DIVERSITY

A News Journal for the International Genetic Resources Community

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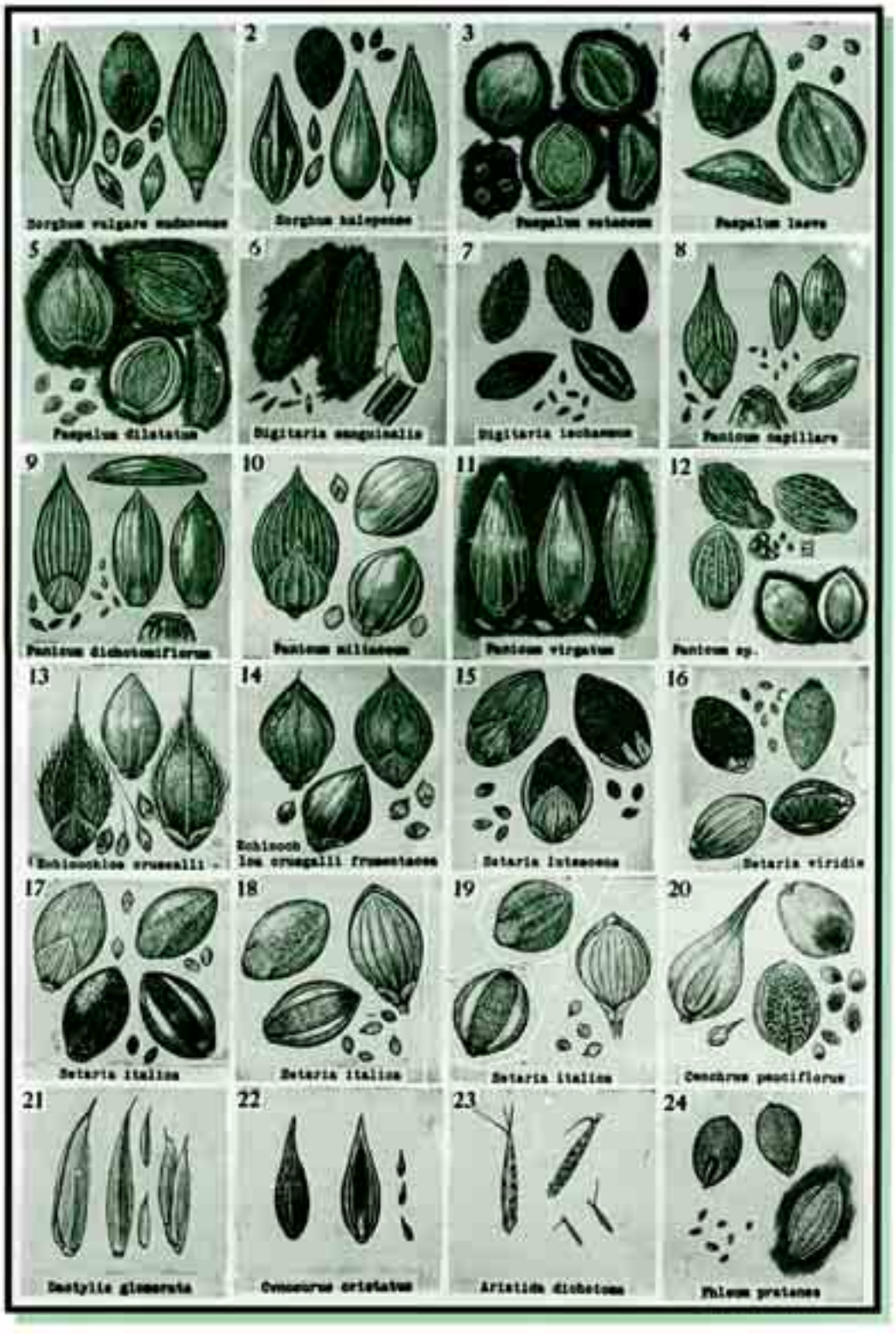

DIVERSITY

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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LATE BREAKER. . . The long-awaited Global Biodiversity Assessment (GBA) was released by the United Nations Environment Programme (UNEP) at the second Conference of the Parties to the Biodiversity Convention in Jakarta, Indonesia. About 1500 scientific experts throughout the world have contributed to the GBA, the first comprehensive scientific assessment ever carried out on the Earth's biodiversity. Complete coverage in the next issue . . .

New Genetic Resources Policy Unit to Assist CGIAR Avoid "Minefields"

"Minefield" was the operative term used by delegates throughout their discussions at the annual meeting of the Consultative Group on International Agricultural Research (CGIAR) in describing policies that might affect access to international germplasm collections. The term was used, in both serious and light-hearted tones, by representatives of the UN Food and Agriculture Organization (FAO), the United Nations Environment Programme (UNEP), and the Secretariat of the Convention on Biological Diversity (CBD) in their formal statements to the CGIAR on the controversial issue, as well as by CGIAR Chairman Ismail Serageldin himself in his introduction of the universally esteemed chairman of the CGIAR's Genetic Resources Policy Committee: M.S. Swaminathan.

"There is no better guide through this minefield," said Serageldin, a World Bank vice president who has shepherded the CGIAR through an unprecedented 1% month "renewal" program (see DIVERSITY, vol. 10,no.4,pp.5-8). But even Swaminathan-whose impeccable credentials* make him one of the few international figures deemed credible and trustworthy by all factions of the genetic resources debate -is not a magician, and even he may not be able to smooth the way to an effective resolution of the debate over germplasm access and ownership, a debate that continues to simmer and threatens to boil over in any number of the national and international fora now considering the thorny issue.

Swaminathan States the Case

The urgency and sensitivity of the issue is what moved the CGIAR committee to "strongly recommend' the establishment of a CGIAR Genetic Resources Policy Unit at the Rome-based International Plant Genetic Resources Institute (IPGRI), Swaminathan told delegates and donors attending the week-long October 30-November 3 meeting at the World Bank in Washington, DC. (Germplasm management in the CGIAR has been estimated as an annual US$25 million enterprise. The entire research budget for the CGIAR 1996 research agenda is expected to be approximately US$300 million.)

It is crucial, asserted the experienced negotiator, that the CGIAR and the international agriculture research centers (IARCs) be "fully briefed about developments in the CBD; the FAO's International Undertaking on Plant Genetic Resources and its Commission, Global System on Plant Genetic Resources, and IV International Technical Conference; the International Union for the Protection of New Varieties of Plants (UPOV); and the TRIPS provisions of the World Trade Agreement, among others."

Most countries are now struggling to establish a focal point from which their policies on genetic resources should emanate, Swaminathan explained. As a result, decision-makers must now track the policies of numerous departments (i.e., agriculture, commerce, foreign affairs, environment, etc.) when trying to ascertain an individual nation's position on a particular issue. Conversely, Swaminathan added, it is also important that the CGIAR's interests and perspectives on key policy issues be brought to the attention of the various policy-making bodies dealing with genetic resources. The committee thus concluded that these onerous tasks require a policy unit within the CGIAR.

> *"We have come to realize that agriculture can simply not be separated from conservation."*
> **-Elizabeth Dowdeswell**

The CGIAR committee also recommended that "in order to convert the concept of farmers' rights into reality" (as required in Article 15 of the CBD), the CGIAR centers should assist National Agricultural Research Systems in developing appropriate policies and procedures for the recognition of those rights.

Noting that farmers' rights are "but one component of a complex web of ethical concerns relating to the conservation and use of genetic resources," the committee urged that a workshop for NGOs with expertise in such areas as equity, gender, sustainability, and biotechnology be held in the very near future. In view of the pivotal role women play both in genetic conservation and seed selection, the committee further recommended that "the gender dimension become an integral part of the CGIAR research agenda as it relates to genetic resources."

During what many observers agreed was the most passionate discussion of the five-day meeting, many speakers and government representatives underscored the immense importance of the remarks Serageldin would make the following week in Jakarta in his address to the CBD Conference of the Parties (COP).

Some recalled the comments made by UNEP Executive Director Elizabeth Dowdeswell to the CGIAR at its milestone ministerial meeting last February in Lucerne, Switzerland. "We have come to realize that agriculture can simply not be separated from conservation," said Dowdeswell, who described as "critical" the CGIAR's objective of integrating natural resource management with its quest for productivity increases. "Issues such as biodiversity highlight the interface of the environment with agriculture, and these linkages cannot be ignored," the UNEP director declared.

Serageldin, known for his diplomatic and often erudite, poetic orations, is expected to underscore those linkages to an audience in Jakarta not as well-versed with the agro-biodiversity component of the world's genetic reservoir as many in the agriculture community feel is crucial for the effective implementation of the CBD.

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Ed note: DIVERSITY plans to publish Mr. Serageldin's address to the COP in the next issue.

*International Rice Research Institute Director General, International Union for the Conservation of Nature and Natural Resources President, Keystone International Dialogue Chairman, and World Food Prize Laureate, to name just a few.

Calestous Juma Named Head of Biodiversity Convention Secretariat

Dr. Calestous Juma, an internationally known genetic resources specialist, has been appointed Executive Secretary of the Secretariat for the Convention on Biological Diversity (CBD). The announcement was made in September by Elizabeth Dowdeswell, Executive Director of the U.N. Environment Programme (UNEP), which provides the Convention's Secretariat.

Until this appointment, Juma, a Kenyan national, had been serving as the Executive Director of the Nairobi-based African Centre for Technology Studies (ACTS), an international non-profit organization he founded in 1988 to promote policy research, undertake training, and disseminate information on the application of science and technology to sustainable development.

Extensive Experience in Bringing Bio-Players Together

ACTS, in conjunction with the Stockholm Environment Institute, organized the 1993 International Conference on the Convention on Biological Diversity: National Interests and Global Imperatives. Held shortly after the CBD was signed in Rio, the conference brought together participants from state agencies, intergovernmental organizations, non-governmental organizations (NGOs), research institutions, and the private sector to discuss the development of implementing legislation, methods of achieving the convention's conservation and technology transfer objectives, financing mechanisms, relationship with other agreements, and interim measures.

The conference was a model for the Global Biodiversity Forum, the gathering of NGOs preceding the official CBD-related meetings that is intended to provide a venue for open debate and dialogue on key biodiversity issues among policy makers, NGOs, and scientists, and analysis and ideas to the officials implementing the convention (see DIVERSITY, vol.9,nos. 1&2, p.11).

"The Convention on Biological Diversity offers great opportunities for dealing with global environmental problems."
-Calestous Juma

The Kenyan researcher is also a board member of several leading international research institutes and has directed a variety of international research programs and projects, with particular emphasis on genetic resources and the emerging field of biotechnology.

Noted Author and Honoree

Juma, winner of the 1991 Pew Scholars Award in Conservation and the Environment and a recipient of a UNEP Global 500 Prize in 1993, has written extensively on genetic resources issues. He is the author of *The Gene Hunters* (see DIVERSITY, vo1.6,nos.3&4,p.65) and contributed to *Biodiversity Prospecting* (see DIVERSITY, vol.9,nos.1&2,p.85) as well as numerous articles and books in the fields of economics, science, technology, the environment and sustainable development, the most recent of which is *Coming to Life: Biotechnology in African Economic Recovery* (1995), edited with John Mugabe and Patricia Kameri-Mbote.

In making the announcement, Dowdeswell noted that Juma's appointment comes at a critical time for the Convention process. The treaty's second meeting of the Conference of the Parties (COP) was held in Jakarta, Indonesia, in mid-November. "I am confident that Dr. Juma's rich experience of dealing with diverse international environment and development agencies and institutes will contribute substantially to the Secretariat's work and the further achievement of the Convention's objectives," Dowdeswell said.

"The Convention on Biological Diversity offers great opportunities for dealing with global environmental problems," Juma said upon accepting the appointment. "But its implementation places greater demands on the international community to cooperate and forge new and effective partnerships. My primary challenge will be to promote such cooperation, and I will count on the support of everyone to achieve this goal."

