

Mojave sustainability project — model for community partnerships

The Mojave Desert is a particularly fragile ecosystem that faces several significant impacts. These include rapid housing development, overdrafted water supplies and loss of wildlife habitat — all a result of mining, industrial activity and urban sprawl.

During the past three years, a diverse group of educators, natural resource managers and business leaders was assembled under the auspices of a local community college. This group's goal was to provide unique natural resource education opportunities for the region.

By leveraging the collective experience of these

present-generation natural resource professionals, the Mojave Sustainability Project hopes to provide the next generation of professionals with that knowledge and the technical skills upon which tomorrow's community can

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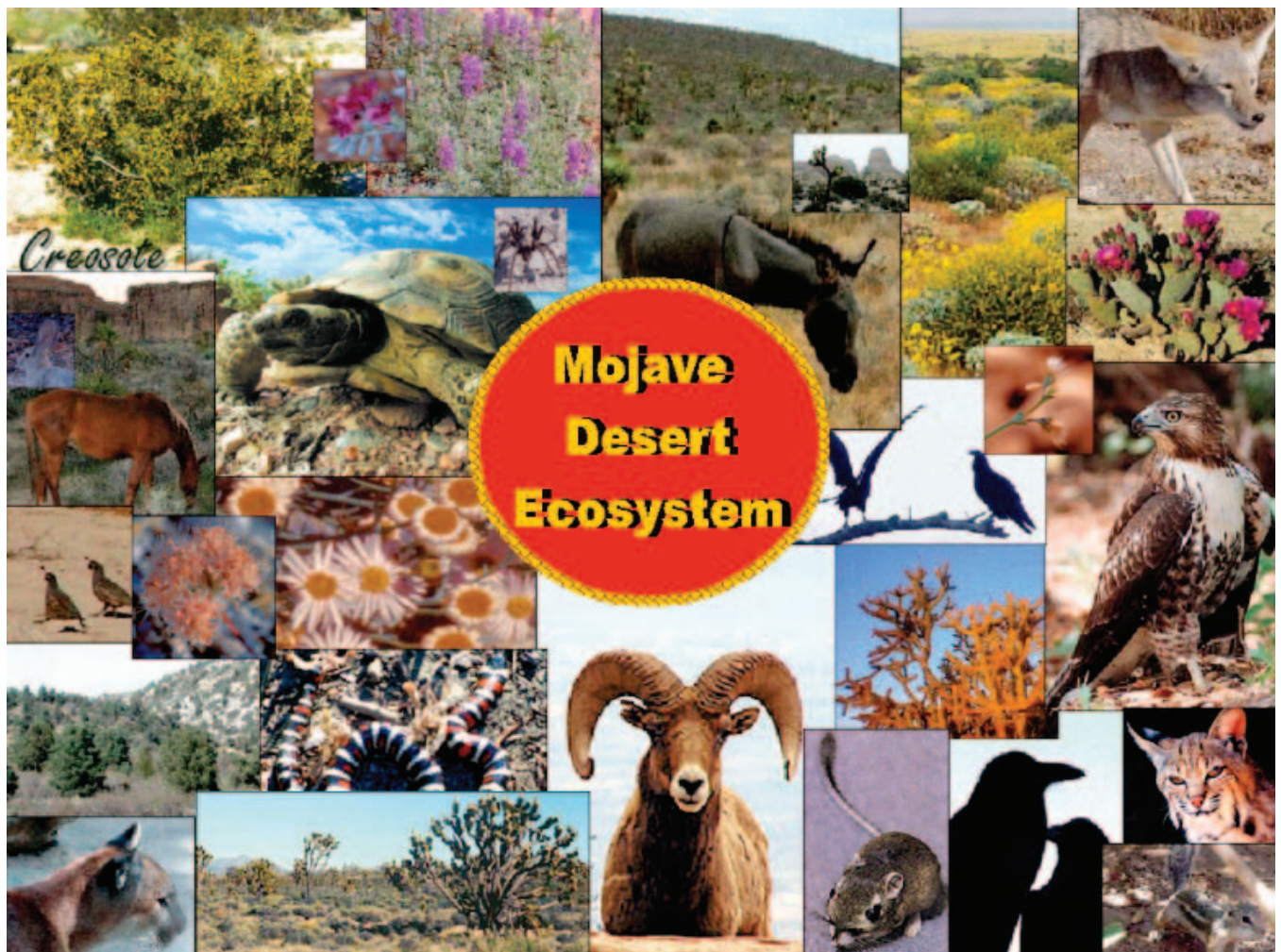


FIG. 1

Sustainability ethic.



rely. This article is a case study of how partnerships between academia, government, industry and the community can address the regional social, environmental and economic needs of today, while investing in the development of those professionals who will balance these needs tomorrow.

