Plant Bloome 2014

The ASPB Plant Biology Learning Objectives, Outreach Materials & Education Grant

Application submitted via http://bloome.aspb.org, by Ehrlich & Nuttle (ASPB Members)

Project Title: Plant Sciences Instruction & Distance Education, Worldwide

Project Abstract: Linda C. Ehrlich, Ph.D. Botany (PI) & David A. Nuttle, B.S. Agriculture (co-PI) will assist the Unlimited Learning Center (ULC), in Cortez, Colorado in creating, developing and starting a plant sciences instructional & distance education facility at ULC. Goals of this effort are to construct and utilize a cold-season greenhouse facility to teach assorted plant sciences 24/7/365 to students at ULC. Project goals also include using existing ULC distance education equipment/ facilities to broadcast the associated lessons to interested K-12 schools, worldwide. Methods used will be based on biosecure quail production, algalculture (algaculture), aquaculture, and aquaponics to grow vegetables, herbs and Grain Amaranth. The anticipated outcome is that students/ participants will learn uses of plants/ plant science for feeding quail and fish, as well as a sustainable means to grow plants for healthful, fresh, organic foods. ULC students will have on-the-job training on how best to accomplish all the above. Our anticipated outcome is that impoverished, food deficient youth, to include Ute, Navajo, Hispanics and poor Anglos, from SW Colorado, as well as the participating youth, worldwide, will learn improved methods of food production based on advanced plant sciences. An independent, third party university reviewer (from the Learning, Evaluation & Resources Network) will evaluate this $47,420.00 program, which will end 12 months from start, to determine accomplishments and successes. Dissemination of lessons/ lesson plans will be global by means of distance education. In addition, the media, ASPB, USDA and other interested parties will receive technical announcements and news releases about the program.

Principal Investigator (PI): Linda C. Ehrlich, Ph.D., owner & President of Spirogyra Diversified Environmental Services, Inc. Address: 2232 Holland Ave., Burlington, NC 27217 Tel. 1-336-570-2520 Email: spirogyra@ juno.com (ASPB member.)

Co-Principal Investigator (co-PI): David A. Nuttle, B.S., founder & President of Needful Provision, Inc. (NPI), an agricultural development charity. Address: NPI, 25337 Road T.5, Dolores, CO 81323 Tel. 1-918-868-7090 Email: npiinc2000@aol.com (Also a member of ASPB.) Website: www.needfulprovision.org.

Goals & Objectives:
Unlimited Learning Center (ULC), (formerly known as the Adult Education Program) was initially established in 1976 to provide basic educational services in Montezuma and Dolores counties, in the 4-Corners region of Colorado. We serve a very rural, multicultural population (Ute, Navajo, Hispanic and Anglo), spread over 5,000 square miles and separated by geographical differences of mountains, canyons, and deserts. 96% of ULC students are determined very low to low-income, with only 4% categorized as low middle income (Adult Education Program). In 2002, the Adult Education Program received its 501 C (3) nonprofit status and officially became Unlimited Learning Center, Inc. (ULC). Also at this time, collaboration began with the Housing Authority of Montezuma County to build a community learning center. After over three years of fund raising, the facility was built in Cortez to serve the area's residents. The resulting Unlimited Learning Center (ULC) officially opened in September 2004, offering instruction to adults, 17 years and older, for 50 hours per week (basic literacy, life skills, ESL, and GED prep).

In 2006, UL participated in a Department of Agriculture (RUS) grant that funded the purchase of distance education equipment. ULC began using its equipment for receiving distance education classes from the College of Eastern Utah, now part of Utah State University, through live interactive videoconferencing. Presently, 43 college courses are offered at the Center, spanning from certificated trainings to Master's degree levels. Since the vast majority of the Center's students are low-income, they can apply for PELL Grant scholarships to pay for their books and tuition. The students are finding that the distance education option is the most efficient and cost-effective answer for achieving their vocational and educational goals in our rural region.

