multi-species. The Bolkar Mountains contained five GMZs covering five target species: Anatolian black pine, Turkey red pine, two types of Taurus fir, and Taurus cedar. All but one of the five GMZs were multi-species. However, the GMZs selected for cedar are still considered provisional, as problems with seed formation delayed completion of the isoenzyme analysis.

Table 1.

GENE MANAGEMENT ZONES ESTABLISHED BY THE TURKISH PROJECT

Name	Size (ha)	Target species
KAZ MOUNTAIN		
Alinoluk	385	*Pinus nigra* subsp. *pallasiana*
Ayigedigi	721	*Abies nordmannia* subsp. *equitrojana, P. nigra, Castanea sativa*
Engece Camlik	491	*Pinus brutia*
Gurgendag	621	*A. nordmannia, P. nigra*
Karakoy	528	*P. nigra, P. brutia*
Kilisealan	*	*Prunus divericata*
Mihlidere	385	*C. sativa*
Sarisu	*	*P. divericata*
Sivrikatran	*	*C. sativa*
Yukaricavus	*	*P. divericata*
BOLKAR		
Asmacik	1,028	*Pinus nigra* subsp. *pallasiana, Abies cilicicai, Cedrus libani***
Bahce	6,108	*P. nigra, Pinus. brutia, C. libani***
Camliyayla	3,227	*A. cilicicai, C. libani***
Karakoyak	1,196	*P. brutia*
Payam-Cocakdere	10,879	*P. nigra, P. brutia, C. libani*
CEYLANPINAR STATE FARM		
Beyazkule	30	*Aegilops speltoides* var. *speltoides, A. speltoides* var. *ligustica*
Cavani	10	*A. speltoides* var. *speltoides, A. speltoides* var. *ligustica, Aegilops tauschii*
Gokcayi	9	*A. tauschii*
Gurgurbaba	35	*Triticum dicoccoides, A. speltoides* var. *speltoides, A. speltoides* var. *ligustica, A. tauschii*
Horozmiran	30	*A. tauschii*
Saraccesme	NA	*A. speltoides* var. *speltoides, A. speltoides* var. *ligustica*
Saraccestic	30	*Triticum monococcum*

* Size of GMZ to be determined later
** GMZs for *C. libani* are provisional, pending results of isoenzyme analysis.

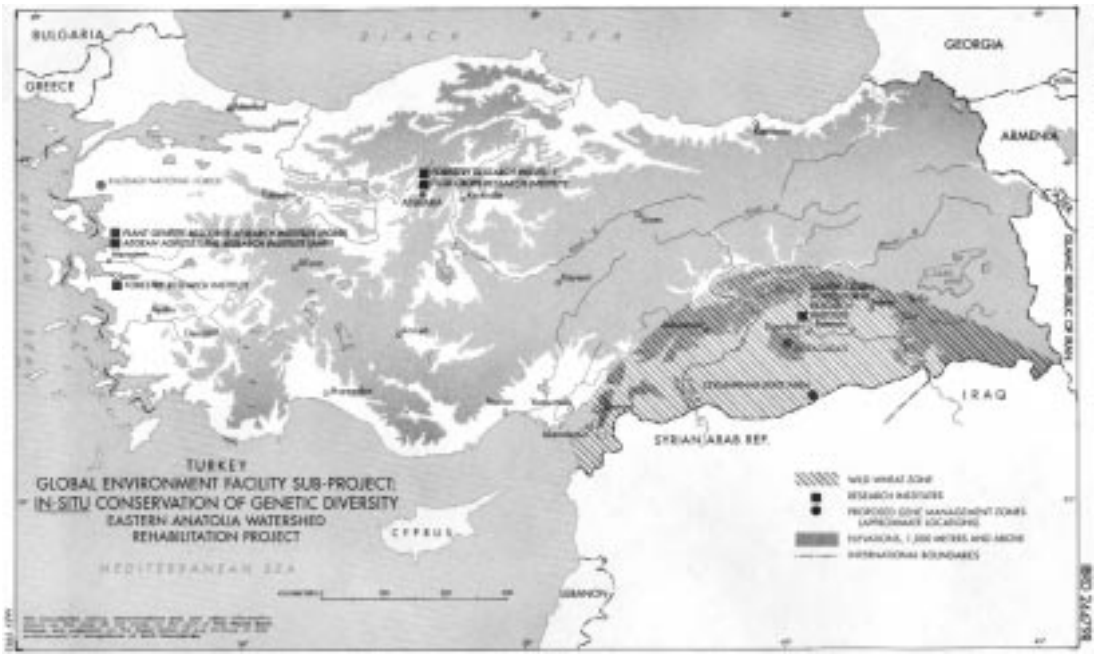

Fig. 1
Gene Management Zones are managed to maximize maintenance of broad genetic diversity while allowing for continued adaptation to changing environmental conditions.
Photo courtesy of IPGRI.

These statistics may create the impression that woody and forest species dominated the project outcome. This is not so, according to Krugman. Much more of the researchers' efforts were devoted to identifying and designating seven GMZs for the wild wheat relatives than for the 15 GMZs containing woody species, he says. This is because of differences in patterns of reproduction and distribution. Unlike the woody plants, the annual species were distributed in small, isolated populations—often tucked away in obscure locations—and populations found in a given location in one year might not appear there the next.

Managing Zones

Once the GMZs had been designated, the next step was to develop management plans for each aimed at maintaining as much genetic variation as possible in a given area. Decision-making on the optimal management practices for the GMZs raised many complex questions, such as whether managers should intervene—and if so, how—to promote colonization of annuals (e.g., many wild relatives of grains) in a given area rather than allowing the succession of biennial and perennial vegetation. A case in point is the easternmost population of *Aegilops tauschii* (a wild relative of wheat) that was observed in the early years of the project. This population became extinct in 1996, probably due to the cessation of grazing in the area. Because many of the target species for this project evolved in an environment associated with grazing for thousands of years, grazing has emerged as a crucial factor in GMZ management plans.

A related, vital element of GMZ management is local community participation. Stakeholder input to the GMZ management plans was sought through workshops held in each of the three priority areas during 1996 and 1997. The aim was to preserve local people's access to the GMZs, as ways could often be found to accommodate traditional activities associated with local livelihoods. Grazing in many cases could continue, but the number of grazing animals might need to be reduced and/or the timing might need to be controlled. For example, grazing is sometimes limited during the early spring to allow for flowering, seed setting, and seed ripening of the target species. However, later in the year, animals may actually enhance a GMZ's desired vegetation pattern by shattering the seed and trampling it into the soil for germination the following year ("natural seeding"). Similarly, the local practice of harvesting chestnuts was incorporated into the management plan for the GMZs for this target species.

Krugman said that one of the biggest concerns about the project voiced by local villagers was the resulting influx of "foreigners" into the area—by which, it turns out, they meant "city people" from elsewhere in Turkey. Awareness of and sensitivity to such concerns is an important aspect of achieving peaceful co-existence between the GMZs and nearby communities.

The management of GMZs was discussed in a September 1998 workshop and management plans for the 22 GMZs have been prepared. These plans will be revised and updated to reflect new data and additional experience. Isoenzyme studies that will contribute important information to the GMZ management plans are still ongoing, and Turkey is funding these despite difficult economic conditions. These studies focus on cedar species in the Taurus Mountains, and were delayed by the plants' failure to reproduce. (Isoenzyme studies of Turkey red pine populations (unrelated to the original project) also are being carried out using the capability and the facilities developed for this project.)

A National Strategy for *in Situ* Conservation

In addition to identifying and designating GMZs, a second principal project objective was the preparation and implementation of a national strategy for *in situ* conservation of plant genetic diversity in Turkey. The national strategy was intended to provide a mechanism for setting priorities and developing a plan of action to ensure protection of genetic resources in their natural habitats, so that the work begun under the GEF pilot project would continue.

The plan was prepared by a team of university and NGO staff and coordinated by the Ministry of the Environment (MOE), one of the three Turkish government agencies responsible for implementing the GEF project. (The other two were the Ministry of Agriculture and Rural Affairs (MARA) and the Ministry of Forestry (MOF).) A draft strategy was completed in January 1995 and revised based on input from a series of stakeholder workshops. The final draft was presented at a November 1996 international scientific symposium organized in connection with the project.

MOE drafted legislation to adopt the strategy, and hoped for approval by the end of 1999. However, the legislation is stalled, said Nedret Durutan, project team leader in the Turkey field office of the World Bank, due to disputes among the three project agencies concerning their respective responsibilities under the draft statute. An interagency meeting to sort out the problems is scheduled for January 2001.

Surmounting the Obstacles

In fact, the question of whether or not effective interagency cooperation could be achieved was identified as a principal risk in the project, as the three agencies were being brought together for the first time to share responsibility for implementation of a major project. Krugman credits Durutan with skillful use of various mechanisms to promote effective collaboration, including an interministerial steering committee, a project implementation committee, and monthly coordination meetings organized and hosted by the World Bank.

