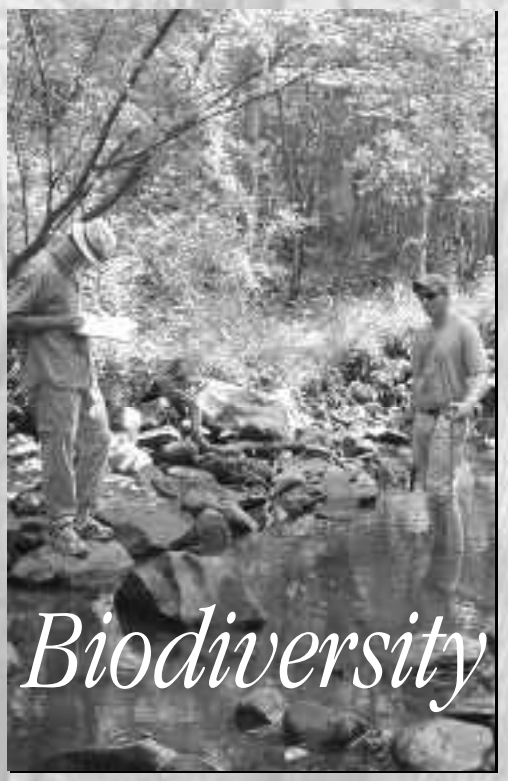
Ecology in Action:



Biodiversity Field Studies

Volume II

The Paul F-Brandwein
Summer Leadership Institute

Ecology in Action: Biodiversity Field Studies

The 2001 Paul F-Brandwein
Summer Leadership Institute

Volume II

The Paul F-Brandwein Institute
Unionville, New York

The F-Brandwein Summer Leadership Institute program is supported by a grant from the Toyota USA Foundation, the Brandwein-Morholt Trust and the Pocono Environmental Education Center.

Designed by Thomas Thornton

Contents

"In the end we will conserve only what we love; we will love only what we understand;and we will understand only what we have been taught."

Baba Doum

A Paul F-Brandwein Institute Vision of Effective Professional Development

It is from Paul F-Brandwein that we learned that teachers are the key to what happens in students' lives. In "Notes Toward a Renewal in the Teaching of Science," he stated that we are not in a paltry crisis; we are entering a newer and different world in which a change in behavior is called for. He summarized his pedagogical views, "As teachers, we enter the minds of others; thus we live in eternity. We help others live better lives, thus teaching remains a mercy. Who else but those who have given their lives to producing change in others can – or should – now take on the necessary change in their own personal behavior in the classroom." Professional development can help teachers meet this challenge.

Jack Padalino

Beliefs about professional development have changed over the years. Today's approach embraces not only the teacher, but also the school and community to which the teacher belongs. Effective professional development efforts value teachers learning and sharing together. It also takes the commitment and involvement of school systems to promote continual learning by providing teachers the time for in-depth field science investigations, collaborative work, and reflection.

Teachers attending Paul F-Brandwein Summer Leadership Institutes expect to continue learning throughout their careers and to improve their practices by choosing and attending appropriate professional development learning opportunities. Teaching is a complex practice that requires planning, acting, observing, assessing, and reflecting. It requires constant and consistent decision-making.

Gerard Piel, founder and publisher of "Scientific American", in his recent book, *The Age of Science; What Scientists Learned in the 20th Century,* says that "scientists do what we all could do if we would clear our heads of preconception and bring our questions in reach of experience." The summer leadership institutes aim to give teachers the experience that will enable them to work like scientists.

By John (Jack) Padalino, President

"As teachers, we enter the minds of others; thus we live in eternity. We help others live better lives, thus teaching remains a mercy."

– Paul F-Brandwein

Mission Statement

Reflecting the wisdom of Paul F-Brandwein – author, teacher, scientist, publisher, conservationist, and humanitarian – the Paul F-Brandwein Institute educates people to recognize their responsibility for sustaining a healthy and healing environment. Paul F-Brandwein Institute programs help all learners develop an understanding of the symbiotic relationship between humans and the environment.

About the Paul F-Brandwein Institute

Established in 1996 as a collaboration between the Brandwein-Morholt Trust and the Pocono Environmental Education Center (PEEC), the Paul F-Brandwein Institute (BI) perpetuates the legacy of Paul F-Brandwein through environmental education. BI programs nurture the gifts and talents of all learners at all levels and foster skills, concepts, and values basic to environmental decision making within a global context. By bringing together students, educators, and scientists, BI educational programs encourage an "ecology of achievement," allowing ideas to form and be tested through meaningful research and fieldwork. There programs integrate the natural wealth of biodiversity at the Rutgers Creek Wildlife Conservancy (Greenville, New York) with scientific investigation, creative analysis, and state-of-the-art technological research tools. In this way, education and conservation of the environment become intertwined.

Paul F-Brandwein (1912-1994)

Scientist

Born in 1912, Paul F-Brandwein (PFB) immigrated to the United States from Austria prior to WWII. Paul's interest in science began quite early, partially owing to the time he spent in hospitals with childhood arthritis. Though the condition cut short a career in piano, his love for the instrument remained strong throughout his life. PFB became an assistant at the Littnauer Pneumonia Research Laboratory in New York where he worked while completing his bachelor of science from New York University (NYU). This early start in original research had a great impact on the direction of his studies and philosophy on education. By 1940, upon completion of his masters and doctorate studies at NYU, PFB was secure in the belief that "the best way to encourage the young in science was to help them early to do original work."

Teacher

Paul's experience as an educator began at George Washington High School. He moved on, through the 1940s and into the mid 50s, to serve as a member and later as chair of the science department at Forest Hills High School. There he piloted a program encouraging students to do original work in science. It has been suggested that more of Paul's students won the prestigious Westinghouse Science Talent Search than those of any other teacher.

Author

An accomplished author, PFB began publishing science textbooks in 1946, revolutionizing the way science was taught throughout the country. Disappointed with lecture and textbook-based teaching, Paul developed classroom materials based on investigation, research, and analysis. His widely used grade-specific series, *Concepts in Science,* pioneered the style of hands-on, investigative, science education that generations of students have come to experience as the norm. Even so, Paul remained aware of the limitations inherent in any textbook. To forward innovative education methods, he joined with scientists and educators on the Sputnik science project. Additionally he served on the Steering Committee of the Biological Sciences Curriculum Study, as chair of its Gifted Student Committee, and as consultant to the Physical Science Study Committee. Through these committees, PFB strengthened the presence of programs designed to interest high school students in science through "originative" inquiry.

Humanitarian

Always concerned with and committed to a vision of equity in education, PFB strived to improve education for the students he believed to be most neglected: the disadvantaged and the gifted. He once said, "We do pretty well for the 80 percent of the students in the middle. But the 10 percent at the top and the bottom: we grind them under our feet!" Based in his belief of equal access to opportunity, he promoted self-selection by interested students rather than assignment based on testing.

"A true conservationist is a man who knows that the world is not given by his fathers but borrowed from his children."

John James Audubon

Philosopher

Lifelong research and experience with education led Paul to develop the concept of an "ecology of achievement" whereby "the school-community ecosystem acts in mutualism with cultural and university ecosystems." With this analogy to the relationship of students, educators, scientists, and the community at large, PFB expressed the necessity for integrating education with life and community. Drawing a distinction between "schooling" and "education," PFB emphasized the impact of the community on the school rather than vice versa. Refusing to allow schools to shoulder the blame for society's ills, he saw the quality of schools as symptomatic of the state of the community. "Specific communities get the kind of schools their economic and social conditions permit; it is simplism itself to blame schools for the plight of the community or of society."

Conservationist

In addition to his involvement with primary and secondary education in the United States, PFB participated in many roles with graduate and undergraduate institutions throughout the world. He was education director and later co-director of the Pinchot Institute for Conservation Studies at Grey Towers in Milford, Pennsylvania. This position combined his interests in education and conservation. The Rutgers Creek Wildlife Conservancy, established by Paul and his wife Mary, has been administered by the Brandwein-Morholt Trust since Paul's death in 1994. In affiliation with the Pocono Environmental Education Center, the Conservancy serves as a site for educational programs and research. The Paul F-Brandwein Institute advances Paul's intention for the land as a place of learning and discovery for students, teachers, scientists, and those interested in natural systems and the environment.

Evelyn Morholt (1914-1995)

Evelyn Morholt was a long-time friend of Paul and Mary Brandwein, and a former science teacher with PFB at Forest Hills High School. Over the course of her long career, Evelyn served as editor of **The Teaching Scientist** *(Federation of Science Teachers, New York City), chair of a New York City high school science department, and acting examiner for the New York Board of Education. She wrote nine books, and the most recent (in 1986, with PFB),* **A Sourcebook for the Biological Sciences** *(3rd ed.), is still an important resource for science education.*

Evelyn Morholt bequeathed her home to the Brandweins in 1994. Her house, which is close by the Brandwein residence, currently contains the BI offices and herbarium.