The literature on sustainable development is abundant. Many definitions of sustainable development have appeared since the phrase was first introduced at the 1972 United Nations Conference on Human Environment. However, the common thread of the concept in most working definitions describes development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. It is also often described as development that considers multiple, sometimes competing, values grouped into three general categories — environmental, social and economic.

Sowing the seeds of sustainability. Seeds from the Blackbush (*Coleogyne ramosissima*) are propagated by Victor Valley College students for use in mine reclamation.



While there may be general agreement on sustainable development as a concept, the question of how best to achieve the goal must still be addressed. The answer to this question will vary within the local, regional and global community. The fundamental objective of the Mojave Sustainability Project is to serve as the educational forum through which this desert community will determine how it will achieve sustainability.

Sustainability ethic

To achieve the goal of sustainable development, the partners of the Mojave Sustainability Project recognize that the onus of responsibility for sustainable development does not rest on one entity, institution or individual. The burden cannot be carried on the shoulders of government alone. Nor can it be borne solely by the “deep pockets” of industry. It requires a sustainabil-

ity ethic within the entire community of which individual citizens, businesses, nongovernmental organizations and local agencies are all a part.

To develop this sustainability ethic, a community must first have a fundamental understanding of its environmental, social and economic values and needs. Next, it must have an appreciation as to how and with what resources those needs will be met for the present and future generations. The sustainability ethic evolves where these three value-spheres intersect (Fig. 1).

The community must first be aware of how its resource consumption patterns affect demand, and how this demand, in turn, generates jobs for the community. As a community grows, how will the demographics change and what will the social needs of this growing community be? The community must also be aware of the true environmental consequences that result from its increasing demand for resources. The individual choices that all stakeholders make — from water and energy usage, to product purchases, to recycling habits, to developing more innovative and eco-efficient ways to produce the resources we need — are behaviors that play a critical role in achieving the goal of sustainable development.

To quantify and qualify social, economic and environmental impacts, the community must have a scientific framework with which to evaluate and mitigate them. Without local professionals with the technical expertise and administrative capacity to study, measure and mitigate these consequences, the community will not have:

- The ability to determine its nexus of social, environmental and economic needs.
- The capacity to develop the community and region within that nexus.

Project history and highlights

Sowing the seeds of sustainability. In 2000, Victor Valley Community College’s (VVC) Agriculture Department added a Natural Resources Management focus. The

department began investigating local community educational needs and opportunities for collaboration. This resulted in the signing of memoranda of understanding established between the Department of Agriculture and Natural Resources (AGNR) and four partners: Mitsubishi Cement, Specialty Minerals, US Borax and the Mojave Water Agency (a state government entity that is the primary regional water resource manager).

The financial support from the original partners allowed for significant enhancements to the department's infrastructure. A state-of-the-art computer lab, numerous drought-tolerant demonstration gardens, drip irrigation systems and a sustainable design greenhouse were constructed for use in the program (Figs. 2 and 3). With drought years dropping seed supplies to low levels, the partners supported the construction of the first native seed bank for the Mojave Desert at VVC. Aside from storing seed for mine reclamation and seed propagation research, the bank may also prove invaluable in the preservation of rarer species in light of the massive fires that have struck the region. In addition to providing financial support to the college, multifaceted "working" partnerships developed that resulted in innovative environmental education programs at VVC. Partners performed many roles including planning, advising, teaching, curriculum development and student mentoring. This collaborative "grassroots" approach attracted additional partners and individuals, culminating in the formal launching of the Mojave Sustainability Project in 2004.

Curriculum development and design. The natural resources program that has developed during the past three years is based on two primary curriculum design principles:

FIG. 2

This sustainable greenhouse stores drought-tolerant plants for use in mine reclamation and for sale to the public.