GEF's Turkish Project Helped Build Capacity, Too

An *in situ* conservation project generates considerable volumes of data, and these must be efficiently managed and exploited if the project is to succeed. Thus, bioinformatic capacity building was a major element of GEF's pilot project. New data capabilities in GIS and GPS were established, as was a database management system specifically designed for PGR conservation. The latter (created by the National Plant Genetic Resources Research Program of Turkey) includes passport information and information on characterization, evaluation, storage, conservation, and ecogeography. Standardized data formats were instituted for each stage of PGR collection and maintenance activity. The project developed a full range of image-processing capabilities, which allow researchers to map the information contained in the database according to species richness, endemism, habitat, and other parameters.

The isoenzyme-analysis studies of genetic variation that were done in the course of GMZ selection also helped Turkish government researchers acquire additional skills and equipment. Previously, such analyses were done only on a small scale in Turkish universities. In the course of the project, academic researchers trained government researchers to perform the analyses in laboratories newly established for the project.

The austerity measures imposed by the Turkish government constituted another significant obstacle. Although the project was financed largely by GEF grant monies ($5.18 million, versus a domestic contribution equivalent to $280,000), project staff had difficulty in securing the release of funds, especially for the purchase of vehicles and other needed equipment. The cumbersome nature of World Bank procurement procedures and project staff's lack of familiarity with them also caused delays.

In addition to administrative bottlenecks, there were some biological and scientific delays as well. The failure of certain plants to reproduce in one season resulted in delays in isoenzyme analysis (e.g., Taurus cedar), and project scientists spent considerable time determining the most appropriate technique for isoenzyme analysis of wild plum and chestnut.

"Growing pains" at MOE also caused delays. (Established in 1991, it was the youngest of the three project agencies.) Changes at the ministerial level and frequent agency reorganization resulted in a lack of continuity of responsible staff during the project's early phases and prevented timely and effective implementation of MOE's responsibilities. However, toward the end of the project, a new MOE project coordinator was able to get the agency back on track.

A Legacy in the Making?

Now that more than two years have passed since the World Bank closed the file on this project, what can be said about its legacy? Besides such concrete accomplishments as the discovery of new species of wild wheat and the designation of almost two dozen specially protected zones, the strengthening of Turkish governmental institutions and the upgrading of scientific and technical capabilities may prove most significant in the long term. The project helped improve researchers' knowledge of plant inventory methods, database management, and mapping and Geographic Information Systems (GIS); introduced the use of Global Positioning Systems (GPS) technology; and expanded isoenzyme analysis capacity (see box). The project also served as the catalyst for the first fitful efforts to bring together ministries with overlapping responsibilities for biodiversity conservation, and encouraged the ministries to inform and consult with affected local communities about conservation programs and priorities.

The lessons learned over the course of the project also are informing the development of a new six-year, $11.4 million GEF biodiversity project in Turkey. Approved in April 2000 and now just entering the implementation phase, this second-round project will focus on the broad range of Turkish biodiversity-conservation priorities at four pilot sites (one in each of Turkey's four principal biogeographic zones). In contrast to the pilot project's strong scientific and technical research focus, the new project's emphasis will be on resource-management issues. It sets out ambitious goals for introducing innovative systems of decentralized management of protected areas, and contemplates much bigger changes in governmental thinking and ways of doing business—with respect to collaboration with NGOs, local-community participation, and interagency cooperation—than did the original project.

In keeping with the project's stated objective of serving as a model for other countries, its impacts are being felt outside Turkey as well. Stan Krugman has been approached by Vietnamese officials who would like to develop a proposal for a project on *in situ* conservation of wild crop relatives in that country. And the United Nations Food and Agriculture Organization (FAO) recently asked the MOF to share Turkey's newly acquired expertise in isoenzyme analysis with other countries, perhaps by bringing researchers to Turkey for training courses.

Given the prospect of global climate change and world population increases, *in situ* conservation of wild crop relatives could become significantly more important in the not-so-distant future. Generations yet to come, struggling to feed an ever-larger human family in a rapidly changing world, may look back and give thanks for the genetic resources that kept pace with the changes.

—KH

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New Regional Genebank in Fiji Was Made-to-Order for Pacific Island Nations

High-Tech Methods Complement Region's Germplasm, Expedite Access

by Mary Bridget Taylor

Plant genetic resources (PGR) have always been important, but in a world where climatic, economic, and social changes are occurring at an ever-increasing rate, their role in eliminating poverty and providing food security is becoming even more significant. At the same time, however, there is increasing pressure on PGR. The shift from subsistence-based agriculture towards market-driven farming is one factor; changing land patterns constitute another. Also, political problems can threaten plant populations that are a source of genetic diversity (while also making it necessary for rural populations to turn to traditional crops for a more secure source of food).

The RGC's sterile transfer room.

Photo by Mary Taylor.

Within the Pacific region, Centers of Secondary Diversity exist for many traditional crops, such as banana, breadfruit, coconut, kava, sugar cane, taro, and yam. These crops are very important for food security, and contribute immensely to the local culture. Migration between Pacific islands has influenced the evolution of a unique diversity within these crops, which is now threatened by changes in lifestyle, recent introductions of improved varieties, and the genetic vulnerability of traditional crop varieties to introduced pests and diseases. This erosion of diversity is exacerbated by losses in germplasm collections.

Mary Bridget Taylor is a tissue-culture specialist with the Australian-funded Taro Genetic Resources Project implemented by the Secretariat of the Pacific Community (Suva, Fiji). Prior to that, she was team leader of a regional tissue-culture project based at the University of the South Pacific in Samoa.

Many Pacific Island crops are vegetatively propagated and so are conserved in field genebanks. This has been the method of conservation over the last 20 years, and collections of various crops have been established in several countries. In many cases, however, these collections no longer exist, and where collections are still being maintained, accessions have been lost. Losses have been largely due to:

- **Insufficient resources:** Field genebanks demand huge amounts of labor and other resources. Many Pacific Island countries have a limited labor supply, and consequently staff members usually have multiple responsibilities. Funds are often scarce as well, and conservation is rarely a priority in budgetary allocations. On some of the smaller islands, the availability of suitable land is also a limiting factor.
- **Pest and diseases:** These, too, can cause major disasters. In the early 1990s, taro leaf blight, caused by *Phytophthora colocasiae*, wiped out all of Samoa's taro varieties and destroyed a very valuable export market. A field collection in the Solomon Islands is currently under severe pressure from a fatal viral disease. And yam collections in the Pacific Island region commonly suffer from anthracnose disease, which depletes accessions.
- **Climatic conditions:** The Pacific Island region's climate can be extreme. Drought, flooding, and cyclones are relatively common events, and have obvious—and sometimes disastrous—effects on field collections.

A Regional Conservation Approach Suits the Islands

The need to look at conservation from a regional perspective has been widely acknowledged. At a 1996 meeting of the ministers of agriculture for six ACP (African, Caribbean, and Pacific Group of States) countries held in Fiji, the following resolution was endorsed: *Conserving genetic diversity is the key to crop performance, and thus its neglect could imperil agriculture. Linked to this is the need to protect and utilize plant genetic resources so that there is equitable sharing of benefits. The honorable ministers of agriculture are urged to put in place, both in their countries and through regional cooperation, policies to conserve, protect, and best utilize their plant genetic resources.*

Both the fragmented nature of the region and the wide scope of conservation lend themselves to regional strategies: If individual countries do not have sufficient resources for germplasm conservation, then it is best carried out on a regional basis. A regional, cooperative approach becomes even more logical in light of the commonality of the major crops of the region.

Both the fragmented nature of the region and the wide scope of conservation lend themselves to regional strategies.

The question then becomes: How should the region's germplasm be maintained? Regional field genebanks would be cumbersome and as susceptible as national collections to the problems already mentioned. As the majority of the region's crops are vegetatively propagated, seed storage is either impossible or has very limited application.

The answer? The Regional Germplasm Center (RGC) of the Secretariat of the Pacific Community (SPC) in Suva, Fiji, which uses tissue-culture techniques to address the region's particular needs and challenges. Officially opened in March 1999, the RGC was established with funds from the Australian government and the European Union (EU); both continue to support projects operating within it.

Experience Proves the Value of *in Vitro* Conservation

The RGC has the advantage of being built upon past regional experience in tissue culture. In the mid-1980s, a tissue-culture laboratory was established at SPC, Suva, as part of a regional United Nations Development Program (UNDP)/Food and Agriculture Organization (FAO) root-crops project. In 1990, the EU's Pacific Regional Agricultural Program (PRAP) funded the development of a regional tissue-culture laboratory at the University of the South Pacific in Samoa (USP-Samoa). These two laboratories raised awareness of tissue cul-

ture's potential benefits for agriculture in the Pacific region.

The PRAP unit's 10-year track record of successfully conserving collections of taro, sweet potato, banana, cassava, and yams has produced a very positive local attitude toward *in vitro* conservation. And in a region composed of individual island countries, each with its own quarantine regulations, researchers also came to appreciate how greatly pathogen-tested tissue cultures facilitate distribution. In addition, the tissue-culture technique enables the majority of the traditional crops to be propagated more quickly than in the field. For these reasons, it was the consensus that a regional laboratory or germplasm center maintaining pathogen-tested, tissue-cultured germplasm would be the best option for conservation.

Conserving Germplasm More Efficiently

Although the conservation of genetic resources through a regional center allows pooling of resources, there is still a need for cost-effectiveness. Simply maintaining large collections *in vitro* under standard conditions would strain resources. Therefore, planners must consider both the number of accessions to be conserved and the techniques to be used.