As Executive Secretary, Juma is expected to organize and direct the Secretariat in making policy decisions that incorporate the Convention's provisions and objectives. In addition to administrative and support duties, the Executive Secretary also represents the Convention in other international fora and is responsible for enhancing the awareness and understanding of the Convention with the media, the scientific community, and the general public.

"My primary challenge will be to promote cooperation, and I will count on the support of everyone to achieve this goal."
-Calestous Juma

First Stop on Road to Jakarta: CGIAR

He began fulfilling those responsibilities swiftly. En route to the Jakarta meeting, Juma stopped in Washington, DC, to address the annual meeting of the Consultative Group on International Agricultural Research (CGIAR), an effort applauded by CGIAR Chairman Ismail Serageldin and one which he will reciprocate when he addresses the COP delegates in Jakarta (see p. 2).

Juma told the CGIAR that the convention's Article 15 (on access to genetic resources) continues to be a lightning rod for the actions being taken by individual governments to implement the CBD. He noted the contrast between this new approach by governments and past instances when the standard was to work through uniform international regulations. Juma urged the CGIAR "to seek solutions directly with the CBD" and said Serageldin's presence at the COP was a step in the right direction.

For more information, please contact: Mr. Robert Bisset, Convention on Biological Diversity, UNEP Information Officer, Secretariat, P.O.30552, Nairobi, Kenya. Tel: +254-2-62-3084. +254-2-62-3692. *-DS*

Ed. note: In an upcoming DIVERSITY exclusive, Dr. Juma will share his thoughts on the outcome of the COP and preview the next steps in implementing the Biodiversity Convention.

The first observance of the **International Day for Biodiversity** will take place on December 29, the anniversary of the Convention's entry into force.

Commission Debates FAO Undertaking Revisions as 4th ITC Approaches

Plans for the upcoming 4th International Technical Conference on Plant Genetic Resources (ITC) in Leipzig, Germany, and debate over revisions of the International Undertaking on Plant Genetic Resources dominated the Sixth Session of the Commission on Plant Genetic Resources of the Food and Agriculture Organization of the U.N. (FAO), held in Rome 19-30 June.

The Commission, which predates the Convention on Biological Diversity (CBD) by more than a decade, has constantly wrestled with the issues of intellectual property rights (IPR), farmers' rights, and germplasm ownership, and continued to do so during this latest meeting.

The ITC's main purpose is adopting the first Report on the State of the World's Plant Genetic Resources and the first Global Plan of Action (GPA) as an integral part of the FAO Global System for the Conservation and Utilization of Plant Genetic Resources (see DIVERSITY, vol. 5,nos.2&3,pp.7-9). It will also include a progress report on the revision of the International Undertaking and its interrelationship with the GPA and the CBD in the context of the Global System.

The Report will be divided into three main parts examining:

- the state of biodiversity;
- the art of genetic resources conservation; and
- the capacity of personnel and institutions in the field.

Delegates agreed that the report should emphasize germplasm's contribution to world food security in the context of sustainable agriculture and that material on forest genetic resources should deal with agroforestry and food-producing forestry.

Delegates raised a number of IPR issues they believe the Report should cover: fair and equitable sharing of benefits; technology development and transfer; a factual assessment of countries' legal capacity; trade and IPR including the work of the World Trade Organization, the World Intellectual Property Organization, and the International Union for the Protection of New Varieties of Plants; and the effects of IPR on agricultural and rural communities.

IPGRI Proposes Multilateral System for FAO-CGIAR Agreement

Since it established the Undertaking in 1984, FAO has committed itself to developing an "internationally coordinated network of national, regional, and international centers in order to hold, for the benefit of the international community and future generations, collections of plant genetic resources of important plant species . . . on the principle of unrestricted exchange" (see DIVERSITY, no.6,p. 16). This network was considerably augmented last year when the Consultative Group on International Agricultural Research (CGIAR) placed its collections, the majority of which were accumulated before the CBD was ratified, into the network (see DIVERSITY, vol. 10,no.4,p.4). However, the model agreements regarding placing germplasm in the network had been developed prior to the CBD. Now FAO is faced with modifying them to bring them in line with recent developments.

An important contribution to this section of the two-week Commission meeting was the report of the International Plant Genetic Resources Institute (IPGRI). The IPGRI report proposes developing a system within a multilateral framework that would both respect the principle of access on mutually agreed terms, as well as provide mechanisms for benefit sharing.

Germplasm's contribution to world food security should be emphasized in the context of sustainable agriculture.

Countries would place their agricultural germplasm into such a system based on prior informed consent. All other countries which are parties to the system would have "unrestricted' access to samples of these resources, i.e., they would not pay at point of access, but the access would be regulated through a legal mechanism such as a material transfer agreement.

In cases where profits are generated through the commercial exploitation of the resources, germplasm users would be obligated to negotiate a share of the profits with countries of origin for material collected after the entry into force of the CBD. Material obtained prior to ratification of the CBD would either continue to be distributed on the present basis, or on the condition that any benefits derived from commercial use could be put into the envisaged intemational fund for the implementation of Farmers Rights. In the latter case, this could be limited only to material where the country of origin is unknown.

The Commission members felt that the proposed system could be usefully considered in discussions on the revision of the Undertaking and recommended that IPGRI prepare an in-depth study for the consideration of the Commission of various possible systems compatible with the CBD and analyzed in terms of their likely efficiency, practicality, and cost-effectiveness.

Some countries suggested that until the Undertaking had been modified, it might be possible to employ the proposed IPGRI system on an experimental basis, thereby assessing its advantages and disadvantages. Others preferred to analyze the proposal's implications first.

In Situ Conservation Areas Network and Expansion of Commission Proposed

While the FAO International Network covers *ex situ* collections, the Commission also supports development of a network of areas for in situ PGR conservation and said that this should be established on the basis of national policies and strong national commitments. Such an *in situ* network may be discussed during a worldwide technical consultation on protected areas in 1997 which the FAO plans to organize.

After discussing the FAO Council recommendation to broaden the Commission mandate to include other agricultural genetic resources by a phased step-by-step approach beginning with animal germplasm, the delegates suggested that the issue be postponed until after the ITC and the revision of the Undertaking.

In addition to these matters, the delegates agreed to hold an Extraordinary Session in April 1996 to prepare for the ITC.

For additional information, contact: Dr. José Esquinas-Alcazar, Secretary of the FAO Commission on Plant Genetic Resources, Food and Agriculture Organization of the UN, Viale delle Terme di Caracalla, 00100 Rome, Italy. Tel: +39-6-5225-4986. Fax: +39-6-5225-3152. *-JDG*

New Division of Labor Between Farmers and Breeders Unites Conservation and Development

by L. Sperling and M.E. Loevinsohn

"Enhancing and Maintaining Genetic Resources On-farm" was the theme of a recent conference held in New Delhi, India, that brought together farmers' organizations, non-governmental organizations (NGOs), and scientists and research managers from universities, national agricultural research systems (NARS), and international agricultural research centers (IARCs) to review field experience and discuss future initiatives. While the focus of the meeting, sponsored by Canada's International Development Research Centre (IDRC), was on South Asia, particularly India, Nepal, and Bangladesh, case material from Ethiopia, Rwanda, Zimbabwe, the Philippines, and Mexico helped highlight methodological and institutional issues which cut across boundaries.

The seminar was organized around three major themes: (1) diagnosis of varietal and seed systems; (2) seed banking and seed supply systems; and (3) decentralized and participatory breeding approaches.

The initial segregation of speakers addressing the themes was striking: only one NGO representative spoke on breeding and selection, and no NARS scientist addressed seed banking or supply issues. This division seemed to reflect genuine differences in institutional perspectives on genetic resource issues, a politically fraught area, particularly in India. But the meeting also helped to reveal a number of points of convergence among the various points of view as well as some abiding differences. Common ground was found in the understanding that genetic diversity continues to be essential to meeting farmers' needs, both socially and ecologically. Conservation must respond to those continuing needs.

What Should be Conserved?

Implicit differences in what people saw as the proper objects of conservation were evident. Were we speaking of particular landraces or the processes by which genetic and varietal diversity are generated, maintained, and spread?

Louise Sperling works as a consultant in Africa and Asia on issues of client-oriented plant breeding and seed supply systems. Michael Loevinsohn is an ecologist working on community-based resource management and environmental health. Both helped organize the workshop.

Several participants, among them Mauricio Bellon of the International Rice Research Institute (IRRI), took the latter view: "Diversity maintained by farmers is not just the set of varieties they keep, but also the management processes these varieties are subject to and the knowledge that guides these processes. In fact, the specific varieties in the set may change through time. Hence, farmers' diversity is a process rather than a state." He added that a dynamic conception of on-farm conservation and genetic enhancement would have to enlarge the varietal choices available to farmers by supporting the processes that create and sustain that choice.

Several presentations recounted the increasing erosion of control of communities over the processes of crop evolution, which has paralleled the erosion of varietal diversity itself.

Farhad Mazhar of UBINIG, a Bangladeshi NGO, suggested that "Farmers don't think high-yield varieties (HYVs) are necessarily bad, but they want seed they can store, control, and replant." P.V. Sateesh of the Deccan Development Society (DDS) described the devaluation of locally adapted varieties of small millets and sorghum in villages of Andhra Pradesh, India, and the promotion of rice and wheat by many governmental programs, including the all-important Public Distribution System.

In a provocative paper entitled "What does *in situ* conservation mean in the life of a small-scale farmer?" S. van Oosterhout of the Agricultural Research Centre, Zimbabwe, traced how public policy constrained farmers' options, first pushing them out of the market in the colonial period, then back into it after independence. Waves of genetic loss have overshadowed smaller waves of gain. As many pointed out, flows of diverse germplasm are critical to evolution and the maintenance of well-adapted, productive farming systems.

Supportive Interventions as Diagnostic Methods?

Participants agreed that efficient diagnostic methods are needed to clarify how farmers' choices are being constrained and to identify the forces underlying varietal change. Greater attention also must be paid to differences among farmers- differences in their expertise, their needs/preferences, and their access to valued seed material. A. Das of Sahayog described some of the problems in pursuing such work in the Himalayan foothills of Uttar Pradesh. Gender and caste divisions can inhibit the sharing of knowledge of varieties as well as seed exchange. For instance, women meeting as a group may be considered with suspicion, and people from villages but three km apart avoid crossing paths.

A study from tropical Kerala (V. Santhakumar, Indian Institute of Technology) suggested how attitudes towards on-farm biodiversity differ among the principal economic groups-marginal farmers, mixed cash croppers, and plantation owners.

What might be the central components of an on-farm plant genetic resource diagnosis? At least four were explored-variety selection; variety adaptation; seed flows; and seed selection and storage. While researchers need sharper methods to understand and measure these processes, farming communities themselves need tools to help them choose useful varietal or seed interventions. Participants described their experiences in two principal realms: alternative breeding/selection approaches, and community-organized seedbanking and multiplication efforts.

Participatory Breeding and Selection

The largest number of breeding presentations focused on programs which are try ing to combine greater user input along with site-specific screening. Farmers have been involved in the early stages of selecting either among existing "finished' varieties or among segregating material from crosses. Rice has been the focus of most of the efforts. J. Witcombe (Overseas Development Administration) and A. Joshi presented work of the KRIBHCO Indo-British Rainfed Farming Project (located in districts of Madhya Pradesh, Gujarat, and Rajasthan); D.M. Maurya described decentralized varietal selection in rainfed areas of Uttar Pradesh, while K.D. Joshi and B. Sthapit, of the Lumle Agricultural Research Centre, Nepal, summarized their experiences in the mid-hills of Nepal with farmer involvement as early as the F3 generation.

Other crops were also represented: E. Weltzien and colleagues from the Intemational Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and with M.K. Choudhary of The Society to Uplift Rural Economy described farmer selection of pearl millet populations in arid areas of Rajasthan, while L. Sperling, a consultant for IDRC, shared lessons learned in a par-

ticipatory program on common beans in Rwanda. What is clear is that such approaches are starting to be integrated within the central concerns of both the NARs and IARCs. D.M. Maurya, a pioneer of early farmer involvement, is now Director General of the Council of Agricultural Research in Uttar Pradesh, a state of 130 million people.