The Brandwein Summer Leadership Institute Sites

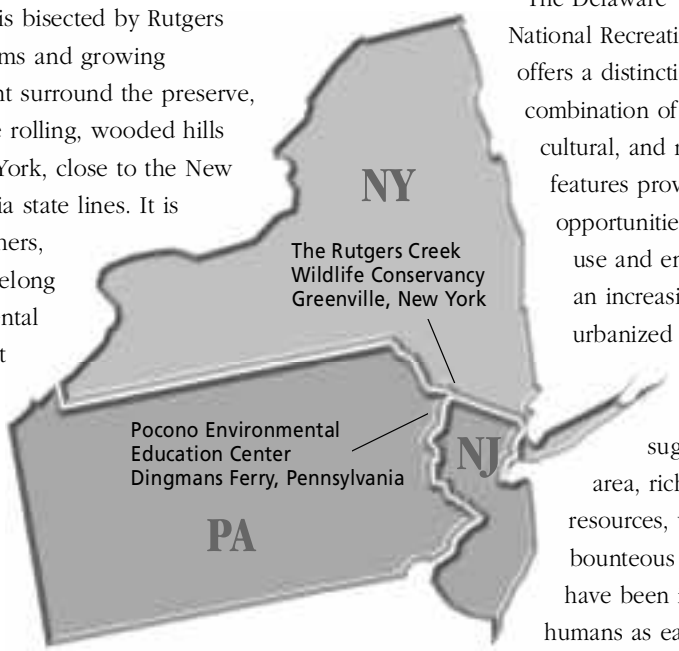
The Rutgers Creek Wildlife Conservancy Greenville, New York

The Paul F-Brandwein Institute is located on the 77-acre Rutgers Creek Wildlife Conservancy preserve, with its offices in the former residence of Evelyn Morholt. The Conservancy land was farmed until the 1960s, and is now wooded and houses diverse wildlife habitats. The land is traversed by stone walls marking the former fields, and is bisected by Rutgers Creek. Active dairy farms and growing residential development surround the preserve, which is located in the rolling, wooded hills near Greenville, New York, close to the New Jersey and Pennsylvania state lines. It is used by students, teachers, scientists, and other lifelong learners for environmental studies. Two houses sit on the property: the former residence of Evelyn Morholt and the Brandwein home, a farmhouse dating from the mid-1850s. In addition to the BI offices and herbarium, the Morholt residence will eventually house laboratory, exhibit, and classroom facilities.

Pocono Environmental Education Center Dingmans Ferry, Pennsylvania

The Pocono Environmental Education Center (PEEC) is the Western Hemisphere's largest residential environmental education center. PEEC annually serves more than 22,000 students, including children, families, teachers, scientists, and other lifelong learners. More than half a million people have visited PEEC since it was established in 1972.

Its 38-acre campus sits on the escarpment of the Pocono plateau and within the 67,000-acre Delaware Water Gap National Recreation Area (a national park). Surrounding parklands and Nature Conservancy lands offer visitors over a quarter million acres for study. PEEC, a nonprofit organization, works in partnership with the U.S. Park Service.



The Delaware Water Gap National Recreation Area offers a distinctive combination of natural, cultural, and recreational features providing opportunities for public use and enjoyment in an increasingly urbanized region. Current theories suggest that the area, rich in resources, wildlife, and bounteous forests, may have been inhabited by humans as early as 8500 BC. Approximately 40 miles of the exceptionally unpolluted Delaware River lie within the park's boundaries. The area's geologic and natural features form scenic landscapes and typify landforms and biotic areas of the Appalachian Mountains. The park encompasses elevations from 500 to 1,500 feet, which contain diverse habitats for plants, invertebrates, amphibians, reptiles, birds, mammals, and fish. The park's mission is to provide outdoor recreation opportunities while conserving its natural, cultural, and scenic resources by working cooperatively with surrounding communities and the public.

Summer Leadership Institute Overview

The Toyota USA Foundation, with the Paul F-Brandwein Institute, supports the Brandwein Summer Leadership Institute (BSLI) program, offering environmental fieldwork and workshop experiences to K-12 teachers nationwide. The goal is to develop a cadre of teacher/scientist mentors who will share their expertise with other teachers and students nationwide.

Each year, a committee of master teachers, field scientists, and members of the BI Board of Directors select 20 outstanding science teachers, using various criteria, including experience with student fieldwork, interest in environmental education and inquiry-based teaching, and desire to share knowledge and expertise with other teachers.

The BSLI focuses on providing teachers with science content and strategies for facilitating student/scientist interactions. Scientists, educators, and resource specialists participate by teaching and mentoring BSLI teachers both in the field and after the summer institute. In addition to receiving opportunities for sharing information and collegial reflection, teachers explore the cultural and natural features of the area, and spend a day in New York City.

The 9-day BSLI concentrates training in four areas:

- Long-term ecological research
- Technology for field-based inquiry
- Assessment strategies for field-based learning
- Funding techniques

At the close of each summer's institute, participants become Brandwein Fellows, a select group of scientists and educators recognized by the Institute. As such they educate and mentor others to accept responsibility for sustaining a healthy and healing environment.

Each participant receives $1,200 to lead at least three workshops to share what they learned at the BSLI. Additional funding is available over the next two years for expanded outreach.

Brandwein Fellows remain in contact throughout the year via an e-mail list service where they can share resources, experiences, and projects. In the spring, the Brandwein Fellows convene at a luncheon following the Brandwein Lecture at the National Science Teachers Association National Convention (NSTA).

Mary Brandwein (standing, far right, first row) with the 2001 Brandwein Summer Leadership Institute participants

"There is nothing in which the birds differ more from man than the way in which they can build and yet leave a landscape as it was before."

Robert Lynd

The BSLI Focus

At the first Brandwein Symposium in 1997, a forum of scientists and master teachers convened where participants discussed and determined priority needs for improved field-based science education. This symposium included several Toyota TAPESTRY awardees, and was the first meeting of Brandwein Fellows. The BSLI is designed to address needs identified by the Brandwein Fellows.

Implementing long-term ecological research

At the Rutgers Creek Wildlife Conservancy, BSLI teachers learn to conduct long-term ecological research techniques for use with students. The first BSLI (BSLI-2000) focused on terrestrial biodiversity studies using the Smithsonian Institution's Monitoring and Assessment of Biodiversity (SI/MAB) protocol for establishing and monitoring biodiversity plots. The SI/MAB protocol has been implemented by scientists and educators at 62 sites around the world.

In addition to terrestrial studies, BSLI teachers conduct aquatic studies in Rutgers Creek. Both low tech and high tech approaches to water quality data collection are used.

Integrating field-based inquiry with the latest technology

Teachers need access to and training in the latest technology used by scientists in order to share with students authentic science experiences. With this in mind, the BSLI is designed to provide ample opportunities for teachers to use technology and to explore ways of integrating it successfully into student field studies. At the BSLI, teachers work with the latest software for analysis, mapping, displaying, and communicating results.

Prior to the BSLI-2000, a Web-based e-mail list service for BSLI participants and resource people was set up. This forum enables teachers to share resources, files, and discussions. After the summer institute, teachers continue posting to the forum, sharing resources and developing new collaborative projects for sharing student-collected data over the Internet. This online list service is an easily accessible means of continuing the collegial relationships formed among participants and resource people during the BSLI.

While in the field, BSLI teachers use hand-held Global Positioning System (GPS) units within their study quadrats, and transfer these data into a Global Information System (GIS) mapping program. In computer labs, teachers learn to merge field data with databases containing geological, soil, topographical, and other data to create rich "overlays" of their study sites.

Representatives from companies such as PASCO, Inc., demonstrate high tech water quality testing devices. Teachers use the equipment themselves, and then learn to graph and analyze the data.

Exploring alternative assessment strategies

Increased student test scores is only one measure of a program's success. It is more likely that quality environmental science education programs will be assessed, in part, by measuring increased understanding of environmental principles by the public. BSLI participants discuss and devise methods to measure the success of problem-based, environmental science field study. They create instruments to measure field-based learning and evaluate alternative

assessments and performance-based examinations. Participants find ways to measure not only what students have learned, but also whether their learning has had an impact on them, on their society, and/or on the environment. Teachers and scientists review different models and metrics to enable them to demonstrate effectively the success of the inquiry approach to field investigations.

Exploring funding resources

Sustainability is a key point for teachers attempting to implement long-term ecological field studies. Many teachers do not know where to begin when it comes to locating funding sources and writing grant proposals. The BSLI includes sessions to help teachers in this area. The sessions provide grant-writing tips and resources, and advice and perspectives from successful grant writers and grant readers. BSLI participants test their own grant-writing skills by preparing a proposal for use of their $1,200 Brandwein outreach grant.

The BSLI Impact

There is a reluctance to teach environmental education in a great many school districts today. The leading reason for this resistance is the lack of teachers prepared to teach scientific principles in the context of the environment.[1] The BSLI addresses this need by building a cadre of science teacher leaders who are trained in environmental field techniques and who then mentor numerous teachers and students throughout the country. This group will grow to include 60 BSLI-trained teachers during the three-year period of Toyota funding.

Paul F-Brandwein said that mentoring was a key ingredient in successful science education. Scientists, educators, and resource specialists participate in the BSLI, presenting sessions, facilitating ecological fieldwork and technology training, and serving as mentors to BSLI teachers in the field and after the summer institute. Teachers take their BSLI training back to their schools, where they mentor students and other teachers in ecological field studies. In addition, teachers are encouraged to contact resources in their community, and to bring in scientists and others who can mentor students.

To maximize the BSLI's impact, participants are selected from a pool of recognized outstanding science teachers including Presidential Awardees in Science Teaching, GTE GIFT Awardees, and Toyota TAPESTRY awardees. By drawing from this group, the BSLI includes many teachers who have already demonstrated excellence and leadership in their profession. In addition, BSLI participants have done extensive student field studies and have demonstrated an interest in the environment and eagerness to share their knowledge with colleagues.

BSLI participants agree to do a minimum of three workshops to share the fieldwork protocols and to help other teachers implement similar projects. Each Brandwein Fellow is expected to reach a minimum of 90 additional teachers through post-BSLI training sessions in the coming year. Venues for these outreach activities include presentations at national and regional NSTA conventions, state and local teachers meetings, and school and district inservice days.

Over the course of Toyota funding, the BSLI will provide training, resources, and mentoring for environmental fieldwork to an estimated 7,500 teachers nationwide.