The RGC has adopted a core-collection strategy for developing taro and yam collections. Approximately 2,500 accessions of taro genetic resources have been collected from many of the participating countries; from these, a core of some 250 accessions will be identified as representative of the genetic diversity within the collection. Likewise, eventually there will be a core collection of 150 accessions of yams (*Dioscorea alata*). In this way genetic diversity will be maintained, but within a smaller pool.

Preservation techniques are the other key consideration. Under standard *in vitro* conditions, subculturing occurs at relatively frequent intervals and at each subculture stage there is the risk of losing material (through contamination and/or human error). There is also the question of genetic integrity, which can be lost when plant material is in culture for long periods of time. With these issues in mind, the RGC decided to use slow growth for short- and medium-term storage, and, where possible, cryopreservation for long-term storage.

Research carried out at the PRAP unit in Samoa showed that temperature reduction was the most effective method for slow-growth storage of most of the root and tuber crops of the region. Morphological changes were observed in sweet potatoes cultured on media containing sugar alcohols, such as sorbitol and mannitol. Similar experiments conducted with taro—evaluating the effect of combining low temperature, reduced light, and osmoticums—showed that although the inclusion of mannitol in the culture medium did suppress growth, it also induced some morphological changes. In addition, the use of mannitol with cultures initiated directly from the field produced a phytotoxic effect. For both crops, as well as for yams and bananas, the subculture period was extended to 9-12 months with culture at 20°C.

Part of the RGC's pathogen-tested sweet potato collection. Photo by Mary Taylor.

Cryopreservation is useful for making the most of limited resources, and so the RGC is investigating this methodology for use with taro, yams, and sweet potato. With all of these crops, the focus is on the techniques—such as vitrification—that allow the use of rapid freezing. (Slow freezing methods are being avoided because of the need to invest in and maintain a programmable freezer.)

Although these conservation techniques might be considered high technology and therefore of questionable sustainability, they have been used in other developing countries and have been selected for their ease of use. All of the methodologies used by the RGC were selected in light of the resources they would require—not only in terms of establishment, but also of maintenance. Lessons learned at the regional tissue-culture laboratory at USP-Samoa have been taken into account to ensure that the RGC in Fiji is practicable and sustainable.

Access Is the Difference Between a Genebank and a Museum

Developing a regional collection raises important issues of access issues. The Convention on Biological Diversity (CBD) recognizes each country's sovereignty over its PGR; thus, in order for the RGC to bank the germplasm of individual Pacific Island countries, it also had to develop access agreements. Without these, the RGC would become a museum containing resources of no practical value.

Genebank Is One Part of a Comprehensive PGR Strategy

The establishment of the RGC is not the only PGR-related activity underway in the Pacific: Recently, a regional PGR strategy was formulated. Now in the very early stages of development, the strategy is a response to increased international and regional interest in expanding and strengthening PGR activities. An essential component of the strategy is the formation of a network (within which the RGC would operate) that would help build strong links among countries of the region and relevant international institutes.

PGR-based networks are already at work in the region. Some of these are international, such as the International Coconut Genetic Resources Network (COGENT) and the International Network for the Improvement of Banana and Plantain (INIBAP); others are regional, such as the Taro Genetic Resources Project (TaroGen) and the South Pacific Yam Network (SPYN). However, there needs to be a superstructure within which these individual networks can operate. With a regional PGR network in place, the impact of all other existing networks would be strengthened, and those networks supported by donor funds could continue, if appropriate, once the funds are no longer available.

Once the regional network is in place, participating members would focus on:

- developing an appropriate PGR policy and legal framework for the region;
- identifying long-term, sustainable sources of funding;
- developing an effective PGR conservation and management strategy;
- strengthening national and regional capacity for implementing a PGR strategy; and
- developing materials for raising awareness of PGR at all levels.

The regional PGR strategy grew out of a 1999 workshop, funded by the Australian Center for Agricultural Research, that focused on identifying practical strategies for collaboration in the conservation, management, and use of germplasm within the region. A working group—comprised of representatives of Fiji, Papua New Guinea, and the SPC—met in October 2000 to formulate the framework of the strategy, which is expected to be implemented in 2001 after regional review.

None of the Pacific Island countries has any form of national legislation governing access to germplasm. Some countries, such as Fiji and Papua New Guinea, are in the process of developing such legislation, but it will not be implemented for some time. In the meantime, though, countries have found effective ways to collaborate. For example, in order to share germplasm within the taro project, participating countries and organizations signed a Code of Conduct and agreed to share germplasm for research purposes. However, the agreement emphasized that germplasm remained the property of the source country.

Since October 1999, the SPC has been distributing germplasm from the RGC using Material Transfer Agreements (MTAs). (The genebank's MTA was based on those used by the International Agricultural Research Centers (IARCs), but was modified to suit the region.) MTAs are the first step in addressing the intellectual property rights (IPR) issues pertaining to traditional food crops, but additional steps must be taken within the region to encompass the full range of these (see box). For example, there is a lack of appropriate legal mechanisms to protect traditional landraces. Also, although plant varieties are generally protected under patents and plant breeder's rights, these systems are neither operational within the Pacific Island region nor applicable to the protection of traditional PGR. However, the World Trade Organization's Trade Related Intellectual Property Rights Agreement (TRIPS) does allow for the protection of plant varieties either by patents and/or an effective *sui generis* system, and the Pacific region may need to develop the latter to protect its PGR and facilitate access and benefit sharing.

As the majority of the region's crops are vegetatively propagated, seed storage is either impossible or has very limited application.

By filling a unique niche, the RGC is expected to achieve international status as a germplasm center and be a boon to agriculture in the region. Although some of the IARCs have a mandate to conserve some crops that are important to the Pacific Island region, these species and varieties tend not to be accorded a high priority. Furthermore, none of the IARCs is mandated with conserving the region's most important crop, taro. Although the RGC will initially focus on major root and tuber crops, it also will attempt to establish collections of a number of minor crops that are endemic to the region and important nutritionally (such as *Abelmoschus manihot*, or bele).

The Pacific Island region—which is very vulnerable to global climatic and economic changes and suffers from internal pressures such as pests, disease, and civil unrest—needs to preserve its genetic diversity in order to meet the challenges of food security and income generation. By uniting to create the Regional Germplasm Center and a new regional PGR strategy, Pacific Island nations are proving that the whole is indeed greater than the sum of its parts.

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Keeping Options Alive: A Case for Averting the Extinction of Wild Cassava in South and Central America

by Nagib M.A. Nassar

Since international attention began to focus on genetic resources in the early 1960s, wild crop relatives have garnered increasing notice as an additional resource for conservation and use. The author has drawn upon wild species of cassava—an important food crop for more than 800 million people in the tropics and subtropics—for many useful traits, including some conferring high protein content (Nassar and Dorea 1982), tolerance to drought (Nassar 1991, 1996), and apomixis (Nassar 1995; Nassar *et al.* 1997, 1998). With the help of the International Development Research Center (IDRC), Ottawa, he also established a living collection of these species at the University of Brasília.

Every year from 1978-98, wild *Manihot* species were collected, propagated, maintained in a living collection, evaluated for economically significant traits, and hybridized. (Of about 35 wild species in this collection, at least 18 have thus far been found to have valuable traits; see Table 1.) This process both transferred useful traits and broadened the crop's genetic base. Results of the project were published in a series of publications, most recently in a chapter of *Advances in Agronomy* (Nassar 1999).

Nagib M.A. Nassar is a plant genetic resources specialist and professor at the University of Brasília, Brazil.

Valuable Traits Being Lost in the Americas

One of the greatest causes for concern noted during the course of this work was the drastic reduction—year after year—in these species' population numbers. The threat of extinction is real, and a number of wild *Manihot* species probably are now extinct. The problem is well documented (Nassar 1978a, 1978b, 1982), particularly in a study that measured the species' occurrence and survival in habitats from which they were collected in previous years and demonstrated their disappearance from a number of regions of Brazil (Nassar 1978c). In 1998, the author re-visited the same habitats and documented the total absence of six species present only 20 years before: *M. oligantha* Pax (5); *M. sparcifolia* Pohl (4); *M. tomentosa* Pohl (4); *M. stipularis* Pax (5); *M. attenuata* Muell. Arg. (4); and *M. neusana* Nassar

The University of Brasília's living collection of Manihot *species.* Photo courtesy of Nagib Nassar.

(4). (The numbers in parentheses indicate the number of habitats visited.)

The author used *M. oligantha*—which conferred high protein content—for interspecific hybridization during the 1970s. The resulting hybrid's protein percentage was at least double that of other cassava cultivars (Nassar and Dorea 1982).

M. stipularis Pax is a source of tolerance to soil toxicity in the Brazilian savanna: As much as 8 ppm. of manganese was found in the habitats in which this species was collected (Nassar 1986). This trait could be critical in the future, given rising soil toxicity levels in many parts of the world.