A number of points emerged from the presentations and subsequent discussions. First, the papers lent welcome empirical support to the argument that the search for specific adaptation to local conditions can result in a set of varieties that are more productive than the one or a few, selected for broad adaptation, that typically emerge from conventional procedures. In various contexts, associating farmers at stages when variation is still meaningful has resulted in varieties being identified that satisfy a range of needs and preferences, including-but going beyond-grain yield. Greater on-farm diversity should also be supported by these approaches, but there is still insufficient evidence from the field on this score.

Secondly, breeders working in some of the most difficult environments, where stresses occur in complex patterns, see a clear need for greater decentralization and participation in selection but have yet to attempt it. These include B. Mishra (Central Soil Salinity Research Institute, Haryana) who has worked for many years selecting cereals tolerant of problem soils and J.L. Dwivedi (Crop Research Station, Ghaghraghat) working on deepwater rice in eastern Uttar Pradesh.

The latter suggests progress might be hastened by submitting a "genetic soup" of diverse breeding populations to natural selection in farmers' fields. This is essentially the "evolutionary breeding" approach that Trygve Berg (Agricultural University of Norway) outlines. It is an approach first proposed for stress breeding decades ago, but which he believes could be made more efficient in meeting farmers' needs by drawing them into the selection process. Breeders would make diverse material available to farmers, then step back and watch what emerges after several crop generations. As L. Sperling pointed out, gaining the most from participation will require a "new division of labor" between farmers and breeders.

Making "Hidden" Diversity Visible

In most experimental programs, the emphasis has been either on material resulting from crosses or on varieties that have already been released. M. Loevinsohn (IDRC consultant) pointed out that considerable farmer-bred diversity often remains in the field, but that it is effectively "hidden" from others due to slow and uneven farmer-to-farmer diffusion. There is reason to believe, however, that certain varieties will prove attractive to cultivators some distance away.

In Rwanda, for example, a study found that of the ten most popular released bean varieties, six had been collected from farmers' fields. J. Witcombe and A. Joshi described another form of diversity which may be hidden. In India, more than 500 rice varieties have been released in recent years. However, public seed enterprises concentrate on only a very few of these, typically ones released a decade back, and often move material only in the one or two states of official launching. Slow and uneven diffusion through either the formal or informal sectors effectively limits farmers' choices. Making such "hidden" diversity more accessible to farmers' selection may be one very practical way in which groups involved in breeding and on-farm conservation can find common ground.

Considerable farmer-bred diversity often remains in the field.

Seedbanking and Local Seed Supply

Initiatives that would assure continued and secure access to diverse seeds focus particularly on community-managed banking, multiplication and distribution. Participants heard of specific initiatives such as R. Khedkar's group from the Academy of Development Sciences (ADS), which has collected more than 300 rices from the Konkan region of Maharashtra and is distributing 1 kg samples of some 60 of these to farmers in several districts. After testing, farmers return 2 kg, either to ADS or to their neighbors.

In Bangladesh, the women of the UBINIG-supported "Nayakrishi Andolon" eschew the idea of a centralized "bank" and are instead developing community "seed wealth centers" where farmers can obtain and exchange seed samples at no cost. Village workers also grow nurseries from which larger quantities of seed are sold, thus helping to sustain their own efforts and the initiative as a whole.

In the hills of Uttar Pradesh, the farmer volunteers of V. Jardhari's Beej Bachao Andolan ("Save the Seeds") are screening more than a hundred local varieties each of rice and common bean, as well as varieties of other hill crops, such as amaranth, that have generally received little attention from formal research. Those found promising are multiplied and made available to neighboring farmers.

The sangams, organizations of mostly lower-caste women, with which DDS is working in Andhra Pradesh, are rehabilitating patches of degraded land owned by these women and turning them into small but productive seed farms. These are expected to form the basis of a distribution network for the seed of increasingly rare local varieties, at the same time as expanding the livelihood options that are open to the sangam women.

An innovative program in the Philippines, described by F. Magnifico, of Community Based Native Seeds Research Center (CONSERVE), selects, banks, and disseminates seed of traditional rice and maize germplasm in an area in the heartland of the Green Revolution belt. CONSERVE has put a strong emphasis on safeguarding local varietal knowledge as well as the germplasm itself.

These various efforts share a number of features. Most are working on varietal erosion as one facet of a wider process of agricultural change and, through their programs, hope to have an impact not only on varietal diversity. DDS, for example, also aims at reclaiming "wastelands" and reestablishing a place in agriculture for coarse grains that are crucial for the food security in poor households. UBINIG is concerned with a range of consequences of intensive rice cultivation, such as pesticide pollution and groundwater depletion. All of the groups appear to be working to enhance farmers' skills: ADS, for example, in hybridization and DDS in small enterprise management.

Early Implications

As these programs are in each case quite young, some still embryonic, it is too early to expect an evaluation of their impact or of the cost-effectiveness of their interventions. Nonetheless, a number of important concerns can be signalled. First, the links among these local initiatives and between them and institutions that might provide useful support appear to be poorly developed. It is unlikely to prove very efficient for communities themselves to maintain large numbers of varieties that are not in current use. Economies of scale will accrue to centralized banks or sub-national ones, such as that being developed by the M.S. Swaminathan Research Foundation in Madras (see DIVERSITY, vol. 8, no.2,p.l1). NGOs present suggested creating stronger

seed networks among themselves to get countrywide coverage but, in addition, R.S. Rana, then Director of the National Bureau of Plant Genetic Resources (NBPGR), stated that the three storage levels mentioned "community banks, medium storage, and longer-term facilities had to be expected to reinforce each other."

Participants also suggested that broadened institutional linkages could enlarge farmers' varietal options for seed initiatives. As E. Weltzein and K. Riley, of the International Plant Genetic Resources Institute (IPGRI), suggested, "dynamic seedbanking could take the form of access to a wider range of genetic material, even to collaboration on enhancing landraces through breeding." Rajeev Khedkar, for one, recognizes such a need: the local rice varieties his ADS is making available to farmers in Konkan are highly susceptible to the yellow stemborer, a pest that has apparently increased in severity in recent years.

Participants also agreed that of at least equal importance to the technical and social organization of seedbanking are the rights of access to and control over germplasm and knowledge, a topic addressed by A. Gupta of the Indian Institute of Management. While the community versus national and international interests has been the most publicized arena of the Intellectual Property Right (IPR) debate, such property issues need to be clarified within communities (where "all members are not always equal"), among communities, and between NGOs and communities as well.

Finding Common Ground

Consensus was found among working groups and subsequent discussions on a number of recommendations and follow-on activities. There was wide agreement that formal researchers should work more systematically with NGOs and farmer groups in selection and seed multiplication. Seedbanks must put more effort into testing demand for diverse varieties and expanding the range and quality of what is offered. Linkages between seed and genebanks at different levels that respect community rights in their material must be worked out. Broad research priorities were sketched for on-farm conservation, ranging from household survival strategies to policy issues shaping international access to germplasm.

Divergence remained, however, on a number of points. One was the issue of "compensation" to communities that have developed landraces: it was unclear that this would help prevent the erosion of diversity, or that it is actually desired by farmers. Another need was for decentralized, participatory selection in the favored environments where "high-yielding" varieties have been widely adopted, but demand for diversity is still evident.

Participants agreed to keep this important dialogue open, with liaison to be provided by IPGRI, the Indian Institute of Public Administration, and IDRC. A number of groups are arranging exchanges on their own, and follow-up meetings are being planned by ADS. The proceedings of the workshop, some 30 case studies with participants' lively commentary, will be available in late 1995 by contacting: South Asian Office of IDRC, 17 Jor Bagh, New Delhi 110 003, India. Tel: +91-11-461-9411. Fax: +91-11-462-2707.

Experts Gathered by International Atomic Energy Agency Assess Plant Breeding through Nuclear Energy

by R. Rabson

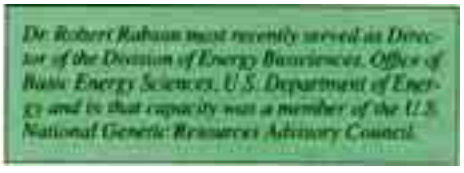
While the world media was re-examining the 50th anniversary of the introduction of atomic power that ended World War II, researchers and technical experts working to develop new genotypes of nutritional and industrial crop plants were meeting to examine the beneficial use of nuclear technology. More than 175 experts from 46 countries gathered in Vienna last June at the FAO/International Atomic Energy Agency (IAEA) Symposium on the "Use of Induced Mutations and Molecular Techniques for Crop Improvement" to learn about the latest efforts to enhance the diversity of genetic materials for plant breeding through nuclear energy and related technology.

A key topic was modification of genetic composition of plants through mutation induction by radiation and chemicals. A major concern was how induced changes in genetic composition may affect gene expression. Gene inactivation was discussed along with how such activities as pathogen resistance, chemical composition, and a variety of other functions may be influenced.

The Joint FAO/IAEA Division Section on Genetics and Plant Breeding has been a strong proponent on the use of mutation induction for developing new crop varieties since its inception in 1964. According to the data base recording the numbers of mutant varieties released for agricultural usage, roughly 1,800 cultivars have been developed through mutant induction over 30 years of activity. In many instances this has had a major positive impact on crop productivity.

Interaction Between Gene Mappers and Plant Breeders is Crucial

A major objective of the meeting was to strongly encourage interaction between investigators heavily involved with the development and use of sophisticated procedures for genetic mapping and other activities relating to plant genetics and other scientists who are concerned with practical plant breeding.


Dr. Robert Rabson most recently served as Director of the Division of Energy Biosciences, Office of Basic Energy Sciences, U.S. Department of Energy and in that capacity was a member of the U.S. National Genetic Resources Advisory Council.

The growing movement towards utilization of mapping procedures to gain a better understanding of genetic manipulation was evident in the large segment of the meeting devoted to newly developed methodologies for chromosome mapping along with reference to the sequences of the genes involved. The results will increase genetic knowledge of existing germplasm collections. Projects with cereals, non-cereals, and vegetatively propagated species described progress utilizing molecular markers. Reports indicated that marker-assisted selection, gene introduction from wild species, and gene isolation would be very important future breeding applications of marker technology, although currently a number of genetic relationship and genetic diversity studies are underway.

From Theoretical to Practical

Participants discussed in detail numerous specific areas that do or could advance plant breeding: plant pathogenesis; the process of apomixis involving production of progeny without fertilization; genetically controlled tolerance for stresses such as abundant aluminum; and the impact of methylation of various cell constituents on gene expression. There was a continued interest throughout the presentations in the features that influence plant growth and how plants react to genetic change and what is known about genetic control of such adaptations.

In addition to various discussions of advanced molecular technologies, many participants reported by lecture or poster on their particular plant breeding activities. The range of crops and specific breeding objectives was very large including gram crops, fruits, ornamental, vegetables including tubers, and tropical species.

The proceedings are expected to be published. To order a copy, contact: Publishing Section, International Atomic Energy Agency, P.O. Box 100, A-1400, Vienna, Austria. For additional information, contact: Dr. M. Maluszynski, Head, Plant Breeding and Genetics Section, Joint FAO/IAEA Division of Nuclear Techniques in Food and Agriculture, International Atomic Energy Agency, Wagramerstraase 5, P.O. Box 100, A-1400 Vienna, Austria. Tel: +43-1-2360. Fax: +43-1-234564.

Rifkin Fires First Shot at W.R. Grace in Battle Against "Patents on Life"

An international coalition of over 200 non-governmental organizations (NGOs), led by activist Jeremy Rifkin, has filed a formal petition with the U.S. Patent and Trademark Office calling for the revocation of W.R. Grace and Company's controversial patent #5124349, granting the company exclusive use of a pesticide extract from the neem tree. The patent is for W.R. Grace's formulation of a solution containing azadirachtin (the biopesticide contained in neem seeds) to meet U.S. market needs that pesticides remain biologically active for at least two years and thus have the necessary "shelf life."