Using the above ULC foundation, facilities and staff, this education/ outreach project seeks to create, develop and demonstrate a teaching/ distance education greenhouse to provide advanced plant sciences instruction 24/7/365 by means of direct as well as distance education to K-12 and other schools, worldwide. This project is important and innovative because it makes advanced, sustainable, biosecure, integrated and organic plant sciences/food production technologies available to many impoverished youth whose parents/families are generally now food insecure in the 4-Corners area (CO, UT, AZ & NM) as well as on a global basis. (According to U.N. data, a reported 920 million people are living on the brink-of-starvation.)

Since 1986, the PI & co-PI (Ehrlich & Nuttle) have engaged in agriculture, algalculture, and food security research with grants from DOE, USDA, NSF (Natl. Science Foundation), N.C. Biotechnology Center, and others. Patents resulting from this work include U.S. Patent No. 5,121,708, plus several current patents pending. Nuttle has over five decades of successful agricultural development experience in 42 developing nations as well as the U.S. Ehrlich has provided research support for these efforts since 1986. In addition, Nuttle has directed the distance education programs for Needful Provision, Inc. (NPI), since 1995 (see

NPI's website: www.needfulprovision.org). On that same website, the 3rd topic on the upper left ("Healthy Foods Handbook") is the innovative home food production handbook that lays the basic groundwork for subject effort(s). This handbook also teaches home food preservation and food safety. Nuttle helped to start the Peace Corps, and wrote the "Remote Areas Development Manual used extensively by Peace Corps volunteers. This manual is posted on ERIC/ Educational Resources Information Center (http://www.eric.ed.gov, as ERIC Tab ED 242881 No. R-36).

Project goals are in perfect harmony with ASPB objectives to promote the growth and development of plant biology as pure and applied science, and to publish results of meritorious research in plant biology.

Methods & Approaches:

The subject project will start with the construction of a unique cool-season greenhouse at ULC's facilities. This 16 ft. x 20 ft. greenhouse shall have automated heating & cooling systems with internal production systems to include quail, algae, duckweed, Tilapia fish, vegetables, herbs and Grain Amaranth. The popping variety of Amaranth will be popped to feed quail and provide a food bar (value-added food product). Quail will produce eggs, meat and plant nutrients (via manure). The algae and duckweed will provide food (feed) for the fish. Fish will facilitate "fertigation" (irrigation & fertilization) of plants in grow-beds & vertical gardens. Water will be recycled. Aeration shall be used to provide O2 for fish and CO2 (carbon) for algae. The carbon is in addition to nutrients provided from the quail manure. System details are given in the "Healthy Foods Handbook," shown on NPI's website (www.needfulprovision.org) … 3rd topic on the upper left of this website, as noted above.

Said project will be under the direction of the PI & co-PI (Ehrlich & Nuttle), plus three members of the ULC Staff. To wit: 1) The Electronics & IT Specialist, Brian Weber; 2) Sciences Director, Randolyn Funk; and 3) Ann E. Miller, ULC & Distance Education Director. The ULC personnel will provide the permanent, long-term staff. There are two target audiences: a) ULC students who are primarily disadvantage Ute, Navajo, Hispanic and Anglos from impoverished families in the 4-corners area (CO, UT, AZ & NM); and b) K-12 students from schools in the U.S. and overseas who wish to participate in ULC's distance education programming derived from, and a part of subject project. Educational activities will include formal instruction on uses of plant sciences and related inputs needed for the above said greenhouse operation … and for modified uses of these same technologies for urban gardening/ farming as well as assorted regular farming operations of varied scale. This instruction will be by means of classroom and distance education presentations, plus on-the-job-training/ OJT (in the subject greenhouse) for ULC students. ULC students will share their OJT experiences by means of distance education broadcasts.

The proposed project is expected to be fully operational, tested and evaluated (by a third party) within 12 months of funding. During this period, the PI & co-PI will train the ULC staff and students in all details/activities needed to sustain the project. Subject activities are fully aligned with the goals & objectives of this project; i.e. to create, develop, demonstrate and teach (by direct or distance education means), the advanced plant sciences techniques needed to increase food production for impoverished persons and families, worldwide.