[1] *Teaming with Life: Investing in Science to Understand and Use America's Living Capital. President's Committee of Advisers on Science and Technology. OSTP. March 1998.*

BSLI Participants

2000 BSLI Participants

Vernon R. Beeson
Banks High School
Banks, Oregon

Allen R. Bone
East Middle School
Butte, Montana

David L. Brock
Roland Park Country School
Baltimore, Maryland

David E. Brown
St. Peters School
Quincy, Illinois

Gary L. Endsley
Texas Rural Systemic Initiative
Jefferson, Texas

Miguel A. Germain
Miami Sunset Senior High School
Miami, Florida

Lura Hegg
Colony Middle School
Palmer, Alaska

Thomas D. Hennigan
DeRuyter Central School
DeRuyter, New York

Larry M. Hodgson
Linford Elementary School
Laramie, Wyoming

Jenelle D. Hopkins
Centennial High School
Las Vegas, Nevada

D.J. Huddleston
Page Middle School
Page, Arizona

Susan Jeffries
Collegeville Elementary School
Bryant, Arkansas

Lori L. Kindsvatter
Pewamo-Westphalia High School
Pewamo, Michigan

Ruth Krumhansl
Souhegan High School
Amherst, New Hampshire

Timothy Maze
Tongue River Middle School
Ranchester, Wyoming

Marilyn K. McComber
Emporia High School
Emporia, Kansas

Connie B. Petruskevich
Somerset High School
Somerset, Texas

Paul M. Schlotman
Souhegan High School
Amherst, New Hampshire

Blake Sills
R.L. Paschal High School
Ft. Worth, Texas

Anne L. Tweed
Eaglecrest High School
Aurora, Colorado

2001 BSLI Participants

David Awtrey
Washburn High School
Washburn, Wisconsin

Kevin Baker
Dennis-Yarmouth Regional High School
South Yarmouth, Massachusetts

David A. Billesbach
Covington High School
Covington, Louisiana

Don Bogdanske
Ripon High School
Ripon, Wisconsin

Nancy Bruce
Circle J-Norris Ranch, Tulare
Springville, California

Mary Jane Davis
Red Bank Catholic High School
Red Bank, New Jersey

Connie Green
Mabelvale Middle School
Mabelvale, Arkansas

Maxine A. Henry
Forest Park Elementary School
Crystal Falls, Michigan

Tracy D. Hollis
Natural Science Education Center
Grand Prairie, Texas

Randy Laurence
Eagle Pass High School, CC
Eagle Pass, Texas

Judy A. Lee
Blocker Middle School
Texas City, Texas

Gilda Lyon
Howard School of Academics & Technology
Chattanooga, Tennessee

Carolyn R. Maragh
Louisa May Alcott Elementary School
Chicago, Illinois

Patricia McGinnis
Arcola Intermediate School
Norristown, Pennsylvania

Joyce A. Nishimura
Woodward Middle School
Bainbridge Island, Washington

Robert Oddo
Horace Greeley High School
Chappaqua, New York

George M. Radcliffe
Centreville Middle School
Centreville, Maryland

Gary Swick
Dundee Crown High School
Carpentersville, Illinois

Harry Weekes
The Community School
Sun Valley, Idaho

Ronald Wilmot
Akron-Westfield Community School
Akron, Iowa

"Over the long haul of life on this planet, it is the ecologists, and not the bookkeepers of business, who are the ultimate accountants."

Stewart Udall

BSLI 2001 Teacher-Participants

Applicants expressed their desire to study, learn and teach, as well as detailing their abilities and interests.

David Awtrey
Washburn High School
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David Awtrey, B.A. Geological Science, M.Ed. Secondary Science Education. I have been a teacher in Wisconsin for the last 10 years, first in a suburb of Madison, and for the last four years at a small high school on the south shore of Lake Superior. I teach biology, chemistry, anatomy and ecology. My two most recent endeavors are National Board Certification and a partnership with the Apostle Islands National Lake Shore running a summer field ecology class. The course focuses on wetlands, amphibians, and biodiversity.

During a previous summer we studied the impact of a state fish hatchery on a local trout stream. We also monitor a local stream using macro invertebrates and local lakes using a protocol designed to measure the degree of disturbance based on aquatic vegetation (along with the usual chemical and physical parameters). We are a GLOBE school and during the years I teach ecology we do as much field time as possible. I was a Woodrow Wilson Fellow at the Biodiversity Institute this past summer in Lawrenceville, NJ, and will be headed to Australia on completion of the Brandwein for an Earthwatch study on seed dispersal in fragmented versus intact rainforest. I am married with one stepson, 13, who enjoys reminding me I'm not as smart as I sometimes think I am, and with a wife who knows more about teaching and learning than any one I've ever met. We love to sea kayak, snowshoe, cross country ski, backpack, hike, garden, and play in the big lake. My fundamental philosophy in environmental education is that people need to be exposed to the outdoors to have any idea of what we are losing.

Kevin Baker
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Kevin Baker began teaching at Dennis-Yarmouth Regional High School (Cape Cod, MA) in the fall of 1996. At DY High School he teaches Anatomy and Physiology, Research in Science, and Ecology. In the spring of 1997 he and his students began monitoring vernal pools in the town of Yarmouth. Since then, they have focused their studies on two vernal pools on conservation land in the town. The students' studies include assessing age and numbers of the spotted salamander population, reproductive success, and genetic and protein variation within the population. A Toyota TAPESTRY grant in 2000 has enabled the group to inject alphanumeric elastomer tags under the skin of the salamander, which allows long-term monitoring of individual salamanders within the population. The grant has also allowed them to determine the age of the individuals in the population.

A graduate of Southern Illinois University-Carbondale, Kevin moved to Cape Cod in 1993. He lives there with his wife and two children. When not teaching, Kevin enjoys spending time with his family, gardening, and looking for and photographing reptiles and amphibians throughout the US. Each April he volunteers for week working for the DNR in southern Illinois.

David A. Billesbach
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After earning a B.S. degree in geology from the University of Nebraska, I worked 13 years in the oil industry as a geophysicist.

Making a career change to teaching required the completion of a teacher certification program at the University of New Orleans.

I began teaching biology and environmental science at Covington High in 1993. In 1997, I completed a Masters of Arts in Education at the University of New Orleans. For the past three years, I have been teaching students environmental science through regular classes and a stream restoration intern program.

My teaching interests have been how to incorporate problem-centered inquiry experiences into the classroom.

Outdoor activities have always been a part of my teaching activities. For the past four years, my students have been involved in a stream restoration project at a local stream, Mile Branch. The project has allowed the students the opportunity to solve a real environmental problem at the local level, in addition to feeling the satisfaction of contributing to the community.

Don Bogdanske
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My name is Don Bogdanske and I have been selected as one of this year's participants for the Brandwein Institute. I am currently teaching at Ripon High School, Ripon Wisconsin. I have been here for twenty-three years. During this time, I have taught Introductory Biology, Advanced Biology, AP-Biology, Anatomy and Physiology, Cell Biology, and assorted other electives. I also teach Advanced Topics and Research, Genetics, Marine and Aquatic Biology, and Zoology. The majority of the students I have are sophomores that are planning to attend college. The upper level courses are usually seniors. I believe in a hands-on approach and I try to continually upgrade my content and laboratory applications.

Nancy Bruce
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Nature study is tremendously fulfilling and spiritual for me. My first contacts with the natural world were on family camping trips in Canada and the northeastern U.S. At the age of 30, I found myself in an "inside" career and longed to spend more of my life outside. A yearlong internship at SCICON, an outdoor school in California, changed all that! Teaching about the natural world thrilled me, and I became an instructor for Yosemite Institute for over four years. What a grand place to call home! In summers, the Colorado Outward Bound School employed me as an instructor of climbing, mountaineering, and alpine natural history. Living my days and many nights outside, I observed the incredible miracle of the cycles of nature. I also met my wonderful husband, Mark Aspery. In 1996 we traveled to South Africa and led Zulu students on two-week expeditions through the Zulu homeland. Magical! Upon our return, I became a naturalist and volunteer trainer for a nature center in Golden, Colorado.

In August of 2000, I accepted the position of education coordinator of Circle J-Norris Ranch, a field trip site operated by Tulare County Office of Education. My job is to develop field study programs on the campus, 620-acres of rolling hills dotted with blue oaks and graced with a five-acre pond and year-round stream. The Brandwein Summer Leadership Institute has been instrumental in my quest to develop exciting, hands-on, real field science programs.

Mary Jane Davis
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In 22 years of classroom teaching, I have found it challenging to keep up to date and inspired. I have sought summer opportunities to recharge my academic batteries. Experiences with Save the Rainforest, Earthwatch, the National Association of Biology Teachers, and others have expanded my network of colleagues and enriched me with unique experiences.

Living and teaching close to the New Jersey coast offers opportunities for field study with my students. Whenever possible, I take my environmental science students outdoors.

We regularly monitor two storm drains for pollutants, are involved in the Red Bank Tree Census, and maintain three trails for the North American Bluebird Society. In my free time, I enjoy kayaking, horseback riding, birding, and fresh water aquaria.

"If we do not permit the Earth to produce beauty and joy, it will in the end not produce food either."

Joseph Woodkrutch

Connie Green
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Connie Green has taught in the Little Rock School District for 15 years, having been at Mabelvale Middle School for 13 years. She received her B.S.E. from the University of Central Arkansas and is certified to teach biology, general science, and English. Connie has also completed courses in weather, math, science, and other specialty programs (SECME, Science Crusades, Project GLOBE, Project WILD, Arkansas WET, Project Life, Project Learning Tree, Project Alert, and Datastreme) from the State University of New York, Louisiana Tech University, University of Virginia, Tuskegee University, University of Texas at Dallas, and the University of Idaho, as well as various schools in Arkansas.