Jeremy Rifkin
(Photo courtesy Foundation on Economic Trends)

The International Coalition of NGOs Opposed to the Neem Tree Patent, a group of 200 farm, trade, scientific, and academic groups from 40 countries, claims that W.R. Grace's patent is invalid under "prior art" provisions of the U.S. Patent Code because the neem tree emulsions have long been used by Indian farmers to protect crops from pests.

The petitioners argue that the W.R. Grace company has wrongfully usurped an age-old biological process used by millions of Indian farmers for generations and claimed exclusive rights to profit from its sale in the global marketplace.

Grace Responds

The company rejoins that its 1992 patent narrowly focuses on a formula which extends the shelf life of Grace's neem-based pesticide, Neemix, to two years, says a company spokesman. This differs from the traditional Indian use of neem seed as a pesticide which is based on mixing the seeds in water and using the solution the next day because it is not stable for more than a few days or weeks. The decomposition of azadirachtin is accelerated by mixing with water.

Grace also challenges Rifkin's charge that they have an exclusive patent, pointing out that Grace holds no patent in India and "does not intend to seek a patent there." Grace claims that there are approximately 40 different patents issued on various extraction, processing, and formulation processes related to azadirachtin. These patents are owned by 22 different companies or groups, three of which are Indian, says the company.

The Indian company, P.J. Margo Private Limited, which built the world's first commercial-scale facility specifically designed for neem-based natural biopesticide production, buys neem seeds on the open market in India. Grace, which is a minority stock holder in P.J. Margo, provided the process technology for the project and purchases the factory's product.

As DIVERSITY goes to press, the case, which was filed September 14, remains before the Board of Patent Appeals and Interferences of the U.S. Patent and Trade Office. The Foundation on Economic Trends (FET), the Washington DC-based organization led by Rifkin, says it does not expect a decision for several months. Similar legal opposition has been lodged in the European Patent Office against a patent granted to both W.R. Grace and the United States for a fungicide method based on extracts from coarsely ground neem seeds. The organizations spearheading that action are the International Federation of Organic Agriculture Movements (IFOAM), the Research Foundation on Science, Technology and Natural Resource Policy of India, and the Greens in the European Parliament.

Neem. (Drawing by Peggy Duke from National Research Council. 1992. *Neem: A Tree for Solving Global Problems.* National Academy Press. Washington, D.C.)

IFOAM vice president, Linda Bullard, says that in addition to the U.S. challenge of the neem patent for lack of novelty and inventiveness, the European case also charges that "the patent should be revoked on moral grounds, according to Article 53(a) of the European Patent Convention."

"The Opening Round of Global Confrontation"

The NGO coalition can boast an experienced leader when it comes to litigation involving germplasm issues as Rifkin almost singlehandedly led a suit against the USDA's National Plant Germplasm System (NPGS) during the 1980s charging that germplasm accessions were not being kept up to standard (see DIVERSITY, vol.6, no. 1 ,p.22). Many, including those associated with the NPGS, concede that Rifkin's action brought about much-needed attention and funding to the beleaguered U.S. germplasm program.

The legal challenge to Grace is seen as a critical test of intellectual property laws under the new guidelines established by the World Trade Organization. The 235 organizations filing the complaint argue that hundreds of indigenous pharmaceuticals, agricultural chemicals, food, and fiber products "are being illegally usurped by global companies anxious to reap windfall profits off native inventions and discoveries." Rifkin asserted "that the battle between native peoples and multinational corporations over the extension of intellectual property rights to the global gene pool is likely to be the critical North-South political and economic issue of the coming decade."

When the U.S. suit was filed, Rifkin predicted that "the international challenge to W.R. Grace's patent [would] mark the opening round of a global confrontation between traditional cultures and transnational corporations for control over the rich genetic resources of the

He made good on that promise two weeks later when the FET announced "a nationwide grassroots campaign to stop all patents on life." Said Rifkin: "We believe that it is morally indefensible to allow scientists and global corporations to patent the very blueprints of life. The rich genetic resources of the earth's biological commons should be shared openly and fairly and not become the exclusive intellectual property of transnational corporations."

The public protests, which began September 27 at the New York Stock Exchange and the Chicago Board of Trade, are planned in more than 25 U.S. cities over the next year. "With this unprecedented grassroots effort," said Rifkin, "we hope to mobilize broad public opposition to patents on life and move this important issue to the forefront of debate in the United States."

For additional information, contact: Ms. Carin Houck-Wylie, The Foundation on Economic Trends, 1660 L St. NW, Suite 216, Washington, DC 20036 USA. Tel: l-202-466-2823. Fax: 1-202-429-9602 and: Mr. Chuck Suits, Manager of Public Relations, W.R. Grace & Co., One Town Center Road, Boca Raton, FL 33486-1010 USA. Tel: 1-407-362-2600. Fax: 1-407-362-1342. *-JDG and DS*

Dependence on Germplasm Collections for Food Security Underscored for U.S. Council

The fall 1995 U.S. National Genetic Resources Advisory Council (NGRAC) meeting provided an overview of the state of the nation's agricultural germplasm as it relates to federal funding, access to germplasm, and the maintenance of large, well-documented genetic resources collections.

Council members attending the Washington, DC, meeting first heard from USDA Under Secretary for Research, Education, and Economics Karl Stauber, whose responsibilities include the Agricultural Research Service (ARS) which oversees USDA germplasm activities. He assured members of his willingness to work with them on germplasm acquisition and maintenance, but warned that they should expect continuing declines in research budgets. Nonetheless, he predicted, "I think we can get the support of the Clinton Administration on genetic resources."

Shrinking congressional appropriations are not the only threat to U.S. genetic resources. The country's access to germplasm with resistance to agricultural stresses may also be more difficult in the future, according to the briefing by U.S. State Department official John Matuszak, who reported on preparatory meetings to the second Conference of the Parties to the Convention on Biological Diversity (CBD) and the U.N. Food and Agricultural Organization's (FAO) Commission (see story, p. 4).

Failure to Ratify Biodiversity Convention Damages U.S. Position

Both forums are redefining intellectual property laws according to the rights of indigenous peoples, country of origin, and farmers, he stated. Some of the options discussed could greatly increase the difficulty and expense to foreigners for accessing native genetic resources. Matuszak told the NGRAC, the highest ranking body advising the Secretary of Agriculture on agrobiodiversity issues, that the failure of the United States to ratify the Biodiversity Convention "is damaging the nation's position in the international genetic resources dialogue."

Two presentations at the NGRAC meeting, one on the reappearance in the United States of the late potato blight and one on endangered microbial collections, illustrated the stakes involved in establishing some of the policies currently being debated by the FAO and CBD.

Another Potato Famine?

One hundred years after the potato blight caused Ireland to lose half its population, the disease has appeared in the United States and has already severely damaged the 1994 Northeast potato crop and the 1995 Idaho and Northwest crop. *Phytophthora infestans*, the fungus that causes late blight, is the world's most virulent disease of potatoes, destroying potato crops, whether in the ground or in storage, within a few weeks, reported Dr. Richard Lower, the Administrative Advisor to the Interregional Potato Introduction Project of Wisconsin.

Until 1984 only the Al type of the fungus had appeared in the U.S. and could be controlled by fungicides, but in 1987, type A2, which cannot be controlled by any of the fungicides permitted in the U.S., appeared in Pennsylvania. The fungus in one form or another now exists in the Pacific Northwest, British Colombia, Texas, California, Wisconsin, Florida, and Maine. The Al and A2 types could recombine into an even more serious threat.

USDA/ARS scientists now trying to breed *P. infestans*-resistant potatoes have turned to the original potato germplasm, donated from the International Potato Center (CIP) in Peru. Department pathologists, geneticists, microbiologists, and physiologists have been using the latest techniques to develop it into a better potato. Other ARS scientists are studying the fungus itself to discover ways to attack it. Although progress has been made and some fungus-resistant potatoes have been developed, experts believe that biotechnological development of commercially desirable potatoes will take years. Whether *P. infestans* is defeated through conventional or bioengineered breeding, NGRAC members were told that the solution will depend on plant or microbial germplasm collected, characterized, and maintained in genetic resources repositories.

Microbial Collections Need Study

Microbial culture collections also are endangered, said Robin Schoen, U.S. National Committee for the International Union of Biological Sciences, Commission on Life Sciences of the National Research Council (NRC). She reported on a fact-finding meeting at the NRC by the U.S. National Committee for the International Union of Microbiological Societies (USNC/IUMS) to gather information about the current and potential uses of microbial collection.

As a result of their meeting-which heard reports that substantial resources and expertise are falling into jeopardy at a time when biomedical, basic research, agricultural, biotechnological, and environmental uses of microbes are expanding-the committee asked that the NAS consider a comprehensive study of microbial collections. Such a study would include loss of gernplasm, collections management, funding structure, and maximizing use and benefit. The NAS has not yet determined whether it will conduct such a study as doing so requires funding not currently available.

Karl Stauber USDA Under Secretary for Research, Education, and Economics. (Photo courtesy USDA)

It was the committee's opinion that the United States, as a whole, undervalues its microbial germplasm collections and that the loss of important germplasm from the collections at Virginia Tech and Rutgers University, the lack of an adequately trained generation of curators and taxonomists for the future, and the exchange of nonstandard culture materials are examples of the results of such low esteem.

The council continued debate on the shape and substance of a strategic plan for the National Genetic Resources Program. The next NGRAC meeting will consider that plan and focus on natural ecosystems, communications, and international issues. The meeting will be held in Washington, February 14-15, 1996, following the AAAS meeting in Baltimore (see p. 18).

For additional information and copies of the NGRAC minutes, contact: Dr. Henry Shands, Associate Deputy Administrator -Genetic Resources, Room 115, Building 005, BARC-West, Beltsville Agricultural Research Center, 10300 Baltimore Ave., Beltsville, MD 20705-2350, USA. Tel: +l-301-504-5059. Fax: +1-301-504-6699. E-mail: hshands@ars-grin.gov. *-JDG*

Survey by CPC Reveals "Extraordinary" Contributions of Wild Plants to U.S. Economy

by 0. Phillips and B. Meilleur

As efforts to conserve plants become increasingly endangered by funding cutbacks, botanists are seeking additional data to strengthen arguments as to the economic value of such preservation. One major contribution is a recently completed report from the Center for Plant Conservation (CPC), a nongovernmental organization headquartered at the Missouri Botanical Garden, which conducted a comprehensive nationwide survey of the economic potential of rare U.S. plants. As part of the project on "Developing the Economic Potential of Native Plant Diversity"-supported by the Surdna Foundation, Philip Morris Inc./Kraft General Foods, and the Missouri Botanical Garden-the study addressed the question of just how useful rare wild plants are. The results of this first landmark work indicate that the monetary values are indeed high.

Developing a Utility-Based Argument for Conservation

The survey sought to understand the economic impact of the extinction of North American plant species and to develop more fully the utility-based argument for conservation. Two complementary approaches were used: (1) construction of a database to compare compilations of rare North American plants and their useful close relatives to make statistically valid statements about rare plants and their real and potential economic value and (2) analysis of research into this economic importance and potential of selected groups of rare plants to improve specific and concrete examples that could be readily understood by most audiences. Some of the key results of each approach are presented below. A brochure summarizing the findings, aimed at business leaders and legislators, as well as a full report will be available from CPC in late 1995.

Defining the Taxa of Interest

U.S. and worldwide information sources were surveyed to determine the usefulness of actual and related (same genus) species and sub-species of "conservation concern" in the United States, as defined by the Center for Plant Conservation (see DIVERSITY no.16,p.20, and vol.5,nos.2&3,p.43). CPC considers a taxon to be of conservation concern if it is "either listed by the Fish and Wildlife Service as endangered or threatened, proposed for such listing, or is being actively considered for such a listing, and/or is defined by The Nature Conservancy (TNC) as being imperiled globally because of rarity, or because of some factor(s) making it vulnerable to extinction throughout its range." By this definition, as of 1992, the survey found 3,2 14 plant species and 4,277 plant taxa (including species, subspecies, and varieties) requiring conservation concern in the United States. These were subsumed within 834 genera, which served as the focus of the plant-use study.