- Science is best taught through the application of the scientific method and not only through lecturing and book learning.
- An environmental stewardship ethic is best instilled through hands-on contact and experience in nature.

By drawing on the strengths and expertise of the partners in the Mojave Sustainability Project, the Department of Natural Resources has built on these two principles and developed creative and exciting education opportunities for the region. With the participation of the partners, the resulting curriculum addresses the current needs of the natural resource industry while creating hands-on internship and full-time employment opportunities for the students.

Student projects. The past three years have demonstrated that Community College students are able to undertake complex applied scientific research and project management. Students working with mine partners, bio-

FIG. 3

Demonstration gardens of drought-tolerant (xeriscape) landscaping.



FIG. 4

Victor Valley students constructed and periodically monitor revegetation test plots for each mine operator.



logical consultants and restoration contractors are able to learn about seed collection techniques, data management procedures and revegetation protocols.

Student research has focused on the propagation and revegetation of native plants from this bio-diverse region of the Mojave Desert, including four carbonate endemic species that are listed on the federal Endangered Species List. Many of these native plants are difficult to grow under greenhouse conditions and they do not germinate or survive when direct-seeded into the often severely degraded or disturbed soils.

Seed propagation and revegetation projects are currently under way for each of the mine partners. In conjunction with various courses in field studies, students learn to identify, collect, clean and test native seed for use in propagation. Each year, the students produce an average of 500 native plants for each partner for use in their respective reclamation projects. In 2004, students also established revegetation test plots for each of the mine partners that included salvaged plants and nursery stock grown on campus (Fig 4). Students return periodically to monitor the success of these test plots in conjunction with their classes. This year, the college will focus on propagating endangered species for Mitsubishi Cement and conducting numerous direct seeding experiments for US Borax.

Soil biology and plant nutrient requirements are be-

ing studied by student applied research projects. Students have conducted Mycorrhizal research for the mine partners to identify local species of fungi and to characterize how these fungal-plant relationships can enhance water and nutrient uptake. Limited research or empirical information is available on the propagation and mycorrhizal relationships of native species such as Creosote and Blackbush. So students have the opportunity to participate and contribute to the development of techniques that will be beneficial to the mine partners and the scientific community.

Technology focus. A significant component of the Agriculture and Natural Resources curriculum includes a technology education focus on the use of geographic information systems (GIS), global positioning systems and satellite imaging to meet local environmental and resource management needs. Numerous student-managed GIS projects have been completed or initiated during the past few years:

- Using household water usage data provided by the Mojave Water Agency and local water companies, students conducted comparative studies between landscape styles, property size and monthly water bills, to quantify the average annual savings a household can realize from drought-tolerant landscaping.
 - The mine revegetation and research projects for Mitsubishi Cement, US Borax and Specialty Minerals are currently supported by a GIS database. It includes plant identification photos, seed collection locales, soil types, seed weights and seed viability.
 - Building from data provided by the California Department of Fish and Game and Specialty Minerals, students are developing a new regional GIS database for the Desert Bighorn sheep in the San Bernardino Mountains. Using sighting cards and photos collected by the mine operators who regularly observe the sheep, students will monitor migration, range and the frequency of use of water sources by the wildlife (Fig. 5).

FIG. 5

Specialty Minerals' bighorn sheep monitoring project uses geographic information systems technology.



- In cooperation with the U.S. Forest Service, students will have access to GIS data from the Carbonate Habitat Management Strategy (CHMS). The CHMS program is a sensible and efficient regulatory framework designed to facilitate economic limestone mining activity while conserving and protecting sensitive, threatened and endangered plant species. Students will incorporate this GIS data into numerous other student projects, such as invasive species management, watershed mapping and wildlife monitoring.

Support from natural resource professionals and working partnerships

Through the involvement and cooperation of various natural resource professionals, students are given a balanced, well-rounded exposure to the environmental, social and economic issues of the region. This integration of natural resource management professionals into the curriculum takes many forms. These include guest lectures, seminars, workshops, projects, adjunct professorships and assistance in developing specific units of study.

The department has attracted adjunct professors who are leaders in their field of expertise. The regional soil scientist for the Natural Resource Conservation Service teaches the new soil science class. The GIS managers from the Mojave Water Agency and the Mojave Desert Ecosystem Program teach courses in geospatial technology.