Connie Green has additional experience and training as a coach (football, basketball, track, volleyball, and golf). Coach Green sponsors several student groups including the Red Raider yearbook, the Raider Voice newspaper, Science Club, Beta Club, Quiz Bowl, SECME, and serves as Science Department chair. She is also a member of area teams, which include the state Textbook Selection Committee, the Campus Leadership Team, Mabelvale's Steering Committee, and the LRSD Science Council.

When Connie is not working with school activities, she stays busy with two very active children: Kellye, 10, who is a competitive gymnast and softball player, and Bryce, 8, who is a black belt in Tai kwon do and plays sports. Connie enjoys camping, photography, reading, and gardening.

Maxine A. Henry
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After raising four children, Maxine returned to college and earned a teaching degree and Michigan elementary certification through an adult degree program. She has taught for 12 years, most recently in a self contained sixth grade classroom at Forest Park School in Crystal Falls, MI. She believes that the experience of raising her own children and the project oriented college degree combined to show her the value of hands-on teaching. She extends this approach both inside the classroom and in field-based study.

Four years ago, Maxine received a Toyota Tapestry Grant to use the study of mammal tracks as a core curricular project. Michigan's Upper Peninsula can have up to five months of snow each winter and snow provides an ideal medium to record the activities of animals. Once a week during snow season, her students strap on snowshoes and study the impressions in the snow in several areas around town. Maxine says, "I believe that getting kids outdoors, doing their own investigation, is a fantastic way to teach science at this grade level."

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My parents introduced me to the great outdoors at a very young age. Family vacations in the 1960s and '70s always entailed traveling somewhere in the U.S. and pitching a tent. It was a wonderful experience and I still hit the road quite often to meet with Mother Nature. I graduated from Stephen F. Austin State University in 1982 with a B.S. degree in education and have completed a majority of my course work toward a M.S. in chemistry education. I immediately began my teaching career as a high school science teacher at South Grand Prairie High School in Grand Prairie, Texas. There I taught Physical Science, Chemistry, Astronomy, and Biology. I also coached the UIL Math/Science teams as well as the Freshman Volleyball and Tennis teams. After teaching in the classroom for 10 years, I then joined the administrative team as the K-12 district science facilitator. There I worked with K-12 teachers designing curriculum, providing staff development, and bringing in and developing new programs. I really enjoyed my job as the science facilitator, but I was missing a couple of things—being outdoors and KIDS! During the last three years, I have been very fortunate to work with some wonderful people on a project near and dear to my heart. I had a vision, along with other GPISD teachers, to have an outdoor learning center for the school district. And the dream came true! I am now the program facilitator for the Natural Science Education Center. The center is a 39-acre city park that has been redefined as a natural area for children to learn within and reconnect with nature in a suburban world. We have a riparian area; a woodland area; herb, butterfly, and vegetable gardens; a pond ecosystem; and we hope to soon embark upon a small prairie restoration project. Our program serves 8000+ students a year and the program offerings have only just begun!

Randy Laurence
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I was born in Corpus Christi, Texas in 1952, graduated from Robstown High School in a nearby community in 1970, and attended Texas A&I University in Kingsville where I received a B.S. in Bio/Geo in 1974. Then, after two years amassing funds as a commercial diver, I returned to TX A&I for two years of graduate work in immunology (snake venom) and chemistry. I moved to Eagle Pass in 1978 and worked for an integrated agriculture operation for 15 years, managing cattle feed lots, farms, and a beef slaughter operation. Seeking more adventure, I attended night school at Sul Ross University in the Eagle Pass area in 1992 and 1993 to obtain minors in education and mathematics, and started my teaching career in 1992, teaching math and science. I currently teach Environmental Systems, AP Environmental Science, and Astronomy at a junior-senior campus of 1300 students in Eagle Pass. I am a reader for the AP exam, participate in two water quality programs (Project Del Rio and Cyberways & Waterways), and serve on the board of directors of the Rio Bravo Nature Center.

I have been married to my wife Phyllis, a middle school science teacher, for 25 years and have three sons: Jesse, age 21, Matthew, 19, and Kevin, 14. I live in a rural area on a small ranch located on the Rio Grande River between Eagle Pass and Del Rio, Texas. My hobbies include fishing, hunting, and birding. I am an avid racquetball player and like to play chess.

Judy A. Lee
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For me, science has always been a way of seeing the world and working on life's problems. This is how I have taught a variety of students the subject of science for the past 18 years. Pre-service teachers from University of Houston Clear Lake, geology students from College of the Mainland, and middle school students are a few of the types of participants in my science classes. The most interesting and unique are the middle school students. They are unpredictable, insightful, curious, and entertaining. Science instruction for any student must have a meaningful application of scientific information and an awareness of the environment.

The scientific investigations accomplished by the students are presented at statewide and national conferences. An example of this work is over ground level ozone in the Houston-Galveston area. This project was supported and encouraged by the National Center for Atmospheric Research in Boulder Colorado. The work continued with the support of the Global Change Workshop sponsored by JPL and Sally Ride along with Rice University's GirlTech, which hosts the Web site for the projects and helps with Web designs.

Each year my science students take the information from previous classes and use it in a new investigation. This year's class project is how to reduce ground level ozone in the Houston-Galveston area. The group project is called "Texas City: 2031." They must design a new section of the city for the year 2031 with the idea that the quality of air, water, and soil must be kept pollution free. We will be presenting our results to Washington through our elected officials. I want my students to realize what they do now will affect them later in all aspects of their lives.

Gilda Lyon
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A native Alabamian, I graduated in 1973 from the University of Montevallo (near Birmingham) and moved to Chattanooga after graduation. I began teaching high school science immediately at Howard High School and have been there ever since. In 1990-91, I was awarded a Howard Hughes Fellowship to Brown University in Rhode Island and spent a year teaching and learning there.

After returning to Chattanooga and back to Howard School, I began involving students in the environmental data collection through an organization called the Tennessee River Gorge Trust. Since I am single and have no children, I have plenty of time to work with my students in the gorge. I am an avid birder and backpacker and enjoy gardening.

"When one tugs at a single thing in nature, he finds it attached to the rest of the world."

John Muir

Carolyn R. Maragh
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I hold a B.S.ED. from DePaul University with minors in geology, ecology, and archeology from the University of Sheffield in Sheffield, England. A seven-year veteran of the Chicago Public School System, I am Science Department chair and lead middle school science teacher at Louisa May Alcott Magnet School.

Alcott School, located on the city's north side, is less than a mile away from the shores of Lake Michigan. Being in such close proximity to the lake has developed my curiosity, love, and appreciation for the Great Lakes. Working in conjunction with the Illinois State Geological Survey, Harza Engineering Corp., and several other agencies, I endeavored to create a research-based learning initiative focusing on the Great Lakes. My students and I frequently utilize Lake Michigan and its components as our classroom laboratory.

In conjunction with my research, I am heavily involved in outreach/in-service activities. I am a frequent presenter to teachers and organizations throughout Illinois regarding Lake Michigan. My Lake Michigan research efforts have been funded by several organizations including Toyota TAPESTRY grants.

Currently, I am pursuing an M.S. at the University of Chicago, and acting as the Illinois Ambassador for Toyota TAPESTRY grants. I continue researching Lake Michigan, and hoping that schools and organizations throughout the City of Chicago and State of Illinois will develop an appreciation for and understanding of one of the world's greatest waterways.

Patricia McGinnis
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I teach middle school life science at Methacton School District. Methacton is located about 20 miles west of Philadelphia, Pennsylvania. I earned a B.S. in biology from Washington State University (Pullman, WA) and an M.S. in biology from George Mason University (Fairfax, VA). I taught high school for six years before taking 10 years off to have my three children (ages 14, 12, and 9). I rejoined the teaching ranks in 1996 and love teaching middle school kids! The changes in teaching (particularly in environmental education) keep me excited and constantly striving to incorporate new ideas and emerging technologies into my teaching.

Joyce A. Nishimura
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Joyce Nishimura teaches 7th grade science/health on Bainbridge Island, Washington, a 30-minute ferry ride from Seattle. She received her B.S. degree in fisheries from the University of Washington in 1970, and her Masters of Education degree in educational technology in 2000 from City University. She is a participant of the Teacher Leadership Project 2000-01, a Gates Foundation grant to integrate technology into the curriculum throughout Washington State. Her environmental education projects include an ongoing stream-monitoring program that involves parents, community volunteers, and technology.

She was born and raised on Kauai, Hawaii, and attended the University of Iowa before settling in the Northwest. She has taught at the middle school on Bainbridge Island for 28 years. She lives with her husband, Steve, who works in finance at Boeing. They have two college-age students, Tracy, a political science major at Western Washington University, and Gary who is majoring in engineering at the University of California-Davis.

Robert Oddo
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Hi, my name is Robert Oddo. I have been teaching high school science at Horace Greeley High School in Chappaqua, New York for the last 14 years. I have taught biology, AP environmental science, earth science, chemistry, student research, and even a little German to students in grades 9 through 12. I recently taught high school biology at Liceum Ogolnoksztalacace nr XVII in Poznan, Poland as a participant on a Fulbright Teacher Exchange. The experience was rewarding and challenging as I had to adjust to teaching in a completely different education system.

I was involved in the development of the AP environmental science curriculum at my school three years ago, participated in the 1998 Woodrow Wilson Environmental Science Institute, and served on the school's building design team and district technology committee. In addition, I coached boy's varsity soccer and skiing.

I enjoy traveling the world, downhill skiing, camping, sea kayaking, and hiking.

George M. Radcliffe
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I am a career middle school science teacher on the Eastern Shore of Maryland. Married for 30 years and with three grown children, I am passionate about my career. I have engaged students in environmental science activities and scientific research for most of my 30 years as a teacher. Raised in Baltimore and after attending Hamilton College in New York State, I settled in the peace and beauty of Chesapeake Bay County.