Having identified these genera, researchers compared them against taxa with a range of documented ethnobotanical and economic-botany uses and then synthesized the information into existing databases. A new, even larger synthetic database incorporated plant use data from the authoritative individual sources that had been chosen and then stored these data in a standardized format. As it was not possible to capture all relevant ethnobotanical and economic botany information,* the statistics of plant use derived from the database are conservative estimates.

Since scientists are far from recording all plant uses, those with economically important close relatives probably are more likely to possess economic potential than plants for which no economically important relatives are known. Moreover, many rare plant species were found to be close relatives of crops, some exceptionally important globally. Today, many of these crops require occasional genetic infusions from close wild relatives to maintain useful features such as improved nutritional value or to combat threats from climatic change and evolving disease. Therefore, by considering congenerics of endangered plants the survey includes many plants of exceptional economic value.

Dr. Oliver Phillips is a Research Fellow in Biodiversity with the School of Geography, University of Leeds, U.K. Dr. Brien Meilleur is President and Executive Director of the Center for Plant Conservation, headquartered at the Missouri Botanical Garden in St. Louis, Missouri, USA.

*Of the 13 databases and books used, the most significant were Moerman's *Medicinal Plants of North America*, Duke, Waine, and Beckstrom-Sternberg's *Worldwide Plant Use Database*, Mabberley's *Plant Book*, and Kunkel's *Plants for Human Consumption*

Summary Statistics

Once the databases of U.S. plants of conservation concern were matched with plants with known utility, some surprising results emerged:

- Of 3,214 rare species in the United States, more than 80 percent are used or have useful close relatives in the same botanical genus.
- In each of three broad use categories-medicine, food, and environmental uses-well over half of the genera of conservation concern are represented.
- Congenerics of plants of conservation concern include many species with great economic impact, including peaches, cherries, squashes, beans, almonds, sunflowers, walnuts, and roses.
- Two-thirds of U.S. plant taxa of conservation concern are congenerics of cultivated species (2,849 out of 4,277).

In contrast to these impressive numbers, at the specific level relatively few are reported to be useful (121, or less than 4 percent). This low percentage is considered to primarily reflect research gaps by ethnobotanists and the fact that, because of their rarity, such plants would be less obvious targets than common plants for use by human cultures. Many rare plants are restricted to just a few protected areas and inaccessible to most people, thus limiting opportunities to encounter them and to learn of useful properties they might have.

Plant conservation is an insurance policy for humankind.

Scientists also tried to establish the real and potential U.S. dollar value of the U.S. genera containing taxa of conservation concern, especially by reviewing data on the market value of their congeneric crop relatives. Recent data are available on the contribution to the U.S. economy of specific plant taxa, but much less economic information is available for the major crops. However, by reviewing studies of the economic value of major and minor crop species from the USDA and other sources, food crop congenerics of rare U.S. plants are estimated to be worth nearly $10 billion annually in wholesale farm values alone. Summaries of several case studies highlighting the economic importance and potential of rare plants help to underline the message derived from the broader statistical findings (see box).

Clearly, the close relatives of rare U.S. plants play an important role in the American economy. The loss of the rare wild species would be a very substantial economic threat to the United States.

Losing Knowledge and Habitats Threatens New Medicines and Markets

The disappearance of traditional knowledge, habitats, and plant species may prevent development of new crops of the future. Many wild plants long known to Native Americans have become domesticated and more widely consumed this century; these include blueberries *(Vaccinium corymbosum),* cranberries *(V. macrocarpon),* pecans *(Carya illinoiensis),* and wild *rice (Zizania palustris).* Such newer and now multi-million-dollar crops have improved the nutritional balance of our diets and enriched our lives.

Texas wild *rice (Zizania texana),* for example, is a rare native plant with substantial agricultural potential, but now it can be found growing only in a single stream in Texas where it is vulnerable to aquifer depletion and grazing by introduced rodents.

Native Americans once used more than 2,000 plant species for medicine. Today, many of these are sold as herbal products for health benefits. This rapidly growing retail market, now worth at least $1.3 billion annually in the United States, is still relatively undeveloped compared with markets for medicinal herbs in Europe and other parts of the world.

Indeed, plants played key roles in the development of seven of the top 20 best selling drugs in the United States. Even a synthetic drug as familiar as aspirin, consumed by Americans at the rate of 80 million pills a day, owes its origins to a chemical found in willow trees. Ironically, no less than 14 species and varieties of willow are threatened today in the United States.

Comparing databases focusing on plant rarity and plant utility developed for the CPC project on native plant economic potential illustrates the truly extraordinary economic contributions wild plants make to our lives. Their potential-especially in terms of new germplasm sources for crop species-is arguably much greater even than their current material benefits. This potential remains one of the most powerful arguments for rare plant conservation. If plant conservation is an insurance policy for humankind, it would appear to offer exceptional value for the investment.

For additional information, contact: Dr. Brien Meilleur, President and Executive Director, Center for Plant Conservation, Missouri Botanical Garden, P.O. Box 299, St. Louis, MO 63166, USA. Tel: +1-314-*577-9450.* Fax: +1-314-577-9465.

Case Study Summaries

• One **walnut** species, *Juglans hindsii*, now nearly extinct in the wild, has been used to develop disease-resistant rootstocks for all of the walnuts that we eat. Without this species, the walnut industry in California as we know it—estimated in 1991 to be worth more than a quarter of a billion dollars at the wholesale level—simply would not exist.

• **Sunflowers** (*Helianthus* spp.) constitute one of the most important native American crops. Even in the late 1970s, national sales of seeds, oil, and related products were worth $400 million annually. Breeding with wild species has now produced disease-resistant and highly productive hybrids that dominate the sunflower industry. Nevertheless, 12 species and subspecies found in the southern half of the U.S. are now in danger of extinction. Several of these are known for their tolerance to salinity and drought.

• **Grapes** are the world's most important fruit crop, with a total farm value in the United States alone of $1.86 billion in 1992. While 65 wild grape species occur in North America, Europe, and Asia, only one domesticated Asian species, *Vitis vinifera*, dominates the wine, raisin, and table grape industries. Yet four North American wild grape species are literally at the root of *vinifera*'s success. Disease-resistant U.S. rootstocks saved the European grape industry from the American pest aphid *phylloxera vitifoliae* at the end of the nineteenth century, and by 1988 their value to European wine exports was $6.26 billion. Worldwide demand for native *Vitis* species as rootstock is increasing to counter the threats posed by mutating races of phylloxera and other diseases, but the populations of several North American wild grape species have suffered through recent habitat loss.

The CPC study was undertaken with help from CPC's 25 Participating Institutions, several U.S. government agencies, and a project Advisory Board. Special thanks to Dun Moerman, Peggy Olwell, the late Calvin Sperling, Jim Duke, and Gary Nabhan for freely sharing data and ideas. Stephen Beckstrom-Sternberg, Don Falk, Steven Foster, Peter Principe, Gail McGranahan, Diane Ikeda, Orlando Mistreda, Mike O'Neal, Alan Whittemore, Philip Forsline, and Bruce Reisch contributed additional information. Sarah Rainwater and Beverley Kahney helped with data entry. Database management was coordinated by Deborah Kama and Hong Song.

NEWS IN BRIEF

The U.S. National Biological Service (NBS) and the Bishop Museum in Hawaii are collaborating on creating a specimen database for Hawaii's rare or declining insect species as part of the NBS Species at Risk Initiative. The project will compile and computerize specimen information and complete the compilation of published information on 274 Hawaiian insects presently residing in Bishop Museum databases and collections. The information will be uploaded to both gopher and web servers, making it available on the Internet. Because "Hawaii has more endangered and threatened species than any other state, this information is critical to fully understanding the species and their habitat needs in order to keep them from being formally designated as endangered species," NBS Director Dr. Pulliam said. For additional information, contact: Dr. Gordon Nishida, Dept. of Natural Sciences, Bishop Museum, 1525 Bernice Street, Honolulu, HA 96817 USA. Tel: +1-8088484196. Fax: +1-808-847-8252.

U.S. Holstein cattle remain the world's number one genetic source for top milk production, according to a recent ARS study. Researchers evaluated the genetics of bulls from the United States, Australia, Canada, Denmark, France, Germany, Italy, The Netherlands, New Zealand, and the United Kingdom. This revealed that of the top 100 bulls for traits of milk, fat, and protein produced by the bulls' daughters, 60 to 80 were from the United States. Other countries' top bulls consist of half, three-quarters, or even full U.S. genetics. For additional information, contact: Dr. Rex L. Powell, USDA-ARS Animal Improvement Laboratory, Beltsville Agricultural Research Center, Beltsville, MD 20705 USA. Tel: +1-301-504-8334. Fax: +1-301-504-8092.

A new, high-yielding, disease-resistant soybean has the highest two-year average yield of five publicly developed varieties and five advanced breeding lines. Named "Probst" after an ARS soybean breeder, Albert H. Probst, the new soybean variety has a gene called Rpsl-k which provides resistance to many races of *Phytophthora sojae,* a root fungus that regularly causes soybean yield losses. For additional information, call: Dr. James R. Wilcox, Agronomy Department, Purdue University, West Lafayette, IN 47907 USA. Tel: +1-317-494-8074. E-mail: jwilcox@dept.agry.purdue.edu.

The USDA Agricultural Research Service has developed a new cultivar of kenaf which stands up to root-knot nematodes better than other available varieties and also yields 200 percent more fiber than another popular variety. In three years of tests in nematode infested fields, the new variety, SF459, averaged 8,450 pounds of fiber per acre. It may also ward off disease-causing fungi that often invade kenaf roots wounded by nematodes. For additional information, contact: Dr. Charles G. Cook, USDA-ARS, Conservation and Production Systems Research, Building 201, 2413 East Highway 83, Weslaco, TX 78596 USA. Tel: +1-210-969-4812. Fax: +1-210-969-4800,

CALVIN ROSS SPERLING
1957-1995

Ten days after receiving plant exploration's highest award-the Frank N. Meyer Medal for Plant Genetic Resources-Calvin R. Sperling, 38, U.S. Department of Agriculture Plant Exploration Officer, succumbed to melanoma after a valiant struggle that touched family, friends, and colleagues around the world. In view of his deteriorating condition, officials awarded Sperling the medal, customarily announced in October during the annual Crop Science Society of America (CSSA) meeting, on May 10, as a way of letting this remarkable man and scientist have some idea of the high esteem in which he was held by all who had the privilege to know and work with him.

Calvin Sperling searched for wild relatives of the carrot on the slopes of the Cayambe volcano in Ecuador. (Photo by Calvin Sperling)

Dr. Sperling was recognized as one of the country's foremost economic botanists, known for his consistent excellence in field research and his extensive work to conserve biological biodiversity and improve crop plants worldwide. The 1995 Meyer Medal, which recognizes distinctive service in exploring and preserving the diversity of the world's plants, was one of many awards that the young scientist had received during his too brief, but most illustrious, career. In addition to receiving the first Richard Evans Schultes Award from the Healing Forest Conservancy and Russia's prestigious N.I. Vavilov Medal, *Fortune* magazine selected Sperling as one of their "25 Most Fascinating Business People of 1989" (see DIVERSITY, vol. 6, no. 1, p.26).

Speaking at a memorial service for the young scientist gathered in a glen outside of Washington, DC, Henry Shands, leader of the National Genetic Resources Program with whom Sperling worked closely throughout his career at USDA, said Sperling had made "significant contributions to national and international plant genetic resources and to the conservation of biological diversity."