Anticipated Outcomes:
Unlimited Learning, Inc. provides its adult education students with a continually growing list of educational opportunities, which currently includes basic literacy development, life skills instruction, GED preparation, computer literacy training, English as a Second Language, Transitions into College and the Workplace, and basic Agriculture and Pre-Med training. Instruction is offered at ULC for 45 hrs/wk from August 10th – June 15th of every year.

Students who complete the basic courses at the Center are strongly encouraged to continue with their education. In fact, when students are nearing completion of the five exams for the GED certificate, they are referred to our student advisor who assists them in applying for a PELL grant for entrance into college or vocational schools. The primary focus for continuing their education is career training, particularly in farming & medical fields, as they are the fastest growing career options, due to the "baby-boomers" starting to retire.

Medical classes currently offered our GED graduates through Utah State University – Blanding Campus include Certified Medical Assistant Training … 34 college credits on Medical Terminology, Quantitative Reasoning (math for medical careers), Medical Administrative Competencies, Medical Clinical Competencies, Emergency Response, Phlebotomy, Anatomy and Physiology], with all classes accessible with their concurrent labs at ULC. Certificated trainings for Surgical Nurse Assistant and Physical Therapy Assistant will also be offered in the near future.

In addition to the medical classes, students can also pursue courses leading to various university degrees, starting from an Associate and going through the Master degree level in other specialized areas, all accessed through live, interactive videoconferencing and online formats. As a result of these many educational opportunities, with the use of technology, ULC is capable of offering all the different levels of adult education, various vocational trainings, and 43 university courses to the residents of the rural, multicultural 4-Corners region.

As an example of distance education, ULC presently offers courses to Kashunamiut School District in Chevak, Alaska through interactive videoconferencing. Chevak, like so many other Alaskan villages, is a very isolated Chu'pik Indian village that has not been able to attract enough teachers to provide electives and some required courses for their high school students. Specifically, we have provided classes in Pre-Medical Prep, Hospitality Training, GIS Training, 3D Computer Animation, Transition into College and

Work, and Health / Nutrition. Furthermore, Kashunamiut School District has asked ULC to start offering GED prep classes and vocational training to students and other Chevak residents, in their newly built community education center. (A special feature of this project will be to design an innovative arctic greenhouse for Chevak, which will consist of a steel-box building, inside another very strong steel-box structure, w/ R-50 insulation between, air-lock entry, oil-fired boilers for heat, and thermoelectric generators to use boiler heat to power all the grow-lights needed.)

As a result of subject project, ULC will be able to greatly expand its instruction in plant sciences/ agriculture/home food production with such instruction being provided to an estimated 94,000 K-12 students (in developing-nation schools) by means of distance education, as well as providing this instruction to some 73 disadvantaged students in the 4-Corners area (all within the first 12 months). Current expansion plans include distance education offerings/discussions with the GOK (Government of Kenya) Ministry of Education. Discussions are also being held with The Chinese Academy of Sciences (P.R. China) regarding a similar effort in that nation. Students/participants in this project should be able to utilize instructions provided to greatly increase healthful home food production, home food preservation and food security for themselves and their families. The measurable learning objectives will be individual student abilities to fully and successfully utilize the above said instruction(s).

The primary technology for this project is based on that posted on NPI's own website (www.needfulprovision.org) under the title of "Healthy Foods Handbook" (the 3rd topic on the upper left, as stated above). This technology is focused on home food production. **What is added** to this effort is the demonstration of said technology in a commercial greenhouse, using variations of proven food-production means, such as having quail in a run, inside a greenhouse, using a simulated natural habitat. Subject project will also develop means to use such greenhouse production to teach advanced agriculture, biosecurity, biodiversity, biology, plant sciences, resource conservation, math, science, environmental conservation, organic production means and other subjects. A small biochar kiln and related bioactivation system, associated with the greenhouse, will teach how to create bioactivated biochar to double typical plant yields. In addition, a 5-wall Tuffak greenhouse will be used to dramatically reduce heating and cooling costs, while demonstrating successful greenhouse operations under adverse climatic conditions (the Cortez area is high desert with hot summers and very cold winters).