I have been instrumental in Maryland in promoting the use of the outdoors as a natural science classroom, in integrating math and technology with instruction, and in promoting student research at many different levels. I have been successful in implementing many new programs in environmental education beginning with the development of a school nature trail 26 years ago. My students spearhead the Chester River Water Quality Monitoring Program, participate in the World Series of Birding, maintain a comprehensive environmental research Web site, and have developed much of our 25 acres of "unused" school property as wildlife management habitat.

Website:
http://www.qacps.k12.md.us/cms/sci/RADCLIFFE.HTM

Gary Swick
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I facilitate a county-wide monthly meeting of environmental science teachers and professionals. For most of the 25 years I have taught in my district, I have been the entire environmental science program. It has grown to the current scene where I am based in one building that has 2.5 environmental science teachers who cover eight different courses. We are hiring a 100 percent ES teacher for next year. Please send prospects my way. I am locally the Watershed Monitoring Network director. Check us out at: **www.friendsofthefoxriver.org.**

My teaching situation can be reviewed at www.centerkey.com/swick/courses.html. It is not current, but close enough.

Since 1984, my summers have been spent as a whitewater raft guide on the Snake River in Wyoming. There I met, worked with, and married Molly. She is also a teacher, and the manager of our young family and suburban home in the woods an hour west of Chicago.

My father grew up on the Delaware River, so I am anticipating family reunion moments, and chances to see his world. I have aspirations of kayaking and fishing his turf. I'll be looking for partners for trail running there, and continued support on our classroom activities.

"Man shapes himself through decisions that shape his environment."

Rene Dubos

Harry Weekes
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My name is Henry de Forest Weekes, and for reasons still unknown to me, I have always and only been called Harry. I live in the great state of Idaho, which I maintain is the state that most people know the least about. We do have famous potatoes, wonderful soybeans, and politically askew types, but those are south and north of me respectively. It just so happens, I live in Hailey, which Bruce and Demi Moore put on the map in the same way Columbus 'discovered' America. I am also a hop, skip, and a spud from Sun Valley—"World Famous Ski Resort." In an odd twist of fate, I don't ski, but play hockey, for which the resort is much less famous.

My family moved to Idaho from New York in 1971, when I was three. So despite some fond memories of my uncle's cat, I am a product of Idaho. I teach at the Community School (located in Sun Valley), which also happens to be where I went to high school. I am in my ninth year and teach Introduction to Ecology, Advanced Biology, Science Seminar, and Field Biology. Spending my days around 14-18 year olds keeps me immature. Or maybe, I keep them immature. Regardless, I have been a biology nerd since I can remember. I bake, I draw, I am still hoping to find someone that watercolor paints as poorly as I do, and although earwigs bother me, they don't scare me nearly as much as jellyfish.

Ronald Wilmot
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I have been married for 38 years and have five children: three biological and two adopted of mixed race. Akron, Iowa has been my home for 33 years, and my non-school activities include City of Akron Park Board, Akron City Convalescent Care Center Board, Plymouth County Conservation Board, and member of Big Sioux Recreational Corridor Council. Hobbies include "Ham Radio," backpacking, electronics, and traveling to Wilmot family historical places.

My teaching career began in 1965 at Rapelje, Montana, where I learned that students gained more from cooperative-learning projects in a non-classroom setting than they were getting out of traditional classroom settings. In 1968 I was hired by the Akron School District to set up and teach ESCP Earth Science. This was the first inquiry method class for the school system. The following year I was asked to set up and teach an inquiry biology class for the district. In 1994 I became the science project director and began planning short- and long- term projects for students who had an interest in science and math.

BSLI Impact

Each participant in the BSLI receives a $1,200 grant to present at least three local or regional workshops reaching 90 additional teachers when they return home (see page 11).

The following proposals, a sample of those written during the 2001 BSLI, cover a number approaches through which Institute participants can share their expertise. In Volume III of Ecology In Action, the results of these and proposals from 2000 will be featured, as well as new ideas stemming from the 2002 BSLI experiences.

Cooperation with schools, government institutions, parks, universities, and a land trust

Gilda Lyon proposes cooperation between several organizations and a mini-Brandwein Institute—Forest Observation, Research & Education for Students & Teachers (F.O.R.E.S.T.) Institute.

Using the Brandwein Leadership Institute as a model, Lyon intends to initiate a field institute for Hamilton County, Tennessee teachers under the auspices of the Tennessee River Gorge Land Trust. F.O.R.E.S.T. will train middle and high school teachers in Hamilton County schools in field biology techniques.

Teachers from Hamilton County schools will learn environmental monitoring techniques at institute workshops during the school day. The institute will be conducted on the property of the Tennessee River Gorge Trust where she has conducted teacher workshops before. A Trust employee, a former National Park Ranger from South Africa, and an excellent scientist and teacher will work with Lyon. Together they will partner with the Environmental Science Department of the University of Tennessee at Chattanooga and local water quality and biodiversity conservation experts who will assist with training (a mini-Brandwein Institute). Outstanding local teachers will share their knowledge and expertise.

The budget will be used to buy equipment (tape measures, diameter tapes) and pay for substitutes so that teachers can attend the institute. If workshops are held on weekends, teachers will be paid a $50/day stipend.

In-kind contributions of property and instructors will be made by the Tennessee River Gorge Trust. Hamilton County Schools will provide equipment and teachers. And, the University of Tennessee at Chattanooga will provide professors for instruction.

A Web site will monitor teacher/student's activities to evaluate the project. If area students are completing environmental research projects with a greater frequency, then the F.O.R.E.S.T. institute will be considered a success.

Lyon plans to conduct the environmental institute in the first year with the $1200 grant. Once the school district recognizes the value of the training, Lyon expects Title I funds will be used to increase training time and advanced monitoring techniques.

Patricia McGinnis, besides being a Brandwein Fellow, has a number of awards and grants: Unsung Heroes Award in 2000; McDonald's Grand 2000, 2001; Pennsylvania Governor's Institute Summer 2000; and has published articles in Science Scope.

McGinnis believes that field techniques can be used to excite students and to help them learn about the world around them. Teachers can benefit from in-service workshops that train them how to involve students in field research and how to incorporate field-based research into the classroom curriculum.

She proposes workshops at the following events:

1. Pennsylvania Science Teachers Convention
2. School District workshop for elementary and middle school science teachers
3. Montgomery County Intermediate Unit
4. Montgomery County Science Teachers Association

To cover the following information:

1. Demonstration of Vernier probeware and its application for field work
2. Terrestrial assessment techniques for deciduous forests
3. Demonstration of KANCRN online projects

Teachers at each workshop will be surveyed to assess the presentation's usefulness. Methacton School District teachers will be resurveyed to learn how they incorporated field-based research into the science curriculum.

Joyce Nishimura, from Washington State, proposes using her grant money to assemble and train science and math teachers in her district to seek grants and community funding for individual project ideas involving

"Till now man has been up against Nature, from now on he will be up against his own nature."

Dennis Gabor

environmental monitoring. Nishimura will also participate in professional workshops where she will share her stream monitoring program and information about the Brandwein Institute.

In addition, Nishimura plans to network with Pocono Environmental Education Center to generate and develop more ideas. She plans to use her new skills and resources to seek funding for these ideas. She also plans to work with the Puget Sound Environmental Learning Center on Bainbridge Island in developing habitat monitoring programs, which will be used by urban students from Seattle.

Her grant will be used for teacher stipends, refreshments for meetings, travel expenses, substitute teacher payment, and costs associated with participating and possibly presenting at the National Science Teachers Association convention in San Diego, California in March.

David Awtrey proposes formation of the HabitatNet program, a series of structured field research activities that can be implemented in many different ecosystems. Awtrey notes that writing and interpreting the national history of an area can be a daunting task for students and teachers alike. Although the gathering of data is a way to teach measurement skills, Awtrey wants to deepen the experience of students in the field and broaden their skills. The HabitatNet program is designed to teach students how to apply the data they have collected.

HabitatNet includes basic activities involved in monitoring vegetation and collecting standardized data. In addition, students will interpret the data they have collected and will use technology to provide visual imaging of the area. Data collected by students will be incorporated in a larger database. The students will also collect information, which will be used to monitor the area over time, will compare the richness and diversity of different plots, and will interprete the natural history of the area.

Awtrey will implement the program at his school during the first year. During the summer, HabitatNet will be implemented in his field ecology class in the Apostle Islands National Lakeshore. He plans to present his HabitatNet program and his monitoring protocol at a BioNet regional meeting to a statewide consortium of Northwestern Wisconsin biology teachers.

Awtrey also plans to have a consortium of Brandwein Institute alumni teach long-term monitoring of plots in Great Smoky Mountain National Park during a summer program. Applied research by students and a training program for teachers will also be conducted there.

Awtrey will use his grant to purchase materials for HabitatNet, including monitoring equipment for students.

HabitatNet will be evaluated as soon as the program is implemented in his classroom. As the number of teachers implementing the program increases, another evaluation will take place.

Mentoring teachers and students

Judy Lee proposes arranging a study of drainage canals in and around Galveston, Texas while mentoring local elementary science students. Their study will examine the salinity of the estuaries and whether changes in salinity will affect bacterial growth.

Students will begin by walking the drainage ditch, duck pond, and estuary to view the area of study. The mayor's office will then discuss water drainage and Lee will arrange a study of this drainage system with the city manager and engineer. The study will employ any available ArcView maps of the city that pertain to the area under study.

Lee will test ditch, pond, and estuary waters for the following: pH, salinity, coliform and E. coli, temperature, macroinvertabrates,

dissolved oxygen, nitrate and nitrogen, settable solids, transparency, and phosphorus. Lee will solicit help for collecting and analyzing data over several months from the Galveston Bay Foundation, Texas Watch, and the Texas City Bird-watching Club.