His outstanding abilities were evident even as a graduate student on a collecting assignment with USDA, recalled Allan K. Stoner, Research Leader of the U.S. National Germplasm Resources Laboratory where Sperling worked during his years at the USDA's Beltsville Agricultural Research Center. Upon first meeting the student, Stoner told DIVERSITY, he could not believe that such a young man could be so professionally mature and already so aware of the many aspects of plant collecting. Still in graduate school at Harvard University, studying under the legendary Richard Evans Schultes, Sperling made ecogeographic studies of wheat and its wild relatives in Turkey and Israel that have contributed to a far better understanding of the distribution of the wild cereals, the natural association of legume species, the natural history of Triticeae, the population biology of wild wheat, and *in situ* conservation of crop progenitors.

> *"Modern botany has produced few specialists whose research outlook was so globally comprehensive as that of our late friend Calvin Sperling."*
> **-Richard Evans Shultes**

"Modem botany has produced few specialists whose research outlook was so globally comprehensive as that of our late friend Calvin Sperling," said Schultes upon learning of his death.

After completing his doctorate in 1987, the ethnobotanist joined the USDA Agricultural Research Service (ARS) where he developed what Shands calls a rational system, based on genepools, that established germplasm exploration priorities reflecting the true needs of the National Plant Germplasm System (NPGS). His system analyzed existing NPGS and other germplasm collections, what is known to exist in nature, plant rarity, breeding utility, and input from breeders and Crop Advisory Committee members. As a direct result of this signal work, NPGS explorations acquired important genetic resources previously missing in U.S. collections.

Sperling participated personally in many of these foreign plant collecting trips which added more that 1,000 fully documented accessions of cereals, food and forage legumes, fruits, and vegetables to NPGS collections. His oversight of 90 trips to 40 countries further contributed several thousand accessions of agriculturally important species and their wild relatives and, thus, a significant increase in the genetic diversity of the NPGS collection.

One of Sperling's most valuable contributions to insuring the safety of the world's food supply was the innovative prototype model he developed for *in situ* conservation of wild species of agricultural crops that could simultaneously complement biodiversity conservation in protected areas. Under his guidance, the plan has been applied in Ecuador, Ethiopia, the United States, and Turkey (see DIVERSITY, vol. 11 nos. 1&2,pp.64-67). This plan serves as a model for countries around the world for surveying, identifying, and protecting naturally occurring plant species. It is also a model for successfully linking communities, non-governmental organizations, and private groups in plant conservation.

National Code of Ethics Became International Model

Responding creatively to the North-South rivalry over genetic resources,

Sperling developed new exploration guidelines incorporating ethics, cultural sensitivity, and equity issues into U.S. exploration standards designed to recognize and compensate germplasm donors. Years ahead of their time, these guidelines were developed in advance of those established by the U.N. Food and Agriculture Organization (FAO) and were the only example of national standards that the FAO had from which to draw in creating an international code of collecting ethics. As a result, similar guidelines are now being adopted by other FAO member nations.

Dr. Sperling's code also serves as the basis of the operational procedures of the Consultative Group on International Agricultural Research, and it is likely that all PGR collections and exchange will be required to implement similar Material Transfer Agreements to meet the intent of the Convention on Biological Diversity. This far-sighted approach to plant exploration reflects Dr. Sperling's groundbreaking leadership in giving plant exploration a new direction.

". . . one of the rare and delightful international plant explorers whose passion for plants known, used, and appreciated by humans was equaled by his love and appreciation for the cultures and their uses of those plants."
-Steven R. King

As a civil servant his supervisors saw him mature rapidly. Although he had only been with the USDA for seven years, Sperling effectively represented agricultural interests in biological diversity discussions with the Department of State and helped prepare U.S. Senate testimony on international biodiversity issues. He also represented ARS in many interdepartmental meetings on issues and initiatives such as developing a biodiversity information center at the Smithsonian Institution and formulating the U.S. government's biodiversity strategy.

Sperling also served on the Gore-Chernomyrdian Environment Committee Working Group on Biodiversity and Sustainable Use (see DIVERSITY, vol.10, no.2,pp. 13-14). This group coordinates U.S. activities supporting conservation and use of natural resources in Russia. Colleagues say Sperling's first-hand familiarity with the status of Russia's N.I. Vavilov Institute of Plant Industry's (VIR) germplasm collection was instrumental in securing $500,000 for VIR from funds raised by this group. He was also responsible for acquiring new funds from the U.S. State Department to support germplasm conservation in the Newly Independent States of the former USSR.

Colleagues Mourn and Honor Memory

The loss of Calvin Sperling is keenly felt in the global plant collecting community both personally and professionally. A long-time friend and fellow classmate from Harvard, Steven R. King, now Vice President of Shaman Pharmaceuticals, describes Sperling as "one of the rare and delightful international plant explorers whose passion for plants known, used, and appreciated by humans was equaled by his love and appreciation for the cultures and their uses of those plants."

One group of Sperling's colleagues, from the USDA Regional Technical Advisory Committee of the NC-7 Regional Project, passed a resolution which conveyed the sentiments that so many working around the world to conserve genetic resources feel: "*Whereas our friend and colleague Calvin Sperling passed away at the beginning of a brilliant career, be it resolved that condolences be offered to his family. We will sorely miss his expertise, enthusiasm, and love for plant germplasm and his gentle and warm friendship.*"

At a memorial breakfast convened by the Meyer Medal Award Committee at the recent CSSA 1995 annual meeting, Sperling's colleagues announced the establishment of a Calvin Sperling Memorial Trust Fund which will sponsor a Calvin Sperling Memorial Lecture at future CSSA meetings. Steven Brush, University of California-Davis, recalled how Sperling brought "unflagging energy and support for plant collecting and conservation, as well as a warm but subtle sense of humor." Brush, an anthropologist who had worked with Sperling in various locales, also talked about how the young plant explorer's personal and professional qualities were recognized and appreciated by people of extremely varied cultural and professional backgrounds and said that "his personal gifts in particular were a great asset in winning the support and confidence of people with different ideas and objectives."

Another friend reminisced that how, "one year, Cal counted all the species he ate during that year and challenged those he knew and addressed in numerous speeches to join him and thereby appreciate in a practical way the interdependence of crop genetic resources. It was this exuberant physical and intellectual fusion in his exploration of the natural living world that characterized him throughout his life."

Calvin's brother-in-law, a minister from Oklahoma who conducted the memorial service, noted that Sperling was a voracious reader who typically did not mark his books. But, he did, most tellingly, mark a much-read copy of *Walden* at the well-known portion in which another plant lover-Henry David Thoreau-declared:

I went into the woods because I wished to live deliberately, to front only the essential facts of life, and see if I could not learn what it had to teach, and not, when I came to die, discover that I had not lived. I did not wish to live what was not life, living is so dear; nor did I want to practice resignation, unless it was quite necessary. I wanted to live deep and suck out all the marrow of life, to live so sturdily and Spartan-like as to put to rout all that was not life, to cut a broad swath and shave close, to drive life into a corner, and reduce it to its lowest terms, and, if it proved mean, why then to get the full meanness out of it, and publish its meanness to the world; or if it were sublime, to know it by experience, and to give a true account of it in my next excursion,

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Sperling is survived by his parents, a brother and sister, his wife Debra Gilmore, and their three-year-old son Carl. The family requests that any contributions be sent to the Garden Fund, c/o Susan Rossi-Wilcox, Botanical Museum of Harvard University, 26 Oxford St., Cambridge, MA 02138, USA. His widow requests that his colleagues write to their young son telling him about his father and what he was like. These letters should be sent to: Master Carl Sperling, 8416 Queen Anne's Drive, Silver Spring, MD 20910, USA. Contributions for the Calvin Sperling Memorial Lecture Fund, which are tax deductible, should be sent to the Agronomic Science Foundation of the American Society for Agronomy, 677 S. Segoe Rd., Madison, WI 53711-1086, USA. *-JDG and DS*

Landraces in Transit-The Threat Perceived

by O.H. Frankel, with contributions from J.J. Burdon and W.J. Peacock

Landraces-populations of plants genetically heterogeneous and commonly developed in traditional agriculture from many years of natural as well as farmer-directed selection-are specifically adapted to local conditions. They have played a significant role in the history of civilization and continue to be important genetic resources for plant breeders and the main sustenance for hundreds of millions who live in the less favored parts of the earth.

Isolation and the difficulty and diversity of habitats had protected these gene treasuries from the incursions of modern varieties which had come to predominate in the more favorable environments. However, the research of scientists familiar with some of the Vavilov Centers of Diversity-Hermann Kuckuck with Iran and Turkey, Jack Harlan with various parts of Asia and Africa, and others elsewhere-revealed that landraces were being displaced at a rapid rate. Such accounts gave a sense of urgency to the U.N. Food and Agriculture Organization (FAO)/International Biological Programme (IBP) Conference of 1967 and to the "genetic resources movement" that it initiated. (For Frankel's exclusive four-part series on "The Founding Years," see DIVERSITY, no.7,pp.26-29; no.8, pp.30-32; no.9,pp.30-33; and no.11 ,pp.25-27.)

This evolution of the technical and political components of the issue resulted in a significant change in attitude. The work of activists such as P.R. Mooney served to arouse public interest and political support. The contributions of ethnobotanists and environmentalists, who studied the ecology and sociology of environmentally disadvantaged communities, made a strong impact on the world's thinking about sustainable systems of agriculture, and on the Earth Summit in 1992. Arising from this ambience came the recognition of the importance of the continuing cultivation of landraces, in particular in the areas where crops had evolved and diversified and to this day retained high levels of diversity. The prospects of *in situ* conservation of landraces are discussed below.

Sir Otto Frankel's distinguished career in conserving plant genetic resources—documented in an exclusive four-part history of the international plant genetic resources movement published by DIVERSITY (no.7,pp.26-29; no.8,pp.30-32; no.9, pp.30-33; and no.11,pp.25-27)—was again recognized recently by the International Plant Genetic Resources Institute (see photo). He is currently an honorary research fellow in the Division of Plant Industry at the Commonwealth Scientific and Industrial Research Organization (CSIRO) in Australia. W.J. Peacock, a distinguished molecular scientist, is Chief of the CSIRO Division of Plant Industry, a Fellow of the Royal Society of London, and a Foreign Associate of the U.S. National Academy of Science. J.J. Burdon, an evolutionary biologist and plant pathologist, is Senior Principal Research Scientist, Division of Plant Industry at CSIRO.

At a ceremony in France earlier this year, IPGRI Board Chair Wanda Collins presents IPGRI's first Distinguished Scientist Award to Sir Otto Frankel to pay tribute to his outstanding contributions to the conservation and use of genetic resources. (Photo courtesy IPGRI)

Landraces in "Sustainable Agriculture"

Landraces play a prominent part in planning for sustainable agriculture based on traditional systems of agriculture. Such plans emphasize stability of production and preservation of genetic diversity rather than high production levels. Sustainability is to be achieved by the interactions of a diversity of species (multi-cropping), by nitrogen-fixing leguminous crops, and by partial inclusion rather than elimination of weed species in the ecosystem. The aim is to generate equilibrium between pests and their predators and to control undesirable weeds (Gliessman et al. 1981).

Discussions on sustainable agriculture tend to focus on subsistence farming in tropical coastal lowlands (Gliessman et al. 1981) or highlands (Altieri & Merrick 1987). These traditional systems seem in tune with economic and cultural community standards and with limitations imposed by farm size and climate. Systems of sustainable farming have been suggested for broader scale cash-cropping by using landraces because of their yield stability and built-in population-based defense against parasites (Altieri and Merrick 1987).

However, modern cultivars also have a role to play in developed, sustainable systems. Breeding for resistances reduces the need for pesticides; productive capacity has been greatly raised and continues to rise (see e.g. Austin et al. 1980). Clearly the use of landraces for broad-acre planting would entail substantial yield losses relative to cultivars selected for productivity in specific agro-ecosystems. A return to the famines such as those in India prior to the Green Revolution is unthinkable.

At the lower end of the fertility spectrum, Ceccarelli (1994) has shown the value of local landraces in plant improvement for marginal land (see DIVERSITY, vol.11,nos.l&2,p.112). He has also shown that selection needs to take place in the particular stress environment, not in more favorably placed experiment stations. This emphasizes the need for far more plant breeders working in marginal areas.