Unlimited Learning Center is committed to offering on-going professional development and ULC certification opportunities to its faculty on best practices for onsite and distance instruction. Teachers are also trained in cross-cultural awareness since approximately 55% of ULC's student population reflects Ute, Navajo, and Hispanic cultures. To ensure ease of access, our teacher training is not only presented onsite, but through interactive video and web conferencing formats.

Finally, in order to tailor instruction to the students here or at a distance, (many of whom have different cultural learning preferences from those supported in our public schools),

ULC has started creating our own specially designed curriculum. The teachers at ULC have learned that its curriculum strongly appeals to students, especially Native Americans and youth from developing nations, who learn best through active participation in projects that integrate academic skills within real-life contexts. ULC also realizes that many of its Native American students lack the academic English and the critical reading skills that are necessary of their success in classes. In the case of distance education, some instruction will need to be in the appropriate foreign language, so ULC will need to arrange for translation services.

As ULC strives to meet the needs of its students, especially in career development, and continues to explore ways to create and pilot courses that will prepare students for the entry-level jobs in our rural area ,,,, especially in the agriculture and medical fields, as these areas promise to keep expanding for the next 30 years. In this piloting process, ULC intends to seek funding to target two groups of people whose workplace training needs continue to go unmet: (1) displaced or disabled older adults and (2) young adults with very limited academic skills who cannot pass the GED anytime soon, but must find employment as quickly as possible to meet family needs.

The overarching problem is that adults who have not succeeded academically face major life barriers, especially when they begin to raise their families. When they enroll in ULC's adult education offerings, it may still take years for them to be able to pass the GED exam. If they decide to pursue training for good-paying sustainable jobs, they face even more years in preparation. The result is that many of these people choose to simply give up and resign themselves to lifelong poverty. In order to break this cycle of poverty and unemployment, new approaches must be taken, such as this proposed project.

Evaluation Plan:
An independent, third party professional evaluator will interview and test participants before and after subject training at ULC. This evaluator will determine the target audience reached directly or indirectly (using distance education). Tests and related interviews will be used to determine knowledge and/or skills gained, as well as any changes in interests, attitudes and/or intentions, plus actual use of skills gained from instruction. Evaluation will be direct in the case of ULC students, & indirect (via tests given by foreign K-12 teachers) in the case of students participating in distance education aspects of subject effort. Data collected will be used to further refine & fully perfect the subject instructional program focused on advanced plant sciences. The person responsible for this evaluation will be Alice (Leecy) H. Wise, a skilled creator, director and evaluator of grant programs of all types.

Dissemination of Results:
Project products and outcomes shall be disseminated by all means possible, to include ASPB, USDA, newsletters, articles, press releases, websites, exhibits, peer-reviewed publications, online discussion forums, and various social media.

Sustainability:
ULC receives operating and program funds from the State of Colorado, as well as grants from foundations and corporations such as Wal-Mart. The subject effort shall be sustained by expansion of ULC's budget to pay for continuation of said program in future years. Ute and Navajo Native American tribes may also provide some funding support since subject program will benefit many of their youth. The design and very successful demonstration of an arctic greenhouse, one element of this project, is expected to produce a design patent and related greenhouse sales producing royalty income for ULC. In addition, the PRC (China) may be willing to pay for distance education project programming provided by ULC

References:
The primary reference for subject project is the "Healthy Foods Handbook," prepared by the co-PI (Nuttle) with support from the PI (Ehrlich), as posted on the website for NPI (www.needfulprovision.org), a 501(c)(3) charity directed by Nuttle since 1995. As part of this handbook, there are numerous references … such as appropriate references on soils, soil fertility studies, organic fertilizers, organic pest control, biochar, crop production/ plant sciences, and instruction in advanced gardening/farming techniques from NCAT (Natl. Center for Appropriate Technologies). There are also references on home food preservation and food safety issues. (The page limits on this ASPB proposal do not allow enough pages to list all these references.)