Students participate in guest lectures at the local mine sites to discuss the role of mining and minerals in the local economy and the basic tenets of sustainable development. Students are introduced to the concepts of ecological footprints, eco-efficiency and industrial ecology. With input from the local mine partners, a sustainable mining curriculum is being developed.

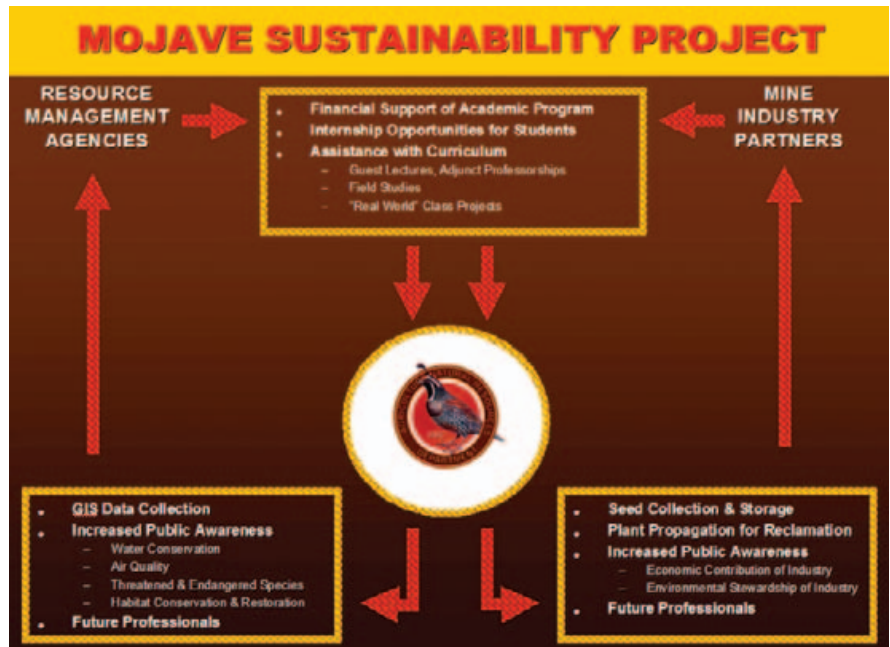
Wildlife biologists from the California Department of Fish and Game and other public agencies have visited to discuss the fundamentals of wildlife studies and other natural resource management issues.

With the assistance of the California Regional Water Quality Control Board, the Mojave Water Agency and the Mojave Desert Air Quality Management District, various programs are being developed in weather, water and air quality monitoring.

Community outreach. This nonpoliticized educational project has resulted in considerable participation from multiple levels of the community. Numerous conservation and environmental awareness groups such as the Society for the Conservation of the the Bighorn Sheep and the Alliance for Water Awareness have become involved. Local garden clubs, Boy Scout troops and the Future Farmers of America are now associated with the

FIG. 6

The Mojave Sustainability Project includes a series of symbiotic relationships between academia, industry and public agencies.



Mojave Sustainability Project. Science classes are offered by satellite to Lucerne Valley High. This helps connect the students with local mine operations and career opportunities. Numerous field trips are coordinated with classes at the junior high and elementary grade level.

In addition to developing a formal curriculum for students, the Mojave Sustainability Project will expand to develop more workshops, seminars and other hands-on land stewardship opportunities for the public. These will cover diverse topics such as strawbale construction, sustainable agriculture and habitat gardening. These activities will create a forum in which the community can learn, participate and therefore develop an informed voice. All this will help guide the future of the Mojave Sustainability Project and the sustainable development of the region.

Conclusion

The Mojave Sustainability Project is a series of collaborative and symbiotic relationships between academia, industry, public agencies and the community. Each working partnership that forms the heart of this project has yielded exciting opportunities and benefits for the students, industry partners, resource management agencies and the community (Fig. 6).

As more stakeholders become involved, and as more of the community takes advantage of the educational opportunities and synergies being offered, a sustainability ethic will emerge. The community will be empowered to define its own nexus of environmental, social and economic values and will have future generations of professionals prepared to continue on the path towards sustainable development.

To provide more information about the Mojave Sustainability Project, Specialty Minerals, with the help of Victor Valley Community College students, created the Web site www.mojavesustainability.org. ■