Landraces Retained in Centers of Diversity

At the time of the FAO/IBP conference of 1967, landraces appeared to be doomed. But this drastic view failed to take account of the large areas where modern varieties were unlikely to penetrate because of the physical, economic, and cultural conditions. This included the centers of genetic diversity-mountainous, isolated regions with small, fragmented land holdings, diversity of soil types, cultures, species, and varieties, complemented by deliberate selection in crops such as potatoes or maize, where individuals can be distinguished and evaluated.

In a wide-ranging study, Brush (1995) surveyed the retention rate of landraces in three areas in, or close to, centers of diversity: potatoes in Peru, maize in southern Mexico, and wheat in western Turkey. In some of the most developed areas landraces had dropped to 10 percent, as in one sample area in Peru. In a highly developed area in Turkey there was a substantial retention rate of landraces of wheat. In such favorable environments, however, landraces are likely to give way to new cultivars and a new generation of cultivators (see DIVERSITY, vol. 11 ,nos. 1&2,p.63). But in the "centers . . . both environment and farmer criteria may be too variable for any breeding pro-

gram to overwhelm" (Brush 1995). Even there, areas are shrinking to patches, and Brush asks whether they adequately represent genetic diversity. This is relevant to the discussion below.

Landraces and the Evolution of Disease Resistance

Landraces are dynamic natural laboratories in which host-pathogen co-evolutionary interactions are played out far into the future. It is these current and future interactions which give landraces their greatest value in the modern world. In landraces new resistances may become available for use in a variety of ways. First, the frequency of particular genes for resistance fluctuates, rising and falling through time as pathogen-induced selection pressures also change. Clear evidence for such dynamic responses come from the barley composite cross populations developed at the University of California-Davis, California, and now grown at several locations, under different pathogen regimes, around the world (Saghai Maroof et al. 1983; Ibrahim & Baffett 1991). Thus over the years the frequency of resistance to some pathotypes of scald have risen at Davis while that to other pathotypes has remained low (Jackson et al. 1978). In this way pre-existing resistances that now occur at undetectably low frequencies may gain future prominence and be isolated and utilized.

Landraces are also natural laboratories in which new resistance specificities may evolve. In some cases these may simply be new combinations of existing resistances generated through outcrossing between individual members of the landrace population. Much more exciting, however, is the possibility of the *de novo* generation of truly new specificities through unequal crossing-over within complex resistance loci during recombination (Pryor & Ellis, 1993). While strong evidence for such processes is currently restricted to well-studied model systems like the Zea *mays-Puccinia sorghi* interaction, this or similar mechanisms have undoubtedly been the source of much of the resistance variation now found in landraces.

The Growing Impact of Molecular Biology

The reference to landraces as "natural laboratories" in which new resistances to pathogens evolve is a useful analogy, highlighting the contribution that the newly developing gene technologies are likely to make to plant improvement. The products of natural laboratories evident in landraces will be supplemented by the products from scientific laboratories, evidenced by the gene constructs which will be able to be inserted into crop species through gene transfer techniques.

In the field of resistance genes, the new sciences are providing an understanding of host-pathogen interactions to an extent where it may be possible in the near future to construct synthetic resistance genes which provide robust protection against pathogens and other pests. This situation is most advanced with resistance to virus diseases. There are a number of different classes of gene constructs which are providing field tolerance to viral agents. The promise is that these genes, particularly in combination, will provide robust protection against the challenges presented by genetic variation in a virus pathogen.

A return to the famines such as those in India prior to the Green Revolution is unthinkable.

A similar picture is emerging for a variety of other pathogens, bacterial, fungal, and even against invaders such as nematodes and insects. In what must be one of the most exciting developments of the last 12 months in plant biology, a number of natural resistance genes to these agents have been isolated over a range of crop species. The characterization of these genes is already increasing our understanding of the way in which plants combat the challenges of pathogens and pests, and it is likely that within a few years laboratory-synthesized genes will be able to provide crops with essentially chemical free protection mechanisms.

Such comments in relation to resistance genes could be interpreted to mean that we will not be so dependent upon the resources of landraces in the future. But I stress that this could only be true in the far future. For virus diseases this may be the situation within five to 10 years, for the other pathogens it is going to be significantly longer than that. Still, this is far from saying that the new gene technologies will completely replace the need for traditional genetic resources. Molecular biology and recombinant DNA technologies are having dramatic effects on our understanding of plant development and plant function at a molecular and cellular level. As we gain more knowledge plant breeders will be able to be more specific about their needs and the new technologies will increasingly prove a valuable adjunct to classical breeding procedures.

The value of any genetic resource collection ultimately depends on the effective transfer of genetic variation from the resource collection into the breeding program where it is needed. The new technologies will certainly increase our capabilities of scanning genetic resource collections for needed variation and increase our capabilities of extracting that variation for use in crop breeding programs. One valuable new dimension will be that useful genes will be obtained from species which are outside the perimeter drawn by the sexual hybridization capability needed in classical breeding.

The Future

In a world in which a growing proportion of the plant breeder's material will be engineered, what is the future of genetic resources, and especially of the landraces, until now the main source of genes? The advances in technology foreshadowed in W.J. Peacock's contribution suggest likely changes in the use, and hence in the management of genetic resources.

First, key elements, such as the synthetic resistance genes providing robust protection against virus pathogens, are likely to be developed for a range of pathogens. This will gradually reduce the need for resistances derived from traditional genetic resources, now their most frequently sought contribution.

Second, rapid as the development of molecular science and technology has been, genetic resources are unlikely to become redundant in the foreseeable future.

Third, with the already shrinking areas of landraces, their medium- to long-term future is uncertain. Incentives to foster their survival in cultivation are unlikely to succeed in the longer term. These considerations lead to an inescapable conclusion: *ex situ* conservation of landraces *must he emphasized and strengthened* as the only reliable long-term conservation measure.

Fourth, ex *situ* conservation should be placed on a secure, sustainable basis for the benefit of the whole of mankind, to be shared by all, just as knowledge is shared by all. This means that all conservation centers, whether international like the Internal Agricultural Research Centers, or national should be subject to international control by FAO.

For additional informationand the bibliography, contact: Dr. Otto Frankel, Division of Plant Industry, CSIRO, GPO Box 1600, Canberra, A.C.T. 2601, Australia. Tel: +61-6-246-49 11. Fax: +61-6-246-5000. E-mail: J.Burdon@pican.pi.csiro.au.

IN REVIEW—*The Last Harvest: The Genetic Gamble That Threatens to Destroy American Agriculture*

By Paul Raeburn. New York. Simon & Schuster, 1995. 255 pages. $24.00 hardcover.

by Edward C. Wolf

Associated Press science editor Paul Raeburn pulls no punches: "American farmers . . . are waging a genetic gamble. They are 'betting the farm' in a way they never intended. Many are not even aware of the risks they face."

Raeburn makes these charges in *The Lust Harvest,* a thoughtful, balanced, and emphatic book about national and international efforts to protect and use the genetic diversity of major food crops. Other critics and activists have leveled similar criticisms, but few have done so with Raeburn's clarity and fair-mindedness.

In today's revisionist political climate, the book may be dismissed as "environmental alarmism" by some policymakers in a position to enact solutions. That would be unfortunate, for not only does *The Lust Harvest* correctly diagnose the Achilles' heel of our food system, it also offers "food security" as a theme capable of bringing environmental concerns close to home.

Book Updates Reporter's Prize-Winning AP Series

In 1990, Raeburn and his AP colleague Lee Mitgang won a Science-in-Society Journalism Award from the National Association of Science Writers for "Seeds of Conflict," a three-part series of articles about the U.S. National Plant Germplasm System (NPGS) (see DIVERSITY, vol.6, no.2,p.22). *The Lust Harvest* expands and updates that series, but offers disconcertingly little evidence that the problems identified in "Seeds of Conflict" are being successfully addressed.

The series-and the charge that the national seedbanks had become little more than "seed morgues"-did ignite a public dialogue with NPGS leaders, who sought to respond to Raeburn's and Mitgang's charges of inadequate germplasm maintenance and evaluation at the National Seed Storage Laboratory (NSSL) in Fort Collins, Colorado.

Edward C. Wolf, DIVERSITY's book and media editor, is Director of Communications at Ecotrust, a Portland, Oregon-based nonprofit group that supports conservation-based development in the coastal rain forest zone of western North America. He can be reached at 1400 N.W. Front Ave., Suite 470, Portland, OR 97209, USA. Tel. +1-503-227-6225.

Raeburn goes to considerable length to present both sides of that controversy in *The Lust Harvest.* NSSL Director Steve Eberhart and NPGS Director Henry Shands are quoted extensively and, indeed, praised by the author and by other germ plasm scientists he cites.

USDA Faulted for Neglect and Underfunding

The blame for inadequate funding and the neglect of germplasm conservation is placed where most of it belongs: at higher levels within USDA's Agricultural Research Service and in the department's top administration. Raeburn has staked out an unusual piece of turf in the germplasm debate. Highly sympathetic to the mission of the U.S. seedbanks and to those who administer the system, he remains sharply critical of their effectiveness.

Calling the U.S. seedbank system, "a tragic victim of overwhelming official neglect," Raeburn particularly faults its work in evaluation of accessions and in prebreeding. His point is valid and important: even a well-funded and well-administered germplasm system contributes little to food security if its materials are not put to work in crop improvement. Raeburn contends that as a result, "U.S. crops are more vulnerable to epidemics than they should be."

The award-winning science reporter also points out that our ability to evaluate that vulnerability has atrophied during the last two decades, despite increased public awareness of genetic diversity concerns:

A report like the 1972 National Academy of Sciences report (Genetic Vulnerability of Major Crops) *can never be done again. The Agriculture Department did not take action to correct the problem pointed out in that report, it stopped monitoring the amount of land devoted to certain crop varieties. Thus, the department made it impossible for the problem even to be monitored.* (p. 146)

The private sector has failed to pick up the germplasm ball fumbled by agriculture department bureaucrats, reports Raeburn. He cites Pioneer Hi-Bred scientist Donald Duvick's summary of private plant breeders concerning the degree of genetic uniformity in their breeding line and Pioneer geneticist Stephen Smith's genetic analysis of commercial hybrid corn varieties. Both of these confirmed the preponderance of closely related varieties on the nation's cropland.

Praise for Heirloom Seed-Saving Efforts

The heirloom seed movement, typified in the book by Seed Savers Exchange, Native Seeds SEARCH, and the North American Fruit Explorers, is praised as a low-cost, highly efficient, and flexible complement to government and corporate germplasm conservation. Yet, Raeburn says, the government neither encourages nor pays much attention to the important work done by these grassroots groups. Even the tax code places obstacles in their path. The book makes clear that such independent efforts cannot fully compensate for the inadequacies of public institutions or the profit-guided priorities of private seed companies.

Duvick's survey revealed a perception more telling-and more troubling-than any of the data about genetic uniformity. He asked corn breeders whether uniformity was a serious concern. The result: "Only one told Duvick it was a problem. Sixty-four percent said there was nothing to worry about." With nonchalance so prevalent among professional crop breeders, what hope is there for the general public?

Carrying his analysis to the international level, Raeburn straddles the contentious North-South issues of germplasm exchange and compensation by charging that institutions of both North and South are doing a poor job of protecting genetic resources. He notes the vulnerability of seedbanks in

developing countries to a panoply of political and natural catastrophes and argues that the germplasm collections maintained by the Consultative Group for International Agricultural Research (CGIAR) network of research centers are insufficiently financed and, in some cases, poorly run. Though the points he makes are salient, Raeburn's discussion of North-South issues and the implications of plant variety patenting is disappointingly superficial.

The author takes environmentalists and biodiversity advocates to task for their failure to draw the connections between conservation and food security. He points out that even the National Academy of Sciences committee charged by Interior Secretary Bruce Babbitt with developing the mandate for the national biological survey gave short shrift to agriculture's dependence on biodiversity.