M. neusana Nassar (Nassar 1984) contains at least two valuable traits. It is very resistant to *Xanthomonas manihotis*, and its hybrid with cassava exhibits a notable vigor and abundant foliage, which makes it an excellent candidate for use as a forage plant. Recently, *M. neusana* (as well as *M. glaziovii* and *M. dichotoma*) has conferred apomixis genes to cassava (Nassar 1994; Nassar et al. 1998). Apomixis is one of the most important phenomena in modern agriculture. In addition to preserving heterozygosity, it has the added advantage of avoiding the pathogens that can accumulate year after year on stems used for vegetative propagation. By preserving the integrity of the genetic structure against breakdown and segregation, apomixis makes it possible to reproduce cassava via true seed. Asexual reproduction requires less time and effort than vegetative propagation and is an efficient method of establishing cassava in new cultivation areas.

Now totally extinct in its natural habitats,* Manihotoides pausiflora *is represented in world collections by only one individual.

Extinction also has been documented in Mexico. Now totally extinct in its natural habitats (Nassar 1999), *Manihotoides pausiflora* Rogers & Appan is represented in world collections by only one individual, which is maintained at the experimental station in Iguala, Mexico. Since the species is dioecious (i.e., individual plants are single-sex), this lone specimen is useless from a traditional breeding point of view, due to its inability to self-fertilize and produce seed.

M. pringlei Watson is another endangered Mexican species (Nassar 1985). Judging from the odor of freshly dug roots, these are almost free of hydrocyanic acid (HCN), a poisonous substance normally found in cassava. It may be an important species in evolutionary terms, since it grows in the same region in which McNeish (1958) reported finding cassava seed in archeological digs. This species probably contributed to the gene pool of the cultivate.

A third endangered Mexican species is *M. subspicata* Rogers & Appan. It grows in a dry region (with annual precipitation of less than 200 mm. per year), and thus is an excellent source of drought tolerance. Moreover, it forms prominent tubers, which makes it likely to hybridize easily with cassava.

Table 1.

WILD CASSAVA (*MANIHOT* SPP.) WITH ECONOMICALLY SIGNIFICANT TRAITS MAINTAINED IN THE UNIVERSITY OF BRASILIA'S LIVING COLLECTION

Species	*Trait*	*Natural Habitat*
M. oligantha Pax	High protein content	Cristalina, Brazil
M .tripartita Muell. Arg.	Apomixis	Goias state, Brazil
M. anomala Pohl	Shade tolerance	Goias and Minas Gerais states, Brazil
M. zehntneri Ule	Abundant tubers	Goias, Minas Gerais, and Bahia states, Brazil
M. paviaefolia Pohl	Adapted to poor, sandy soil	Goias Velho, Brazil
M. pruinosa Pohl	Adapted to limestone soil	Goias Velho, Brazil
M. falcata Rogers & Appan	Adapted to slopes and well-drained soil	Coromba de Goias, Brazil
M. reptans Pax	Adapted to a wide range of soils; hybridizes easily with other *Manihot* spp.	Goias state, Brazil
M. alutacea Rogers & Appan	Adapted to rocky slopes at elevations of 1,200 m.	Goias state, Brazil
M. pentaphylla Pohl	Adapted to limestone soil	Goias state, Brazil
M. cearulescens Pohl	Drought tolerance	Piaui state, Brazil
M. procumbens Muell. Arg.	Adapted to poor soil with high aluminum concentrations	Goias state, Brazil
M. stipularis Pax	Adapted to high altitude	Goias state, Brazil
M. glaziovii Muell. Arg.	Drought tolerance; resistance to cassava African mosaic bigeminivirus	Pernambuco and Ceara states, Brazil
M. pseudoglaziovii Pax & Hoffmann	Drought tolerance	Pernambuco state, Brazil
M. dichotoma Ule	Apomixis	Bahia state, Brazil
M. neusana Nassar	Apomixis; resistance to cassava bacterial blight	Parana state, Brazil
M. aesculifolia Pohl	Vigor of its hybrid with cassava	Sinaloa and Nayarit states, Mexico

More Conservation, Research Desperately Needed

The drought tolerance of *M. subspicata* and other wild relatives should not be overlooked. The Centro Internacional de Agricultura Tropical (CIAT), which has a mandate to preserve cassava genetic resources, attempted to improve cassava's drought resistance by selecting clones with low frequency of stomata, but the 10-year project proved that this species' drought-tolerance mechanism is different from that of *Gramineae* (grasses). As the author documented in 1983 and 1990, cassava's best proof against drought may be a deep taproot that extracts water from distant subterranean levels (e.g., that of the wild *Manihot glaziovii* (Nassar 1995)), or a short life cycle that lasts three or four months during the rainy season (such as that of *M. subspicata*).

None of the endangered species mentioned above is maintained in CIAT's living collection. Moreover, of the recognized

This comparison of M. oligantha *Pax (right) and common cassava (left) illustrates the difference between the two species' plants and tubers.*
Photo courtesy of Nagib Nassar.

98 species of wild cassava, only approximately 20 species are represented in that collection.

It is indeed regrettable that the potential of these wild species is not being explored and exploited more aggressively. But the world can no longer afford to neglect opportunities to improve this crop: Cassava productivity has dropped in South America from 14.6 tons per hectare in the 1960s to 12.5 in the 1970s, 1980s, and 1990s (FAO 1998).

These valuable genetic resources must be conserved and studied. The 800 million people who depend on cassava for food deserve as much.

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From Pygmies to Pomegranates, IPGRI's Stefano Padulosi Revels in Our Planet's Rich Cultural and Genetic Diversity

In an unusually green ravine in the mountains of southwestern Turkmenistan, Stefano Padulosi stopped walking, looked around at the green plants covering the ground, and exclaimed, "Look at this! This is all *rucola* [arugula]. My god, my favorite vegetable!" Then he fell to his knees and began eating. Between mouthfuls he said, "I had no idea this was here. We have written articles about the distribution of *rucola*, but we had no records from here." The moment was quintessential Padulosi, an expression of his passion for plants enhanced by his background in science.

Stefano Padulosi is currently a senior scientist at the International Plant Genetic Resources Institute (IPGRI)'s office for Central and West Asia and North Africa, based in Aleppo, Syria. His work centers on integrated conservation methodologies and uses, and he serves as IPGRI's point person on underutilized and neglected crops. He has held the position for the last three years, but the passion that led him to it germinated in childhood. "I was always interested in nature," he said. And since he grew up in Italy, a country known for its love of good food, it is no surprise that his interest in nature was translated into an interest in agricultural plants.

Padulosi studied at the University of Naples, Italy and earned his Ph.D. at the University of Louvain, Belgium before landing a position at the International Institute for Tropical Agriculture (IITA) in Ibadan, Nigeria in 1987. There he hit his

Stefano Padulosi (shown here sampling wild pomegranates in Turkmenistan) inspires others with a sense of adventure and wonder about plant genetic resources. Photo by Anne Marie Ruff.

stride as a plant explorer, undertaking collecting missions to Cameroon, Chad, Equatorial Guinea, Gabon, Lesotho, Nigeria, Republic of the Congo, Somalia, South Africa, Swaziland, Tanzania, and Zimbabwe. His work—which focused on wild rices, cassava, yam, cowpea, and other leguminous crops—contributed to the expansion of IITA's germplasm collection and the understanding of cowpea's wild relatives.

After seven years at IITA, Padulosi spent four years at IPGRI in Rome as coordinator of an Italian-funded project on underutilized plant species before taking his current position in Aleppo. While he still travels frequently, it is more often to capital cities and meeting rooms, and less often in the field. So when *DIVERSITY* recently caught up with him in the mountains of Turkmenistan, it was obvious he was thrilled to be out in the field again.

Now based in Syria, plant collector Stefano Padulosi has worked in a number of African countries. Photo courtesy of Stefano Padulosi.

Padulosi, three other foreign scientists, and two experts from Turkmenistan were on a mission to assess the status of conservation of cultivated and wild pomegranate (*Punica granatum* L.). The center of origin for pomegranate, Turkmenistan is home to the most extensive *ex situ* pomegranate collection in the world: 1,117 accessions are housed at the Turkmenian Experimental Station of Plant Genetic Resources in Garrygala. The team's mission was not to collect germplasm, but rather to collect information about wild and cultivated pomegranate populations. They will use the information to secure support for the station, which is under extreme financial duress.

Padulosi appreciates people, from all over the world, as much as he appreciates the plants they cultivate.

One of Padulosi's responsibilities in Turkmenistan was to taste the different varieties of pomegranate. While he didn't get to all the varieties represented in the collection, he relished the responsibility, and determined that he preferred those with ruby-red, slightly sour, and tightly packed seeds to the paler, sweeter varieties. "You can see the architecture of nature …" he said, his description of the fruit's geometry cut short by a mouthful of juicy seeds.

In the process of hiking to several wild populations of pomegranates, Padulosi feasted not only on his favorite vegetable, arugula, but also on wild blackberry, grape, fig, and garlic (sadly, the walnuts, pistachios, apricots, cherries, and carrots were not in season). "This is a generous land," he marveled, "rich in plant diversity, rich in people, rich in cultural diversity." It was a telling statement, because Padulosi appreciates people, from all over the world, as much as he appreciates the plants they cultivate.