At the end of the study, Lee will present information to both the community and the mayor's office regarding any clean up that may be needed. She will work with community and local officials to implement an estuary watch.

Lee will use her grant money for test materials.

Randy Laurence

proposes leading students from his classroom in a mentoring program to conduct a rapid environmental assessment of a unique area, a riparian habitat along the Nueces River in south central Texas. The habitat is a 10-acre area held by the recently formed Lehmann Research Foundation. The riparian habitat escaped irrigation activities, such as vegetation clearing and leveling, during the early decades of the 20th century. The foundation director, Val Lehmann Jr., has offered the facilities and his time in an effort to document this habitat, which at one time bordered a wide swath of the river.

Although other areas bordering the Nueces River resemble the habitat selected for study, none are rectangular in shape. The assessment will be modeled after the Smithsonian Institute's protocol, which uses 20 meter by 20 meter quadrats.

The students that Laurence plans to mentor are from his school's 9th and 10th grade campus and from both middle schools. His class will be trained first. They in turn will mentor students from three other secondary schools. Laurence will teach the protocols using PowerPoint presentations, followed by on-site field data collection. The effectiveness of their training will be measured by tests administered before and after the training. Students' understanding of both the protocols and data interpretation will be evaluated.

Laurence will be responsible for recruiting teachers from each of the other secondary schools and for establishing objectives that correlate to state standards. He and his students will accompany participating classes to the study area to establish new plots with them. Students will establish a quadrat system in the riparian forest and then determine water quality and biodiversity of the site. This material will then be included in a formal report to the foundation.

Middle school students proficient in habitat assessment protocol will mentor elementary students after the protocols have been adapted for their grade level. This will prepare elementary students for more detailed studies when they reach middle school. Since elementary students do not travel as well as older students, suitable local sites may be substituted for training purposes. Elementary students will be evaluated with pre- and post-tests to determine how well they understand the protocols and data interpretation.

Interdisciplinary techniques

Maxine Henry

proposes to train teachers to employ an interdisciplinary curriculum combining practical skills in field biology, mapping, geography, writing, and public presentations, using teacher in-service workshops in environmental education as the basis.

Suggested sites for workshops are some of the following events:

- Michigan Science Teachers Association Forest Park School District
- Dickinson-Iron Intermediate School District
- NSTA – San Diego

And will cover the following information:

- Field collection techniques for mammal species
- Tips for writing field journals
- Alternative assessment techniques
- Mapping data collection for local geographic areas

A formal workshop evaluation will be made and a network of interested teachers will share information via e-mail or a collaborative Web page about mammal species in Michigan's Upper Peninsulas.

Tracy Hollis proposes an interdisciplinary study of the areas, which were part of the "Great Grand Prairie" long ago. She will use her grant to purchase equipment and train a minimum of sixteen science and social studies teachers in the use of Garmin GPS Units and ArcView software.

After training, each teacher-team will return to engage their own students in a habitat assessment of school grounds or other select locations. This assessment will follow HabitatNet collection protocol. Teachers will use the GPS units to establish suitable locations for data collection and will use the GIS programs to collate the information and to create useful layered maps. The maps will then be used cooperatively in their science and social studies classrooms. During this assessment, students will see that the prairies that once existed and inspired their city's name, Grand Prairie, can no longer be found there.

Hollis hopes that in future science and social studies classes, the students will continue to study their city's ancestral prairies, including its history and varied plant and animal life. She will also encourage students to reclaim a small area of land on their own campus or on an adjacent property, transforming it into their own prairie area for study.

Hollis will also attempt to reclaim at least one acre of land at the Natural Science Education Center for the education and enrichment of Grand Prairie's community. Only species native to North Texas will be used in her reclamation project.

Using technology

Robert Oddo proposes collecting information in the field, then using geographic information systems (GIS) technology as the basis for activities that will be used by students as they analyze the data. He will use his grant to acquire GIS software and related materials.

Oddo notes that the importance of GIS was emphasized throughout the Brandwein Leadership Institute this year. Although GIS is used extensively in business and at the university

"The sun, with all those planets revolving around it and dependent on it, can still ripen a bunch of grapes as if it had nothing else in the universe to do."

Galileo

level, only 2 percent of high school teachers incorporate any aspect of GIS into their curriculum. Oddo will use the GIS software with his students to perform habitat analysis on school property and at some local nature preserves.

Oddo will introduce both the GIS technology and field techniques learned at the Brandwein Institute to AP environmental teachers and to other members of his own Horace Greeley High School Science Department. Oddo will deliver his presentation to AP teachers during a workshop that he will initiate and conduct. Participants will receive a follow-up evaluation a few weeks after the teacher workshop takes place.

Oddo also plans to establish a local network of teachers who will create fieldwork activities and incorporate them into their environmental science curriculum. To keep teaching materials and activities current with this evolving technology, Oddo expects this group to meet periodically and update their work.

Student Exchange

Carolyn Maragh wants to develop a students' exchange program to incorporate field-based research into environmental education. Eco-America, an outreach facilitator, will assist educators throughout her state to develop field research activities.

Eco-America is a hands-on, Illinois-based, interactive "ecological exchange" program geared to elementary school educators and pupils. It promotes environmental education, awareness, involvement, and literacy. It encourages cooperation and participation in the spirit of ecological conservation.

The goal is to promote student collaboration in identifying eco problems in their community, city, and state, and to develop solutions, using scientific investigation to solve real world issues.

Eco-America will communicate via a Web site including an open forum on world eco-issues. Students will contribute their thoughts, suggestions, and solutions to a monthly global question. Educators will have a question and answer page, a forum for ideas, successes, concerns, advice, and planning assistance/how-to page, plus detailed field-based lab activities and a resource guide.

The culminating project will be the exchange of eco-boxes the size of a bulk paper box, containing field data collected throughout the year (i.e., leaves from local trees, tree bark, water specimens); information/novelties on the community, town, or city (post cards, sports team mementos—anything unique to the community); information on the class and school; and pictures. Eco-boxes will give students an opportunity to share research in a physical form as opposed to the Internet.

The number and involvement level of schools, teacher evaluation/response, and ability to expand beyond Illinois will determine the success of the project.

During the year students will be asked to complete several activities from responding to the monthly global question to identifying tree species common to their area. Student assessment will be based on a five-component alternative procedure: Recall-repeat; Analysis-categorize; Comparison; Inference-conclude; and Evaluation-critique.

The Chester River Watershed Biodiversity Network

A long-term, regional research and monitoring program

Inventorying and Monitoring Biodiversity in a Watershed

Presented by George M. Radcliffe

Total Project Overview

I will help establish a watershed-wide network of schools and scientists that will both inventory and monitor the flora and fauna and environmental parameters in the Chester River Watershed area. Data will be pooled and displayed via a Web site using GIS mapping. Not only will students in the watershed area be able to access the data, but also the Web site and teachers will encourage the use of data in student-generated research projects.

Brandwein Institute Grant

Abstract

As preparation for a larger grant, I will be starting to recruit teachers and scientists for a Chester River Watershed Network. We will meet on two occasions to brainstorm ideas and resources in preparation for developing the network. Concurrently I will purchase and begin training in the use of GIS and ArcView software, which will be a cornerstone of the data analysis and sharing. From these efforts I plan on developing in 2001 a proposal for funding for the larger program.

Problem Statement

There is data available for the Chester River Watershed, but much is unavailable to teachers for use by students. There is also considerable data, which can potentially be collected by students in the watershed. This data should be made available to teachers, and a network for communicating and sharing should exist. Students also frequently are not asked to analyze data and look for patterns.

I propose to lay the groundwork for a networking project in our community, which will link schools and the scientific community in inventorying and monitoring the watershed area. In order to accomplish the goals of this long-range project, two prerequisites are necessary:

Identify a team of core teachers with a commitment to field research and who can brainstorm and plan the framework for a Watershed Monitoring Project.

Acquire and begin working with ArcView since GIS mapping will be critical to the final project.

Objectives

- Develop a preliminary network of teachers in the Chester River Watershed who are interested in environmental data collection, sharing, and student research.
- Acquire and begin training in the use of ArcView.
- Attend state and regional NSTA Conferences to continue networking and development of plan.

Procedure

Network Development

I will assemble a core of teachers and professionals to plan the Chester River Watershed Biodiversity Network. The teachers will come from two counties (Queen Anne's and Kent) and from all schools. My goal would be to get at least one high school, one middle school, and one elementary representative from each of the counties for a total of 10 (50 percent of the two counties). The group will meet twice (one evening and one Saturday morning) to be briefed on the potential project. They will identify measurable variables, possible uses of the data, and ways of turning data into student analysis and experimentation.

GIS Preparation

After purchasing the ArcView school package, I will begin to train in its use. I have three users available to assist me in this: Horn Point Environmental Laboratories, Washington College, and the MD Department of Natural Resources. I also need to begin to look for sources for the base map and overlays for vegetation and key animal groups (e.g., amphibians, nesting birds).

Outreach

At two conferences I will attend, I will interact with colleagues to further develop the project idea and to identify resources. At the MD Association of Environmental and Outdoor Education Conference, I will make a presentation on student research using field data.

Evaluation

- Successful recruitment of teachers from 50 percent of the watershed schools.
- Successful networking with elements of scientific community needed.
- The development of at least two grants from this preparation.

Budget

Item Cost School License for ArcView $500 Inservice/Planning for Watershed Teachers $500 Partial Cost for Local/NSTA Conventions $200 (The following are the beginnings of some rough idea of where I'm headed, although not all at one time.)

Future Grant Proposal

Create a network of scientists, agencies, and teachers in the Chester River Watershed area in Maryland.