Germplasm Link to Food Security Could Reinvigorate Public Support

While Raeburn takes the criticism a bit far (many groups have performed valuable advocacy on farming and germplasm issues), it is possible that food security—and its genetic underpinnings—could offer a rallying issue for activists seeking to renew ebbing popular concern for the environment. Proceeding from discussions of *ex situ* and *in situ* germplasm conservation and genetic vulnerability to consideration of global environmental changes that will place a premium on farmers' adaptability, *The Last Harvest* leads readers to a legitimate concern about paths to food security.

Unfortunately, the concluding chapters are the weakest links in the chain of Raeburn's argument. The global change chapter—breezing through a laundry list of environmental ills from soil erosion to ozone depletion—relies far too heavily on analysis by Paul and Anne Ehrlich and David Pimentel. Their reputations as doomsayers may unfortunately lead some readers to doubt the merits of Raeburn's argument. The final chapter, appraising the promise of alternative agriculture and agricultural biotechnology, deals with both topics too superficially to support any clear conclusion about the resilience they might offer to our food system.

The value of Raeburn's book is not that it breaks new ground, but that it brings credible information about genetic vulnerability to a wider audience than ever before. Whether that audience will read Raeburn's book with the sympathy and comprehension it deserves, and support an effective political response to the problem, is an open question.

None of the facts and examples marshalled in *The Last Harvest* sends a more ominous message than Illinois farmer Glen Fritz's reply to the author's question about the risk of genetic uniformity: "It never really entered my mind. It probably wouldn't be a concern. We've always had good seed." ≜

CORRECTIONS:

In the special regional issue of DIVERSITY on the Mediterranean, vol.11,nos.1&2, the caption on p. 27 should read: *CIMMYT scientists A. Mujeeb-Kazi and S. Rajaram;* the credit on p. 50 should read *Dr. Esteban Hernández Bermejo, Director, Jardín Botánico de Córdoba, also contributed to this article;* and on p. 85, the last paragraph should begin by stating: "A national symposium to be held in early Spring 1996 at the Portuguese Plant Germplasm Genebank in Braga is now being organized."

The harrowing ordeal of CIAT kidnap victim Tom Hargrove will be the focus of an upcoming segment of the CBS news magazine *60 Minutes*. Hargrove, the former communications chief of the Cali, Colombia-based International Center for Tropical Agriculture (CIAT), was released on August 22 after 11 months of captivity by guerrillas of the Marxist Armed Revolutionary Forces of Colombia (FARC). Guarded by "illiterate 14-year-olds with AK-47s," Hargrove told DIVERSITY that he was isolated in a dark wooden cell for days at a time, chained when he was allowed out, and, on occasion, starved, until the guerrillas accepted ransom raised by his family. Throughout the ordeal his captors persisted in believing the charge, as stated by one of their leaders, "You work for the Centro Internacional de Agricultura Tropical which . . . is part of the CIA [the U.S. Central Intelligence Agency]." For more details, contact Tom Hargrove through his e-mail address: 72370.2444@compuserve.com and ask for his November 14 letter.

CIAT workers waving panicles of rice tied with yellow ribbons welcome back Tom Hargrove, a Texan whose state song is "Around Her Neck She Wore A Yellow Ribbon." (Photo courtesy CIAT)

The 4th M.S. Swaminathan Research Foundation annual Dialogue, "Reaching the Unreached," addressed *Farmer's Rights and Plant Genetic Resources: Recognition and Reward.* The Foundation's dialogues bring together top social scientists and technologists to examine how sustainable rural development rooted in the principles of ecology, economics, equity, and employment can be promoted so that the disadvantaged peoples of rural societies can benefit from modern technological advances. For more information and copies of the proceedings, contact: M.S. Swaminathan Research Foundation, 3rd Cross Street, Taramani Institutional Area, Madras 600 113 India. Tel: +91-44-235-1229. Fax: +91-44-235-1319.

***Genetic Time Bomb*, a documentary about the loss of agricultural biodiversity and the threat it poses to the world's food supply, is scheduled to appear on local PBS stations in early 1996.** The documentary explores the serious financial difficulties currently faced by seed banks and international crop breeding programs and explains why preservation of diverse germplasm is crucial for future food production. *Genetic Time Bomb* takes viewers to the U.S. National Seed Storage Laboratory, the International Center for Improvement of Wheat and Maize (CIMMYT), the International Rice Research Institute, and the Vavilov Institute and looks at efforts of groups such as the Seed Savers Exchange that preserve diversity. Producers John de Graaf and Vivia Boe ask that readers remind their local PBS programmers that they would like to see this program and tell them that it will be fed to U.S. PBS stations by the Pacific Mountain Network via satellite at **4:00 pm EST, Sunday, January 28, 1996, on Transponder 6.**

The 1995 World Food Prize, "the Agriculture Nobel," went to insect specialist Hans R. Herren, Director of the International Center for Insect Physiology (ICIPE), for his work at the International Institute of Tropical Agriculture (IITA) that saved cassava in sub-Saharan Africa from mealybug devastation by introducing huge numbers of their natural predators, wasps. The $200,000 World Food Prize recognizes outstanding individual achievement in improving the quality, quantity, or availability of food in the world. Recipients are chosen by an anonymous panel of experts chaired by Nobel Peace Prize winner Norman Borlaug. An article by Dr. Herren on insect biodiversity will appear in a future issue of DIVERSITY.

"Community-based management of genetic resources" is now the key concept guiding the South East Asian community of germplasm experts as a result of the recent meeting of the Third South East Asian Symposium, cosponsored by the Indonesian National Committee for Genetic Resources, the Indonesian Biodiversity Foundation, and the Singapore Regional Office of the International Plant Genetic Resources Institute. In addition to broadening the scope to include animals, participants focused on the use of genetic resources for the livelihood of the area's peoples and on-farm conservation. Consensus emerged that the key issue is the conservation and utilization at the community level. For additional information, please contact: National Committee on Genetic Resources, P.O. Box 422, Bogor 16004, Indonesia. Fax: +62-21-875-4588.

Events

— 1996 —

January 14-18- **4th International Plant Genome Conference,** San Diego, CA. Contact: Sherago International, 11 Penn Plaza, Suite 1003, New York, NY 10001, USA. Tel: 1-212-643-1750. Fax: 1-212-643-1758. E-mail: Scherago@Biotechnet.Com.

January 15-18- **Technical Consultation on an Implementation Framework for Farmers' Rights,** Madras, India. Contact: Dr. V. Balaji, Organizing Secretary, M.S. Swaminathan Research Foundation, 3rd Cross Street, Taramani Institutional Area, Madras 600 113, India. Tel: 91-44-2351229/2351698/2350698. Fax: 91-44-2351319. E-mail: mssrf.madras@sm8.sprintrpg.sprint.com or: MDSAAASl@giasmd0l.vsnl.net.in.

January 21-24- **ASTA Vegetable and Flower Seed Conference,** San Diego, CA. Contact: American Seed Trade Association, Suite 570 South, 601 13th St., N.W., Washington, DC 20005-3807, USA, Tel: 1-202-638-3218. Fax: 1-202-638-3171.

February 4-17- **Intellectual Property Rights (IPR) International Internship Program: Technology Transfer-Use and Management Under GATT,** East Lansing, MI. Contact: Dr. Karim Maredia. Institute of International Agriculture, 4 16 Plant and Soil Sciences Bldg., Michigan State University, East Lansing, MI 48824-1325, USA. Tel: 1-517-353-5262; Fax: 1-517-432-1982. E-Mail: Kmaredia@msu.edu.

February 8-13- **AAAS Annual Meeting and Science Innovation Exposition,** Baltimore, MD. Contact: Membership/Meetings Services, American Association for the Advancement of Science, 1333 H St., N.W., Washington, DC 20005, USA. Tel: 1-202-326-6448. Fax: 1-202-289-4021.

February 19-23- **International Conference on Domestication and Commercialization of Non-Timber Forest Products in Agroforestry Systems,** Nairobi, Kenya. Contact: Dr. Roger B.B. Leakey, Chairman, Organizing Committee, International Conference on Domestications and Commercialization of Non-Timber Forest Products in Agroforestry Systems, United Nations Avenue, Gigiri, P.O. Box 30677, Nairobi, Kenya. Tel: 254-2-521450; Fax: 254-2-521001; Telex: 22048 ICRAF.

February 25-27- **American Soybean Association-National Corn Growers Association (ASA-NCGA) Convention,** Phoenix, AZ. Contact: Bob Callanan, ASA-NCGA, 1000 Executive Parkway, #105, St. Louis, MO 63141, USA. Tel: 1-314-275-9915. Fax: 1-314-275-7061.

February 28- March 26- **Training Session on Ethnobotany of Sacred and Medicinal Plants,** Belize. Contact: Dr. M. Naxon, Director, Central American Institute, P.O. Box 59, San Ignacio, Cayo District, Belize, C.A. Tel: 501-92-3110; Fax: 501-92-3136.

March- **International Symposium,** Braga, Portugal. Contact: Dr. Rena Farias, Director, Portuguese Plant Germplasm Bank, Quinta dos Peoes-Gualtar, 4700 Braga, Portugal. Tel: 351-53-676758. Fax: 315-53-677328.

March 26-- **"International Wildlife Law: Preserving Biodiversity in the 21st Century," Washington,** DC. Contact: Wil Burns, Pacific Center for International Studies, 33 University Square, Suite 184, Madison, WI 53715, USA. Phone/fax: 1-608-256-6312; E-mail: pcis@igc.apc.org.

March 27-30- **Society of Ethnobiology 19th Annual Conference,** Santa Barbara, CA. Contact: Jan Timbrook, Anthropology Department, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, CA 93105, USA. Tel: 1-805-682-4711, ext. 307; Fax: 1-805-569-3170.

May 11-16- 8th **International Lupin Conference,** Asilomar, CA. Contact: Conference and Events (lupin), University of California, Davis, CA 95616-8766, USA. Tel: 1-916-757-3331. Fax: 1-916-757-7943.

May 12-17- **VIII Congress of the International Society of Citriculture,** Sun City Resort, South Africa. Contact: Congress Secretariat, Private Bag X11208, Nelspruit 1200 South Africa. Tel: 27-1311-52071; Fax: 27-1311-23854.

May 19-22- **Beltsville Agricultural Research Center Symposium and Association of Systematic Collections Meeting: Global Genetic Resources-Access, Ownership, and Intellectual Property Rights,** Beltsville, MD. Contact: Virginia Hupfer, USDA/SBML, Bldg. 003, Rm 329, BARC, Beltsville, MD 20705, USA. Tel: 1-301-504-6108. Fax: 1-301-505-8092.

May 30-June l- **Annual Conference of the American Association of Botanical Gardens and Arboreta** (AABGA). Contact: AABGA, 1996 Annual Conference Program, 786 Church Road, Wayne, PA 19087, USA.

June 16-21-- ***In Vitro* Culture and Horticultural Breeding Third International Symposium,** Jerusalem, Israel. Contact: Professor Arie Altman, Chairman, Organizing Committees Faculty of Agriculture, The Hebrew University of Jerusalem, P.O.B. 12, Rehovot 76100, Israel. Fax: 972-8-468263.

June 17-23- **International Conference on Plant Genetic Resources,** Leipzig, Germany. Contact: Cary Fowler, FAO, Viale delle Terme di Caracalla, 00100 Rome, Italy. Tel: 39-6-5225-5925. Fax: 39-6-5225-5533. E-mail: fileserv@icppgr.fao.org

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June 23-27- **113th American Seed Trade Association Annual Convention,** Scottsdale, AZ. Contact: ASTA, 601 13th St., NW, Suite 570 South, Washington, DC 20005-3804, USA. Tel: 1-202-638-3128. Fax: 1-202-638-3171.

July 1 -& **Joint Meeting of the Society of Economic Botany and the International Society for Ethnopharmacology,** London, UK. Contact: The Linnean Society, Burlington House, Piccadilly, London WlV OLQ, UK. Tel: 44-0-171-434-4479. Fax; 44-0-171-287-9364. E-mail: marquitaelinnean.demon.co.uk.

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