He told stories of the people who have entrusted him with their seeds, such as the woman from a very poor village in Tanzania who brought him a handful of beans. "This is all I have," she said. "I took them from my store bin. But I think your mission is so important that I think it is more important to give them to you. I know you will be keeping these for us for the future." And then there was the old farmer in Uzbekistan who had spent years collecting, cataloguing, and maintaining melon seeds at his home. Proudly dressed in his military uniform, decorated with medals, he shared his collection with Padulosi. "We have an obligation to these people," Padulosi said emphatically, "to repay their generosity by maintaining their seeds for future generations."

Padulosi also told stories of the people who helped him get to those seeds. "I shall never forget the people in the [Republic of the] Congo. As we were entering from Cameroon, the border guard asked for my address. I asked why. 'Because I will have to send a message to your family because you're not coming back,' he said. 'This is the end of the rainy season; there is a lot of mud. I'm sure you will get stuck and I cannot rescue you.'" An hour after this grim prediction was made, Padulosi's Land Cruiser was up to its axles in mud. A local colleague went to find help and returned accompanied by two dozen pygmies. By ingeniously piling wood and stones under the tires, they successfully rescued the Land Cruiser from the mud, and the border guard never had to send that letter to Padulosi's family.

Other tales followed, not about people but about Africa's wilderness. There were the two prides of lions that surrounded Padulosi's tent the first night he ever camped in Africa, and the startled elephant that charged the car on a moonlit night in a Zimbabwean park. Padulosi began to sound a bit like Indiana Jones, the fictional film archaeologist/adventurer, but then reaffirmed his botanical zeal with stories of meter-long flower petals hanging from a Congolese tree, tree-sized ferns in Cameroon, and the thrill of finding rich genetic diversity in Swaziland. "It is the dream of every plant collector to be able to reach the very center of origin where a crop has been domesticated," he said. (Swaziland turned out to be the center of origin for cowpea (*Vigna unguiculata*), and Padulosi found a species there that was previously unknown to the outside world. That "new" species is now being bred with cultivated cowpeas to increase their hardiness.)

Before leaving the mountains of Turkmenistan, Padulosi and his colleagues sat on carpets before a meal of grilled goat, vegetables (including wild arugula), bread, and pomegranates. Raising a glass of pomegranate whiskey, Padulosi toasted his host, the director of the Turkmenian Experimental Station. He expressed his affection, appreciation, and hope for its future and the conservation of the ruby-red pomegranates and all their relatives.

Padulosi may still be searching for plants, but he has already found the perfect outlet for his passion.

—AMR

21st-CENTURY NOAHS:

The ALBC Is Securing a Future for Endangered North American Livestock and Poultry

by Marjorie E.F. Bender

DIVERSITY is pleased to introduce this new feature about the role of small-scale husbandry in the conservation of animal genetic resources. The staff of the American Livestock Breeds Conservancy (ALBC) will author the column, and this inaugural edition is an introduction to that organization and its work. Future editions will highlight individuals and small organizations from the United States and around the world that are working to preserve rare or endangered breeds of livestock and poultry.

Editor's Note

Milking Devon cattle—used for their milk and meat, as well as for draft purposes—flourished on the U.S. eastern seaboard from the seventeenth through the nineteenth centuries. By the 1970s, however, they were extinct in their native Great Britain and had dwindled to fewer than 100 animals in the U.S. Only a handful of persistent New England dairy farmers and oxen drivers still kept the versatile breed.

Agricultural historians, animal scientists, and farmers joined forces to see if they could salvage the Milking Devon and identify other breeds of great historical importance in the U.S. that faced the same fate. In response to this need, the ALBC (originally known as the American Minor Breeds Conservancy) was founded in 1977. ALBC activated the Milking Devon breed association, established a new herd book and a semen bank, and raised awareness of the breed. Though the breed's future is still not secure, today there are over 700 Milking Devon cattle.

The breed's near-extinction is the ongoing legacy of the industrialization and consolidation of animal agriculture: The Milking Devon is only one of over 100 endangered breeds of livestock and poultry. Genetic erosion in livestock is occurring at an unprecedented rate globally; the United Nations Food and Agriculture Organization (FAO) estimates that six breeds face extinction every month. Only a few breeds fit the current system of intensive production.

Conservation is essential, because a narrow gene pool renders the whole population of an animal species vulnerable to disease and infection. In fact, significant resources now are devoted to preventing disease and infection in industrial populations. In the past, plant breeders relied upon plant genetic diversity to thwart the pathogens that caused crop disasters, and the rich variety of livestock and poultry breeds can provide a similar safety net for animal agriculture today.

However, varied breeds are valuable not only because of their usefulness in a crisis, but also because of their ability to confer different traits that suit changing cultural needs. As farmers seek new, more profitable niche markets and the consuming public seeks animal products produced by more humane and less chemically intensive methods, endangered breeds with useful characteristics are again finding "gainful employment."

ALBC's mission is to work toward a sustainable economic, social, scientific, and agricultural environment that supports the conservation of endangered breeds of livestock and poultry. To this end, it focuses on four areas: genetic conservation, public education, agricultural policy development, and sustainable agriculture.

Less than 25 years after a brush with extinction, Milking Devon cattle are on the rebound.

Photo by Rob Amberg; courtesy of ALBC.

ALBC supports genetic conservation in a variety of ways. Censuses determine which breeds are extant and document their geographic distribution and population health; these data become the baseline for tracking population trends over time. Systematic documentation of breed characteristics helps stewards find production niches appropriate to each breed. And a semen bank for rare livestock both supplies current needs and preserves samples for the long term.

While preventative conservation strategies are obviously preferable to crisis intervention, the latter is sometimes necessary. Unique populations may be discovered en route to the slaughterhouse (e.g., Randall Lineback cattle) or when extermination plans are proceeding (e.g., San Clemente goats). In such situations, ALBC facilitates the rescue of populations that otherwise would be lost and helps establish new flocks or herds.

Concerned people are the key to breed conservation, and ALBC seeks to support these stewards. It provides technical support to breed associations and registries, and, in emergencies, may assume this role when no other existing group can. It also has published several definitive works on breeds and breeding to provide information that may not be found elsewhere and help interested parties learn more about the role they can play in genetic conservation.

But ALBC also seeks to educate the general public and expand the base of support for genetic resources conservation among agricultural policymakers and their institutions. The U.S. Department of Agriculture's National Animal Germplasm Program has recognized ALBC's leadership in this area by including it in the planning and implementation of a national genetic conservation effort for livestock and poultry.

Finally, ALBC is attempting to document rare breeds' performance in sustainable agricultural systems. Sustainable agriculture (SA) is a complement to genetic conservation, since its emphasis on reduced inputs helps provide viable, long-term habitats for non-industrial—and often rare—breeds of livestock and poultry. SA focuses on systems that are highly functional within the context of their specific ecosystems, and many rare breeds have qualities (such as climate adaptation, foraging ability, reproductive efficiency, maternal instincts, parasite- and disease-resistance, and longevity) that recommend them for use in a particular system or location.

Effective conservation of rare breeds of livestock and poultry is a complex challenge. Successful conservation will depend upon skilled stewards, an informed public, and an agricultural system that values genetic diversity.

For further information, contact: Marjorie Bender, Program Coordinator, American Livestock Breeds Conservancy, P.O. Box 477, Pittsboro, NC 27312. Tel: +1-919-542-5704. Fax: +1-919-545-0022. E-mail: *mbender@albc-usa.* Or visit the ALBC's Web site at *http://www.albc-usa.org.*

IN REVIEW:

American Dreamer

by Maureen Kuwano Hinkle

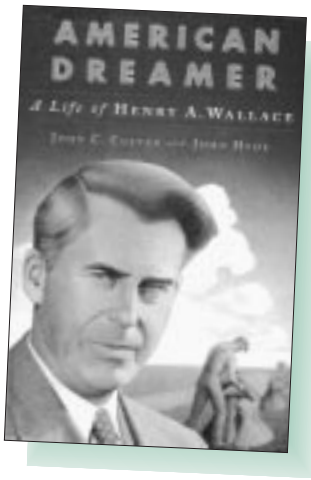
American Dreamer: The Life and Times of Henry A. Wallace by John C. Culver and John Hyde, Norton & Company: New York. 580 pp. $35.00.

Many readers of *DIVERSITY* will remember Henry A. Wallace as the founder of Pioneer Hi-Bred International and the man who hired William L. Brown as a young researcher. Brown went on to become president and CEO of Pioneer and, in another of his enduring legacies, founder of this magazine.

In *American Dreamer,* their absorbing new biography of Henry Wallace, former U.S. Senator John Culver (D-Iowa) and reporter John Hyde portray a Renaissance man who was at once visionary statesman and passionate plantsman. Culver and Hyde note the rare, perfect match of Wallace's background, talent, and desire to the public service that beckoned during the Great Depression of the 1930s. "[B]orn to a family whose very mission was the preservation of agriculture, [Wallace] had become the mobilizing general of just such an effort. … Few men knew more about agriculture than Wallace, and no man anywhere burned with greater zeal to rescue farmers from their cruel misfortune."