Develop a Web site, which can display species sampling protocols, inventory data, monitoring data, and resources in a GIS format.

Add to the Web site strategies for having students analyze data, generate research questions, and conduct research projects.

On the Web site, provide data overlays, which students and scientists can access to look for patterns and relationships.

Possible Data to be Included

Biodiversity Inventory

- Botanical
- Trees
- Wildflowers
- SAVs
- Wetland Vegetation

Zoological

- Birds
- Amphibians
- Reptiles
- Mammals
- Butterflies

Ecological Monitoring

- Water Quality Chemical Testing
- Macroinvertebrate Sampling
- Biodiversity Sampling

Web Site Capability

- Input data on form into data base
- Use images of GIS maps
- Click on sites in watershed to access data
- Input data via Java input into database.

Research Connection

- Link to Science Fair/Research Site
- Math Toolbox - Data Analysis Tool
- How to Find Patterns and Trends
- How to Formulate a Researchable problem from Data

"What is a weed? A plant whose virtues have not yet been discovered."

Ralph Waldo Emerson

Reflections

Real Science and Encouragement
by Thomas Hennigan

As a science teacher, I had been looking for ways to get my students to do relevant, meaningful science while learning basic skills. It was difficult; I didn't know a whole lot of teachers who were doing such things. I was trained to do the typical canned experimental activities where outcomes were known, and real, investigative science was unknown.

Then, I had the opportunity to participate in the Brandwein Summer Leadership Institute and it became a new and exciting opportunity for me. I was given ways to get students to do real science but also get them to think, integrate core disciplines, and process data. I was given skills such as grant writing opportunities that greatly enlarged the horizons of my own classroom. But more importantly, I had the privilege of working with outstanding teachers across the country who were breaking the mold on traditional science instruction and who were a real encouragement to me. The fact that we can network with each other is a continuing source of feedback for my own programs that stretches and challenges me as a science educator.

Risk Taker
by David Brock

What the BSLI program did for me more than anything else was to provide me with a model of an educational risk taker. Interacting with so many amazing colleagues gave me the opportunity to observe how to take the creativity at the heart of all good teaching and flesh it out into sustainable form.

I came away from BSLI knowing that I, too, could write successful grants; that I, too, had the resolve and the wherewithall to overcome bureaucratic barriers; that I, too, had something worthwhile to offer the larger educational community. I came away knowing that I, too, could dream big and make that dream come alive, and as a result, my long-term goal to implement an environmental science summer research program for 9th and 10th grade high school girls became a reality this July.

For three weeks, 17 young women learned everything from how to conduct a quadrat survey to advanced statistical analysis of the data. I have already found numerous elements that I can incorporate into my actual classroom this coming fall — not least of which will be a GTE grant proposal for creating a statistics-ecology unit with a math colleague. My participation in BSLI has changed my self-perceptions as a teacher, and that more than anything else has been its greatest gift to me.

Riches from a Ten-Day Workshop
by Ruth Krumhansl

A year later, my students and I continue to benefit from my rich ten-day experience at the Brandwein Summer Leadership Institute 2000. I developed valuable connections with accomplished teachers and experts, gained

curriculum ideas that I have implemented in the classroom, and obtained information about grant opportunities to help me develop and share field-based science curriculum with others.

Every time I check my e-mail, I am inspired by the accomplishments of BSLI 2000 participants. They set a high standard of professionalism, and give me the courage to pursue my own ideas. During the past school year, 88 students benefited from BSLI 2000 when I implemented a new unit on biodiversity that involved the study of forest quadrats adjacent to the school. This curriculum will become a permanent part of my 9th grade integrated science course.

Currently, I am working on the development of a field-based geology unit with the New Hampshire Geological Survey. Using the information on grant opportunities I obtained at BSLI, we are seeking support to improve the authenticity of geologic mapping techniques used by students, to incorporate GIS technology, and to develop ways in which data collected by students could be used to support the state's mapping program. Our goal is to share this curriculum with teachers in other communities.

When I think about the impact of BSLI on my teaching during the past year, I am reminded of the seeds given to us by Mary Brandwein—it was a year of beginning new things that I am hopeful will grow and benefit many students.

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Dan has been developing and implementing a districtwide program to meet the needs of students for the 21st century. Souhegan High School, now in its seventh year, has received a number of state and national awards for offering public school students authentic research and interdisciplinary opportunities in academic areas. During this time, Dan has won several national awards for teaching. His work is cited in George Wood's Schools That Work (1993) and Robert Fried's The Passionate Teacher (1995). In addition, he received a Toyota TAPESTRY grant for his project HabitatNet: A Global Biodiversity Monitoring Project.

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Steve Case has experience with grant reviewing and writing. He served on the review panel for NSF, and has also reviewed grants for the U.S. Department of Education. He has written many grant proposals, which have ranged from small in-school district minigrants to his current project, a $4.5 million Technology Innovation Challenge Grant through the U.S. Department of Education. He is currently at the University of Kansas, although he was a classroom teacher for twenty years. He taught a field class called Student Naturalist in which they did lots of field research. He also lived on and managed a 300-acre tallgrass prairie nature center for 12 years.

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Jay started working at the museum in 1992 as a lecturer for the special exhibit, Global Warming: Understanding the Forecast. In 1993, he became the coordinator of the museum's after school program for high school students. This program is a series of five session courses in the natural sciences and anthropology. Participating students work with museum educators and scientists from institutions around New York in hands-on laboratory classes. Last spring, Jay transferred to a new project, the Discovery Room, a hands-on learning area in the museum that opened in April 2001. Over the past eight years, Jay has also been the advisor for the museum's Ecology Club for teens and YouthCaN, a collaborative project between New York University, the International Education and Resource Network, and several schools. YouthCaN culminates in an international environmental conference for youth by youth. Jay also conducts teacher workshops and writes curricula in a variety of

"Climb the mountains and get their good tidings.Nature's peace will flow into you as sunshine flows into trees.The winds will blow their freshness into you, and the storms their energy, while cares will drop off like falling leaves."

John Muir

geology and environmental science subjects. Prior to working at the museum he was a laboratory manager for an environmental consulting firm in New York and a junior high school science teacher. He has a Bachelor of Science from Rensselaer Polytechnic Institute in geology and attended graduate school in geophysics at the Pennsylvania State University.

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Terry is the environmental education coordinator for U.S. EPA's office in New York City serving New Jersey, New York, Puerto Rico, and the U.S. Virgin Islands. She came to EPA in 1988 and in 1990 transferred to the Community Relations Branch. While coordinating Region Two's environmental education program, Terry is also the region's program coordinator for the grants program authorized under section six of the 1990 National Environmental Education Act. Terry came to EPA after sixteen years in education as a science teacher and school administrator. Her years in education were preceded by two years as a medical research technician. Her current position at EPA combines her educational expertise with a long standing interest in the environment. She holds a bachelor's degree in biology from Marymount College. She did graduate work at New York University and received a master's in environmental health science from Hunter College, City University of New York.

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H. Michael Mogil is a certified consulting meteorologist with B.S. and M.S. degrees in meteorology from Florida State University. He has earned the American Meteorological Society's Television Seal of Approval and is also a Certified Consulting Meteorologist. He has practiced meteorology for more than 30 years, working closely with educators across the country since 1979. He has also taught fifth grade math and science. Mike has co-authored several books about weather experiments and a comprehensive teacher's guide for using the newspaper to study weather in the classroom. He has also developed several weather posters and cloud charts. He has written scores of articles for National Science Teachers Association and American Geologic Institute journals, and numerous other magazines and newspapers. During 1999 he served as a consultant to the Discovery Channel's new WEATHER Field Guide. Mike has also co-authored six articles in the "Geography and Weather" series in Science and Children Magazine. He recently began serving as the weather consultant to Grolier's New Book of Knowledge Encyclopedias and Mississippi State University's "Teachers in Geosciences" Education Program.

Mike has also conducted dozens of in-service teacher training workshops and graduate courses in meteorology and many workshops for young people nationwide. He is an avid photographer and videographer with published weather photographs in numerous weather text and trade books, educational journals, various magazines, and the "Washington Post." Mike was recognized by the National Weather Association in 1988 for his outstanding efforts in weather education.

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Jim earned his PhD from Rutgers University in the early 60s and since has been working at, teaching, and studying ecology, especially in regard to wetlands. As terrestrial studies director at Ecology III, a company he started with a partner in 1985, he performs wetland delineations and evaluations for engineering, development firms, and individuals. The studies include detection of wetland presence, marking of wetland boundaries, and securing Corps of Engineers jurisdiction determination.

Jim, who received his certification as a wetland delineator from the U.S. Army Corps of Engineers, has spent much of his career as a college professor teaching biology and chemistry. During the last twenty years he has performed more than 350 wetland delineations and evaluations for various clients. He has also authored more than 40 articles published in scientific journals.

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Kelly Nolan is the Mohawk River regional coordinator for Hudson Basin River Watch. He is active in training volunteers, teachers, and area students in stream monitoring, and has recently completed a stream study on the Indian Kill in Glenville, New York. He previously worked as the assistant director for the Environmental Clearinghouse of Schenectady where he established both an environmental summer day camp for middle school students and an environmental study team for local high school students. The study team, which he continues to advise, works with numerous environmental agencies on outdoor and conservation projects. Kelly has also served as educator and advisor for Schenectady County students participating in the Envirothon. He is a research associate for Bat Conservation International, and has supervised students in making and installing bat houses for the NYS DEC Stoneykill Environmental Education Center. A native of Glens Falls, New York, Kelly has also lived in Mississippi where he worked as a forest technician and earned a degree from Mississippi College. He lives in Niskayuna, New York, with his wife and two children.