Education, Expertise & Outreach Experience of Project Staff:

1. PI, Linda C. Ehrlich, Ph. D. Botany 1987, has extensive experience in teaching, outreach and research with an emphasis on algalculture (algaculture) for use in innovative methods of producing algal foods/ feeds as well as algal-biofuels and other products. As noted previously, she has received extensive grant funding for research projects from DOE, USDA, NSF (Natl. Science Foundation), N.C. Biotechnology Center and others. Dr. Ehrlich has joined the co-PI (Nuttle) in research and outreach projects since 1986. She has been the technical advisor to extensive food production, food security and green energy projects for many disadvantaged and impoverished populations assisted by Nuttle's charity, NPI (Needful Provision, Inc,). Such collaboration includes development of varied new technologies for the "Healthy Foods Handbook" providing the foundation for this innovative plant sciences project.

2. The co-PI, David A. Nuttle, B.S. Agriculture 1958, has over five decades of outreach, research, education/distance education experience in 42 developing nations as well as the U.S. He is a published author and respected inventor in the area of agriculture, and has additional training in tropical, desert, urban and greenhouse crop production. An example of one of his outreach projects is found in a study entitled the "Buon Enao Experiment …JP Harris," as posted on Google. In 1995, Nuttle founded an agricultural charity, NPI, that has undertaken advanced food production and food security projects, worldwide. As noted above, Nuttle has worked with the PI since 1986 on several joint research projects. Current research has resulted in the above referenced "Healthy Foods Handbook" that forms the basis or foundation for this project. A summary of

other current research may be found in the following two unique NPI articles: a) http:// www.needfulprovision.org/articles/counterdesertification.php; and b) http://www. needfulprovision.org/articles/the-greening-of-energy.php. Nuttle has 63 agricultural-related patents/inventions such as U.S. Patent No. 5,121,708, and has authored several publications to include the "Remote Areas Development Manual," previously referenced. He has received many domestic and foreign honors such as the Thomas Jefferson Award for Humanitarian Service.

3. ULC's Director of Programs and Distance Education is Ann E. Miller, M.S. Adult Education and advanced training in distance education. She has been the successful Executive Director of ULC since 1990, and serves on several committees and boards for education and economic development in the 4-Corners area. Ms. Miller has been a strong practitioner of community service and outreach as well as providing excellent instructional efforts via distance education.

4. The Director of Science at ULC is Randolyn Funk, B.S. w/ several university Science Education certificates. She has been a science teacher of disadvantage youth for over two decades. She has focused on teaching cell biology, genetics and living systems and integrated her instruction with chemistry, physics and math. Ms. Funk has considerable gardening and greenhouse operations experience so she is in an excellent position to teach science courses utilizing the project greenhouse.

5. Brian Weber, ULC's Electronics & Technology Specialist, with extensive training in both areas, will help install and then maintain the automated systems & controls in subject greenhouse, located at ULC's site.

6. The independent, third party project evaluator, Alice (Leecy) H. Wise, has a pending Ph.D. in adult education and is a professional project evaluator performing her project evaluations as part of the Learning, Evaluation & Resources Network (LEARN).

Project Budget:
A detailed budget, for the subject 12 month plant sciences instructional project is as shown below, for a total of **$47, 420.00:**

a) PI - $5,400.00; **b)** co-PI - $4,200.00; **c)** 5-wall greenhouse (16 ft. x 20 ft.) … $14,440.00; **d)** Various internal greenhouse production & support systems … 11,560.00; **e)** Automated controls $2,980.00; **f)** Greenhouse construction … $3,720.00; **g)** Biochar kiln … $2,170.00; **h)** Biochar bioactivation system … $440.00; **i)** Tools, seeds/ seedstock, quail & fish … $510.00; and **j)** Project Evaluation … $2,000.00.

N.B. There are no indirect costs, fees, travel, per diem, or other expenses.