One of the most fascinating and influential figures in the administration of Franklin D. Roosevelt, Henry Wallace served two terms as FDR's secretary of agriculture and became vice president during Roosevelt's third term. Within days of taking office in 1933, Wallace and his aides crafted a bill to address the crisis in agriculture brought on by the Depression. Enacted less than two months later, the Agricultural Adjustment Act (AAA) gave Wallace broad powers to make the U.S. Department of Agriculture (USDA) the most decentralized and participatory federal program in the nation. It immediately raised farmers' income by 30%.

When the Supreme Court overturned the AAA in 1936, Wallace not only refused to admit defeat, he was energized by it. Four days after the Court handed down its decision, Wallace convened a meeting of farm leaders to outline a new program. Within two months, the AAA had been replaced by the Soil Conservation and Domestic Allotment Act of 1936—signed, fully funded, and still in force today.



Considered by many to be the greatest secretary of agriculture in U.S. history, Wallace oversaw the creation of a huge new bureaucratic machine to carry out his revolutionary vision. Under his leadership, the USDA became the largest agency in the federal government, with field offices and representatives in every county in the nation, and its budget more than quadrupled. After a rough beginning, Wallace's department "became a model of effectiveness," said to be "the best run department in the New Deal." And the department's research center at Beltsville, Maryland became the largest and most varied scientific agricultural station in the world. It now bears his name in honor of this contribution to public research (see *DIVERSITY,* Vol.16, Nos.1&2, p.6).

Culver and Hyde portray a Renaissance man who was at once visionary statesman and passionate plantsman.

When FDR asked Wallace to resign from USDA in order to run for the vice presidency, Wallace observed that "nobody has less power than a vice president." But the two men worked well together, and Wallace functioned as FDR's conscience. Within six months, Wallace became arguably the most powerful vice president in the nation's history, one with both administrative authority and a voice of consequence in policy matters.

First, Last, and Always a Plantsman

Throughout his life, however, Wallace's first love was plants. He was proud of his hybrid corn and the abundance it made possible. Wallace started Pioneer Hi-Bred in 1929 in the basement of his home, with no full-time employees. By the time his wife Ilo died in 1981 at the age of 93, the company recorded sales of $478 million and earned a net profit of $63.5 million.

Following publication of *American Dreamer,* the authors were frequently asked what Wallace, who died in 1965, might have thought of today's genetic engineering of plants. Although one can only speculate, Culver and Hyde's illumination of his philosophy and beliefs does offer some insights into what Wallace might have thought.

Wallace believed that the ends of science should always be human welfare. Progress should not be blocked, but rather guided to serve human needs and conquer social and economic obstacles. The well-being of farmers was his paramount goal for plant breeding.

With his sense of justice, orderly scientific mind, and abiding interest in helping poor countries feed themselves, Wallace well may have been a thoughtful proponent of genetic engineering of crops. However, in specific instances he likely would have criticized the public and private sector's oversight and application of genetic engineering: In his lifetime, Wallace called to task companies for overselling their products, administrations and congress for failing to fund public agricultural research, and public demonstrators for their tactics.

But though we will never know exactly what he might have thought about biotechnology, we do know that he was a highly complex man who also took pleasure in simple things. In a speech marking the USDA's centennial, the 74-year old legendary former secretary told the standing-room-only crowd, "Scientific understanding is our joy. Economic and political understanding is our duty. Our objective is the understanding of life at all its varied levels." He concluded by saying, "I recommend to all of you that you become gardeners. Then you will never die, because you have to live to see what happens next year."

Wallace's ideas and his unfinished agenda fill the pages of *American Dreamer* and give readers a dramatic rendering of a great and decent man who profoundly influenced America in one of its times of greatest need. Culver and Hyde have written a balanced, perceptive book that will enrich anyone who loves plants.

Maureen Kuwano Hinkle served on the board of DIVERSITY from 1982 to 1995, during which time she directed agricultural policy for the National Audubon Society (1981-99). Prior to that, she worked for Environmental Defense (1972-81). Now retired, she serves as an adviser to nonprofits and funders.

— INFORMATION RESOURCES —

• **The International Plant Genetic Resources Institute (IPGRI) has published a compilation of experiences, approaches, and tools from around the world for encouraging *Participatory Approaches to the Conservation and Use of Plant Genetic Resources.*** The volume aims to help translate global policies touting community participation into on-the-ground equitable practices for the maintenance and management of plant genetic resources (PGR). The four substantive sections of the book focus on: ways to increase farming communities' access to germplasm and information from genebanks; methods for enabling community-level management of PGR; examination of a few participatory approaches to community seedbank management and seed exchange; and participatory methods of enhancing awareness of PGR conservation and use among the public and policymakers. Full contact information is provided for the 30+ international contributors to the volume. For further information, contact editors Esbern Friis-Hansen of the Danish Center for Development Research (*efh@cdr.dk*) and Bhuwon Sthapit of IPGRI-Malaysia (*b.sthapit@cgiar.org*).

• **A new publication from IUCN/Earthscan reviews the history of and current debate on patents and other forms of intellectual property rights (IPR), and protection of plant genetic resources and traditional knowledge.** Authored by Graham Dutfield of the Traditional Resource Rights Working Group of Oxford, UK, *Intellectual Property Rights, Trade and Biodiversity* provides case studies of specific approaches and experiences as well as recommendations for further study and action. It provides a detailed account of how to integrate the requirements of the Convention on Biological Diversity in an equitable global IPR regime, and argues for finding ways to accommodate both the property rights systems of indigenous people and conventional intellectual property protections. For further information, consult the Earthscan Web site (*www.earthscan.co.uk.*) or contact *earthinfo@earthscan.co.uk.*

• **Academic Press has published a five-volume, 4,800+-page *Encyclopedia of Biodiversity,* edited by Princeton University biologist Simon Levin.** More than 300 peer-reviewed entries survey a vast landscape of biodiversity-related topics, ranging from evolution and genetics to habitats and ecosystems to human effects, public policy, and economics. More than 430 authors from 31 countries contributed to the encyclopedia, and the text contains almost 2,000 figures and tables. For further information, visit *www.apnet.com/ecology/.*

• **A Spanish-language training module on *ex situ* conservation of plant genetic resources is available in electronic form (CD-ROM and via the Internet) from IPGRI.** The module is intended to help train genebank staff in the principles and procedures for maintaining germplasm in genebanks, from collection through utilization. The training materials were created as part of a project funded by the Spanish government to foster research and training on plant genetic resources in Latin America. Downloadable PDF files can be accessed at *www.ipgri.cgiar.org/system/page.asp?theme=9.* For further information, contact Margarita Baena at *m.baena@cgiar.org.*

• ***The Genetics of the Horse,* a new reference work from CABI Publishing, provides a detailed review of current equine research.** With 18 chapters contributed by international experts, the volume covers diverse topics, including breeds and their origin, the genetics of color variation, and genetic resources conservation. For further information, visit the CABI Web site at *www.cabi.org.*

• **IPGRI has released two publications designed to bring together the scarce, scattered literature on traditionally underutilized species of tropical American fruits.** One is a bibliography retrospective to 25 years, containing more than 650 references on nine themes, including pathology, breeding, propagation, taxonomy, and entomology. Downloadable PDF files can be found at *www.ipgri.cgiar.org/system/page.asp?theme=7.* The other is an inventory of 1,100 species in 66 families and 282 genera, with information on taxonomy, use, origin, and geographic distribution. For further information, contact Dimary Libreros regarding the bibliography (*d.libreros@cgiar.org*) and Geo Coppens concerning the inventory (*g.coppens@cgiar.org*).

— PEOPLE —

• **Peter Raven, director of the Missouri Botanical Garden and current president of the American Association for the Advancement of Science, has received the National Medal of Science, the USA's highest scientific honor.** A leading authority on plant systematics and evolution, Raven responded to his selection by calling for "compassionate concern about the Earth's future through preserving biodiversity." He and 11 other scientists were honored at a dinner in Washington, DC in December.

• **Canadian Nobel Prize laureate Michael Smith died on October 4, following a two-year battle with leukemia.** Smith won the Nobel in 1993 for his work on site-directed mutagenesis. A passionate advocate for science, Smith is remembered for donating the $500,000 in Nobel Prize money to charitable causes in Canada—including under-funded researchers studying the genetics of schizophrenia, a science museum program promoting grade-school science teaching, and a program encouraging women to enter science—and successfully challenging the federal and provincial governments to match his donation. Smith was born in Blackpool in northern England in 1932, the son of a market gardener. The University of British Columbia, where Smith was University Killiam professor and Peter Wall distinguished professor of biotechnology, announced that a new building housing the biotechnology laboratory founded by Smith in 1987 would bear his name.

• **On November 10 in Vatican City, Te Tzu Chang was inducted into the Pontifical Academy of Sciences in recognition of his work on the Pope's Food Security Council.** Chang, a renowned rice geneticist whose work has helped boost agricultural productivity in Asia, Africa, and South America, was awarded the Tyler Prize in 1999. Now based in Taipei, Taiwan, he retired from the International Rice Research Institute in 1993 after serving as principal geneticist. Chang has advocated preservation of our genetic resources as the best means of feeding the world's poor.