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Joseph M. Russo, Ph.D. in agricultural meteorology, is cofounder and president of ZedX, Inc., a 10-year-old information technology company that specializes in custom weather databases and decision support algorithms for the agricultural and environmental industries. He has created databases and algorithms compatible with geographic information systems and other data management programs. Russo's research duties call for participation in the design phases of university, government, and private projects that require information from meteorological and other environmental data sets. From 1981 to 1988, Russo was an assistant professor of agricultural climatology at the Pennsylvania State University. His research efforts were in theoretical aspects, experimental designs, and database needs of agricultural production systems. Since 1993, Russo has been active in the International Geosphere-Biosphere Programme, which conducts research worldwide on how climate change will impact global biogeochemical cycles and life support processes. He also participates in the Biospheric Aspects of the Hydrological Cycle program and the Data and Information System committee. As part of the former program, Russo is cooperating with an international team of scientists evaluating numerous collected and generated climatological and environmental data sets for incorporation into ecological and hydrological models. These evaluations are being published.

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Dorothy Smullen has an M.A. in biology from Brooklyn College, and received an NSF fellowship for a six-week study of tropical botany in 1968. She served as director of the Reeves-Reed Arboretum in Summit, New Jersey for five years. Dorothy has taught middle and high school science for 15 years, currently at North Plainfield High School. For ten years, she's been teaching environmental science and biology. She has been a member of the New Jersey Mycological Association for 25 years, and has served as the group's president. She received the Eximia Award from the Northeast Mycological Foray in 1987 for her contribution to amateur mycology. Dorothy has lived in Millington, New Jersey for 31 years with her husband and two children.

Randolph Richard Tully, Jr.
Fellow, Paul F-Brandwein Institute
Resource Teacher
Lee County School District
Fort Myers, Florida

Randolph Richard Tully, Jr., has been in his current post with the Curriculum Services Department specializing in environmental education for 17 years. As part of his duties, he coordinates field trips in environmental education districtwide, last year organizing more than 1,400 expeditions K-12. He also teaches a full-year seminar for 11th and 12th graders that involves students in positive local action relevant to environmental issues. Over the years, his students created a manatee observation park, established a local ordinance to protect bald eagle nesting habitat, initiated recycling in the local school district, and conducted numerous environmental awareness programs for students and the community. Since 1989, Tully has coordinated a local rivers project in water quality monitoring associated with the Global Rivers Environmental Education Network.

Before coming to Florida, he worked from 1973 to 1981 with a federally funded project in southeast Pennsylvania schools to encourage student action to improve the environment. The project was part of the National Diffusion Network, and he conducted training sessions nationwide from 1975 to 1981. From 1971 to 1973, he ran environmental programs in two Pennsylvania school districts and served as an interpretive naturalist at Platt National Park (Oklahoma). Tully is the recipient of several local and national awards.

"Water is the driving force of all nature."

Leonardo Da Vinci

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William Bavoso, JD, is admitted to practice law in New York, Florida, Pennsylvania, and the U.S. Supreme Court. He is a fellow and director of the New York Bar Foundation and member of the Ninth Judicial District Grievance Committee, overseeing ethical conduct of attorneys in five counties. He has served as president and director of the Orange County, New York Bar Association and as the Orange County delegate to the New York State Bar Association House of Delegates. William is the attorney for several towns in New York, and his column "It's the Law" appears monthly in the Tri-States Gazette.

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Marily DeWall is director of the Jason Academy for Science Teaching and Learning, a new initiative of the Jason Foundation for Education. The Jason Academy began providing online science content courses for middle level teachers in Fall 2001. Marily previously spent many years with the National Science Teachers Association, most recently as associate executive director of corporate, legislative and public affairs. She also served as director of the Building a Presence for Science Program and oversaw many industry-sponsored programs, such as those affiliated with Duracell, Shell, Sears, Toshiba, and Toyota. In addition, she was editor of various NSTA journals and publications including Science Scope (for middle and junior high school science teachers), which she launched in 1978 and edited for nine years. She has been principal investigator for several National Science Foundation-supported programs, award programs, and student science competitions. Marily planned and coordinated two international NSTA conferences, was instrumental in the formation of the Academy of Mexican Science Teachers, and serves on numerous advisory boards.

Dr. William F. Hammond
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For more than three decades, William F. Hammond, Ed.D. and Ph.D. in curriculum theory and environmental education, was the director of curriculum development services and environmental education for the Lee County School District in Fort Myers, Florida. His career began with a decade of junior and senior high school science teaching. In the late 1960s, Bill became the Lee County science supervisor and coordinator of environmental education, positions he held until 1983. At that point, he became the district's director of the Department of Curriculum Services, retiring in 1993. From 1978 to the present, he has been consulting in corporate training for several Fortune 100 companies through his firm Natural Context. In 1997, Bill joined the faculty of Florida Gulf Coast University. During the course of his school, university, and consulting career, he has lectured, made presentations, and led workshops on curriculum and program development. He has presented in all 50 states, Canada, England, the former Soviet Union, and 19 Caribbean nations. He advises a wide range of private and public organizations, as well as more than 250 nonprofit organizations.

John "Jack" Padalino
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Paul F-Brandwein Institute, Inc.
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John Padalino, M.S. in field natural history, M.S. in conservation education, and Ph.D. candidate in science education, has been working at the Pocono Environmental Education Center (PEEC) since 1972, assuming his current post in 1986. PEEC, which cooperates with the National Park Service, is the largest residential center for the study of the environment in the Western Hemisphere. Before coming to PEEC, he taught precollege science and social science and directed Head Start programs. Since 1992, with support from the Rockefeller Foundation, Jack has been providing technical assistance to education specialists from nature preserves in the former Soviet Union. Jack wears a number of other hats as well. In the late 1960s and early 1970s, he was a trainer of teacher trainers at New York University. In the early 1980's, he was principal investigator on two National Science Foundation-sponsored initiatives in field science, science leadership, and science for persons with disabilities. Late in the decade, he led a Wheels of the Mind project sponsored by the Apple Corporation. He is president of the John Burroughs Association and past president of three national science and education organizations. He is also an active member of the National Science Teachers Association and a fellow of the American

Association for the Advancement of Science. Jack has received numerous awards, most recently the Thomas P. Shelburne Environmental Leadership Award from the Pennsylvania Environmental Council (1997).

Alan R. Sandler
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San Francisco, California

Alan R. Sandler is the executive director of the Architectural Foundation of San Francisco (AFSF). Alan joined AFSF in the summer of 1999 to develop, implement, and administer AFSF programs. Prior to directing AFSF, Alan was director of operations and education programs for the American Architectural Foundation (AAF) and the American Institute of Architects (AIA) from 1979 to 1999. At the AAF and the AIA, Alan was responsible for the development of Learning by Design, the AAF's elementary and secondary education program, which involved development and dissemination of information resources, teacher training, and instructional materials to the education and architectural communities. He also established a national technical assistance network. Alan served as an advisor for technology and instructional television programs, and served as the executive producer of The White House Is Our House: A CD-ROM Visit. Alan coordinated the management of Building Connections: Enriching Learning Through the Power of Architecture and Design, a concept paper released in 1999 by the Carnegie Foundation for the Advancement of Teaching and the AAF. This report explored the possibility that the design process used by architects to create buildings might also serve as a general model for teaching and learning, and it discussed the ability of architecture itself to be used as a tool for enriching curricula in a variety of subject areas. Alan has authored publications and articles on education and also has served as contributing editor to several education journals and magazines. Alan also has served as an education administrator in several school districts in Florida. He has also worked for the U.S. Forest Service and the Florida Governor's Office, as well as serving as a consultant to school systems throughout the nation.

Keith A. Wheeler
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Since 1997, Keith Wheeler, M.S. in soil science, has directed the Center for a Sustainable Future, an international nongovernmental organization whose mission is to educate learners of all ages to act sustainably on personal, family, community, and global scales. He was the first executive director of the 136-nation Global Rivers Environmental Education Network, an organization aiming to create formal and informal educational programs and networks that focus on watershed sustainability and stewardship. As the assistant director for the Adirondack Park Agency (New York, 1987-1993), he worked for sustainable development and sensible land use of the state's natural resources, both public and private. He has also worked in research, policy, and management capacities for the U.S. Department of Agriculture and as a research soil scientist for Cornell University (New York). Keith has also served as member and leader of many international, federal, national, and local organizations working for education for sustainability and the environment, for conservation, for science education, and for watershed protection. In addition, he consults in national and international policy settings to encourage creation of sustainable programs in developing areas. He contributes publications and makes presentations dealing with resource issues, education, and sustainability and is currently at work on a book tentatively titled Education for Sustainability: A Paradigm for the 21st Century.

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Assistant Director
Greenville, New York

David M. Foord, M.S. in environmental studies, joined the Brandwein Institute as assistant director in 1997. Before coming to the Institute, he studied and worked in advertising in Philadelphia and New York. In 1988, he left the ad industry to pursue his interest in film, beginning in freelance film production and working as a production assistant and lighting technician on the sets of commercials, features, and video projects.

During his New York film career, Foord's continuing commitment to conservation led him to maintain a small orchard in nearby Burlington County, New Jersey. Eventually, he also left the film business for a career in environmental education, first working as an intern at the New Jersey School of Conservation and then entering graduate school. He spent four summers as assistant director of a wilderness camp in Maine.

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"To me a lush carpet of pine needles or spongy grass is more welcome than the most luxurious Persian rug."

Helen Keller

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"The earth is not a mere fragment of dead history, stratum upon stratum like the leaves of a book, to be studied by geologists and antiquaries chiefly, but living poetry like the leaves of a tree, which precede flowers and fruit — not a fossil earth, but a living earth; compared with whose great central life all animal and vegetable life is merely parasitic."

-- Henry David Thoreau

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