• **Australian Prime Minister John Howard created a brouhaha in October when he named two genetic engineers as recipients of the inaugural Prime Minister's Prize for Science.** Jim Peacock and Liz Dennis—two researchers at CSIRO, Australia's scientific and industrial research agency—received the award for their work in the discovery of the Flowering Switch Gene, a key gene for determining the onset of plant flowering. Peacock and Dennis are working to produce genetically modified (GM) varieties of canola, wheat, and other crops that flower at the optimal time for the climate in which they are grown, thereby reducing the risk of crop loss due to adverse weather. The prime minister raised hackles earlier in the year with his statements urging state and territory leaders to soften the proposed Australian labeling regime for GM foods, one of the strictest in the world.

• **Distinguished botanist and Arnold Arboretum curator Bernice Giduz Schubert died in her sleep on August 14.** A graduate of Radcliffe College, Schubert helped edit Fernald and Kinsey's *Edible Wild Plants of Eastern North America* and the eighth edition of *Gray's Manual of Botany.* After a stint at Jardin Botanique de l'État in Brussels, Belgium, she joined the USDA Plant Introduction Station in Beltsville, Maryland, where she worked on *Dioscorea.* She also collaborated with National Institutes of Health chemists in the search for plant alkaloids potentially useful in treating high blood pressure, collecting samples in Brazil, Costa Rica, Cuba, México, Panama, and Puerto Rico. From 1962 to 1983, Schubert served on the staff of the Arnold Arboretum—first as associate curator, later curator and senior lecturer—continuing her studies of begonia, *Desmodium,* and *Dioscorea.* She was awarded the Eva Kenworthy Gray Award of the American Begonia Society and was an honorary member of the Sociedad Botánica de México. A fellow of the Linnaean Society of London, she also served on the Council of the Society of Economic

Botany and was a member of the American Society of Plant Taxonomists, the International Association for Plant Taxonomy, the American Institute of Biological Sciences, and the Botanical Society of America.

— RESEARCH —

• **Researchers from the U.S. Department of Agriculture's Agricultural Research Service (ARS) have made two promising advances in wheat genetics.** In the first instance, scientists are using wild wheat relatives to assemble a multiple gene complex conferring more durable resistance to the fungal pathogen *Puccinia triticina.* The genes come from two Near East wheat relatives, *Aegilops tauschii* (goatgrass) and *Triticum timopheevii.* Currently available varieties produced by wheat-breeding programs contain single-gene resistance to leaf rust, and many begin to lose effectiveness within a few years. With the gene complex, breeders hope to develop varieties with longer-lasting rust resistance that will sharply reduce the 50 million bushels of wheat now lost to rust damage each year on the Great Plains of the U.S. For further information, contact Gina Brown-Guedira at +1-785-532-7260 or *gbg@ksu.edu.* … Also, a team of investigators from ARS and the University of Nebraska has decoded the entire genome of wheat streak mosaic virus (WSMV) and demonstrated use of the altered virus as a vector for introducing genes into wheat. The scientists identified gaps within the 9,300+-nucleotide sequence of the WSMV genome for inserting new genes coding for new proteins or traits. Thus far, the team has only modified the virus with two bacterial enzymes as proof of concept, but the technique holds out the hope of delivering useful new genes into wheat much more quickly than even conventional genetic-engineering approaches. Waiting times for the expression of new genes have been cut from six months to four or five days, according to the scientists. For further information, contact ARS plant pathologist Drake Stenger at +1-402-472-3166 or *dstenger@unlnotes.unl.edu.*

• **In an intriguing comment piece, German geneticist Diethard Tautz argues that a "biological uncertainty principle" akin to physics' Heisenberg Uncertainty Principle may make unrealistic the goal of understanding a gene's full function.** Writing in the November 2000 issue of *Trends in Genetics,* Tautz takes note of the empirical and theoretical evidence supporting the existence of genes that confer vanishingly small fitness benefits to an individual but which are selected due to their impacts on the long-term fitness of a population. Just as it is impossible to simultaneously observe the energy of an atomic particle and time, it may be impossible to observe the trajectory of an advantageous, low-frequency allele in any one generation. Thus, in order to fully elucidate the functional genomics of an organism, geneticists may need to devise experimental designs at a semi-evolutionary scale, e.g., under competitive conditions for several generations, or otherwise take into account a "population genetics uncertainty principle." For further information, contact Tautz at the University of Cologne at *tautz@uni-koeln.de.*

• **Biotechnology is opening new fronts in the war on potato diseases.** ARS researchers are using molecular techniques to study 19th-century herbarium samples from Europe and North America and learn more about the fungus that caused the 1845-51 epidemics of late blight in potatoes in Ireland. The scientists are using polymerase chain reaction (PCR) technology to amplify unique segments of fungal DNA from *Phytophthora infestans.* The technology can reproduce millions of copies of DNA segments, enabling investigators to quickly distinguish among pathogens without the tedious, time-consuming process of isolating and culturing diseased tissue for identification. To date, 20 samples—including one from Ireland collected in 1846 and others from Britain collected in 1845-7—have tested positive for *P. infestans.* For further information, contact Carol L. Groves of the ARS New England Plant, Soil, and Water Laboratory at +1-207-581-3267 or *cgroves@maine.edu.* … Monsanto scientists have created the first-ever transgenic potato in which a single gene, derived from alfalfa, has been shown to protect plants as effectively as soil fumagation, according to the December 2000 issue of *Nature Biotechnology.* The researchers announced that they had isolated an anti-fungal peptide from alfalfa, which they called alfAFP (alfalfa anti-fungal peptide), and cloned its gene. When the alfAFP gene is expressed in potatoes, it acts strongly against *Verticillium dahliae* (Verticillium wilt, or potato early-dying complex) and two other plant pathogens. However, the gene is not effective against potato late blight. While the mechanism of fungal growth suppression is not clear, the evidence suggests that the alfalfa protein binds onto chitin and prevents *V. dahliae* from building cell walls. (The cell wall of the potato late blight fungus *P. infestans* does not contain chitin.) A Monsanto spokesman said that it will take another eight to 10 years to bring the altered potato to market. Currently, potato growers lose an estimated $70-140 million per year to the fungus. For further information, contact Monsanto's Ai-Gai Gao at *jihong.liang@renessen.com.*

• **Researchers associated with the UK Biotechnology and Biological Sciences Research Council have published a review of recent genetic analyses that are unraveling the mechanics of plant-pathogen recognition.** This research is helping to elucidate the sophisticated systems used by plants to detect pathogens and induce appropriate defensive responses. Genetic studies of plant mutants impaired in mounting a resistance response to invading pathogens have exposed the existence of a complex signaling network involving cross talk between distinct but interconnected pathways. In the October 2000 issue of *Trends in Genetics,* the authors review recent analyses illustrating plants' ability to fine-tune responses to particular pathogens in order to activate appropriate subsets of downstream defenses. Though the precise molecular mechanisms of plant-pathogen recognition remain elusive, plant genomic sequencing is providing a flurry of new information on disease-signaling proteins as well as targets for further biochemical analysis. For further information, contact Bart J. Feys at *bart.feys@bbsrc.ac.uk* or Jane E. Parker at *jane.parker@bbsrc.ac.uk.*

• **ARS research has uncovered a genetic basis for sheep's dietary preferences, a finding that could be used to help improve rangeland management by breeding sheep with a taste for invasive weeds.** The documentation of Rambouillet sheep's preference for mountain big sagebrush (a common plant covering at least 100 million acres of rangeland in the western U.S.) extends other scientists' findings of genetic influences on food preferences in mice, goats, cattle, and humans. Some ranchers already use sheep to control troublesome weeds like leafy spurge, and breeding sheep to favor specific plants could help both the animals and the environment, says ARS geneticist Gary D. Snowder of the U.S. Sheep Experiment Station in Dubois, Idaho. For further information, contact Snowder at +1-208-374-5306 or *gsnowder@pwa.ars.usda.gov.*

• **Further evidence of outcrossing in canola and corn has been found.** The Canadian agriculture agency announced in November 2000 that it is accelerating investigations to determine the extent of gene flow from bioengineered, herbicide-resistant canola to non-GM canola grown in adjacent fields. The announcement by Agriculture and Agri-Food Canada (AAFC) follows on the discovery last year of canola resistant to three types of herbicide growing in a field in Alberta. Scientists have collected seed samples from 11 test sites in Saskatchewan where RoundUp®-ready canola was grown in fields adjacent to fields of Liberty Link canola. Initial findings were expected to be available by the end of 2000. Estimates of rates of canola outcrossing have ranged from 20-30%. Three-quarters of last year's Canadian canola crop was herbicide-resistant. For further information, contact Judy Hume of AAFC at *humej@em.agr.ca.* … The *Washington Post* reported in late November that the protein found in StarLink corn, Cry9C, was found in another corn hybrid produced by the seed company licensed by Aventis CropScience to produce and distribute StarLink. The discovery raises the specter of gene flow between fields of StarLink and other corn, and follows on recent massive recalls of taco shells and other corn products found to contain StarLink, which currently is not approved for human use. A spokesman for the seed company, Garst Seed Co. of Slater, Iowa, said that it was notifying farmers who bought the possibly contaminated seed but that it did not think that a "substantial" number of lots were affected. For further information, contact Jeff Lacina of Garst Seeds at 1-800-831-6630, ext. 5202.

• **The ARS has announced the release of 'Ruddy,' its first red-skinned, orange-fleshed sweet potato with multiple-pest resistance.** Developed by a team of ARS scientists and researchers at the South Car-

olina Agricultural Experiment Station at Clemson University, the new variety contains the very high levels of beta-carotene, a vitamin A precursor, that are typical of orange-fleshed sweet potatoes. It also produces high yields and keeps well in long-term storage. 'Ruddy' is highly resistant to the larvae of several soil insects, including wireworms, cucumber beetles, and flea beetles. Roots, shoots, and cuttings are expected to be available to researchers for the 2001 growing season, and genetic material will be placed in the clonal repository at Griffin, Georgia. For further information, contact ARS geneticist Janice R. Bohac at +1-843-556-0840 or *jbohac@awod.com.*

• **Breeders take note: University of Florida researchers have found that temperature increases of the magnitude generally expected under global climate change could suppress rice yields 20-40% by 2100.** These results extend previously reported findings of depressed yields in peanuts and soybeans associated with warmer temperatures; however, rice yields appear to be even more temperature-sensitive. Scientists with the university's Institute of Food and Agricultural Sciences examined two rice varieties—one tropical variety from the Philippines and one temperate variety from California. Yields of the former began to decline when diurnal temperature cycles exceeded 73-91º F.; for the latter, the corresponding daily range was 68-86º F. Although the vegetative portions of the plants continued to flourish, seed production declined and virtually ceased when the diurnal cycle reached 86-104º F. For further information, contact Hartwell Allen at +1-352-392-8194 or *lhair@gnv.ufl.edu,* or Kenneth Boote at +1-352-392-1811, ext. 231 or *kjb@gnv.ifas.ufl.edu.*

— OPPORTUNITIES —

• **The World Food Prize Foundation has issued a call for nominations for the 2001 prize, which will be awarded on World Food Day (October 16) to an individual who has helped make food more plentiful, nutritious, or available to substantial numbers of people.** Nominees may have distinguished themselves by their work anywhere in food production and distribution, including but not limited to: soil and land; plant and animal science; food science and technology; nutrition; rural development; marketing; water and the environment; natural resources; physical infrastructure; transportation and distribution; special or extraordinary feeding programs; social organizations and poverty elimination; economics and finance; policy analysis; advocacy and implementation. The prize carries a cash award of $250,000. Required nomination documentation includes biographical information, statements of achievement and impact, the endorsement of the nominating organization, and seconding nominations. **The deadline for receipt of nominations is February 28, 2001.** More detailed guidelines are available at: The World Food Prize, Attn: Judith Pim, Director of Secretariat Operations, 1700 Ruan Center, 666 Grand Avenue, Des Moines, IA 50309 USA. Tel: +1-515-245-3783. Fax: +1-515-245-3785. E-mail: *wfp@worldfoodprize.org.* Internet: *www.worldfoodprize.org.*

Please visit *www.diversitymag.org* for a more comprehensive list of coming events. Editor's note

— 2001 —

February 15-20—**The American Association for the Advancement of Science (AAAS) Annual Meeting and Science Innovation Exhibition,** San Francisco, CA. Contact: AAAS, 1200 New York Avenue, NW, Washington, DC 20005. Tel: +1-202-326-6450. E-mail: *aaasmeeting@aaas.org.*

March 3-9—**Cambridge Healthtech Institute's Genome Tri-Conference,** San Francisco, California. Contact: Cambridge Healthtech Institute, 1037 Chestnut Street, Newton Upper Falls, MA 02464. Tel: +1-617-630-1300. Fax: +1-617-630-1325. Internet: *http://www.genometriconference.com.*

March 5-9—**14th ASTA Management Academy,** Purdue University, West Lafayette, Indiana. Contact: Suzanne Nicholas, ASTA, 601 13th Street NW, Suite 570 South, Washington DC 20005-3807. Tel: +1-202-638-3128, Fax: +1-202-638-3171. E-mail: *snicholas@ix.net.com.* Internet: *http://www.amseed.com.*

March 5-9—**International Centre for Genetic Engineering and Biotechnology (ICGEB) First Biosafety Workshop,** Trieste, Italy. Contact: ICGEB, AREA Science Park, Padriciano 99, 34012 Trieste, ITALY. Tel: +39-040-37571. Fax: +39-040-226555. E-mail: *biosafe@icgeb.trieste.it.* Internet: *http://www.icgeb.trieste.it.*

March 12-16—**Sixth Meeting of the Subsidiary Body for Scientific, Technical and Technological Advice (SBSTTA-6),** Montreal, Canada. Contact: The Secretariat of the Convention on Biological Diversity, World Trade Center, 393 Saint-Jacques St., Suite 300 Montreal, Quebec, Canada H2Y 1N9. Fax: +1-514-288-6588. E-mail: *secretariat@biodiv.or.* Internet: *http://www.biodiv.org.*

March 24-26—**52nd Annual Meeting of the American Institute of Biological Sciences (AIBS),** Washington, DC. Contact: AIBS, 1313 Dolly Madison Blvd., Suite 402, McLean, VA. Tel: +1-703-790-1745. Fax: +1-703-790-2672. E-mail: *admin@aibs.org.* Internet: *www.aibs.org.*

March 25-27—**Second International Conference on Date Palms,** Al-Ain City, United Arab Emirates. Contact: Plant Production Dept., Faculty of Agricultural Sciences, United Arab Emirates University. E-mail: *datepalm@uaeu.ac.ae.* Internet: *http://www.agri.uaeu.ac.ae/agri/conferences/sicdp.html.*

April 2-6—**ICGEB Second Biosafety Workshop,** Florence, Italy. Contact: ICGEB, AREA Science Park, Padriciano 99, 34012 Trieste, ITALY. Tel: +39-040-37571. Fax: +39-040-226555. E-mail: *biosafe@icgeb.trieste.it.* Internet: *http://www.icgeb.trieste.it.*

April 18-20—**Global Agriculture 2020: Which Way Forward?** John Innes Centre, Norwich, UK. Contact: Agric 2020 Conference Secretariat, John Innes Centre, Norwich Research Park, Norwich, UK, NR4 7UH. Tel: +441603 450581/450641. E-mail: *agric.2020@bbsrc.ac.uk.* Internet: *http://www.jic.bbsrc.ac.uk/events/agric2020.*

May 8—**Global Environment Facility (GEF) NGO Consultation Meeting,** Washington, DC. Contact: Hemanta Mishra, GEF, 1818 H Street, NW, Washington, DC 20433. Tel: +1-202-473-0508. Fax: +1-202-522-3240. E-mail: *hmishra@worldbank.org.* Internet: *http://www.gefweb.org.*

May 9-11—**GEF Council Meeting,** Washington, DC. Contact: Hemanta Mishra, GEF, 1818 H Street, NW, Washington, DC 20433. Tel: +1-202-473-0508. Fax: +1-202-522-3240. E-mail: *hmishra@worldbank.org.* Internet: *http://www.gefweb.org.*

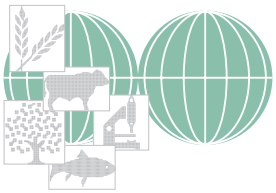
May 21-25—**CGIAR Mid-Term Meeting,** Durban, South Africa. Contact: The CGIAR Secretariat, World Bank, 1818 H Street, NW, Washington, DC 20433. Tel: +1-202-473-8951. Fax: +1-202-473-8100. E-Mail: *cgiar@worldbank.org.* Internet: *http://www.cgiar.org.*

May 22-24—**National Agricultural Biotechnology Council Conference (NABC 2001)** High Anxiety and Biotechnology: Who's Buying, Who's Not, and Why? Chicago, Illinois. Contact: The National Soybean Research Laboratory, University of Illinois at Urbana-Champaign 170,National Soybean Research Center, 1101 W. Peabody, Urbana, IL 61801. Tel: +1-217-244-1706. E-mail:*nsrl@uiuc.edu.* Internet: *http://www.aces.uiuc.edu/research/nabc2001/index.html.*

May 28-June 1—**FIS/ASSINSEL Congress,** Sun City, South Africa. Contact: Suzanne Nicholas, ASTA, 601 13th Street NW, Suite 570 South, Washington DC 20005-3807. Tel: +1-202-638-3128, Fax: +1-202-638-3171. E-mail: *snicholas@ix.net.com.* Internet: *http://www.amseed.com.*

May 28-June 3—**Society for Economic Botany Annual Meeting: Building Bridges with Traditional Knowledge,** Honolulu, Hawaii. Contact: Building Bridges Summit, University of Hawaii, Honolulu, HI 96822-2279. Fax: +1-808-956-3923. E-mail: *bbt2@hawaii.edu.* Internet: *webmaster@traditionalknowledge.com.*

June 4-8—**REDBIO 2001—Latin American Meeting on Plant Biotechnology of the REDBIO/FAO Network,** Centro de Convenciones, Goiania Goias, Brasil. Contact: Dr. Juan Izquierdo, Plant Production Officer, REDBIO/FAO Secretariat, FAO Regional Office for Latin America and The Caribbean (RLC), Box 10095, Santiago, Chile. Tel: +56-2-3372224. Fax: +56-2-3372101. E-mail: *juan.izquierdo@fao.org.* Internet: *http://www.rlc.fao.org/redes/redbio/html/home.htm.*



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