Student Sample: Grade 7, Informative/Explanatory

The extended project that led to this scientific report required students to review existing research, conduct original research, and produce a report. Although the student who wrote the report was in grade 7, the conceptual understanding the report displays is clearly at an exemplary level.

A Geographical Report

My report is on a very rare and unique wetland that many people do not even know exists. They occur only in a few places around the world.

My topic is created by a specific geographical condition. Vernal pools in San Diego occur only on the local mesas and terraces, where soil conditions allow, but these are the ideal place for much of the city's urban and agricultural development. Is it possible to find a balance between the two conflicting purposes of expansion and preservation?

This raises an interesting question; how can you establish vernal pools being thought of as a geographical asset?

METHODS

To answer my question I had to get information on vernal pools: what they are, where they are, and how they are a sensitive natural habitat. Then I needed to examine how city expansion is affecting vernal pools, and if it is apt to continue. I needed to know what the City thinks about the problem and what they are planning to do.

First I looked for any information available on vernal pools at public libraries, but I couldn't find what I was looking for. The topic is apparently too obscure. Next I went to a university library that had an environmental department to get as much information as possible (University of San Diego).

I also interviewed several authorities in the field: the district representative for the U.S. Army Corps of Engineers, the federal agency responsible for the protection of wetlands; a senior environment planner with the City of San Diego, who wrote the City's Resource Protection Ordinance (RPO); the Station botanist at Miramar Naval Air Station, who is in charge of their vernal pool management plan on the land that has the largest number of pools remaining in the City of San Diego; a biologist working for RECON (Regional Environmental Consultants), a firm which is mapping the vernal pools for the City of Hemet, (another city in San Diego County facing the same issues); and finally a geographer working for SANDAG (San Diego Association of Governments), a regional organization that gathers, records, and analyzes data associated with regional planning and environmental issues. They answered many questions and offered their own ideas and information, including additional articles on my subject. I looked at several maps and photos of vernal pools locations, and charts of changing land use.

To decide how much education may be needed about vernal pools, I made a questionnaire, and surveyed two classrooms of elementary students, and a group of forty-two adults, trying to cover most age groups.

WHAT VERNAL POOLS ARE

Vernal pools are a unique and rare form of wetland. Wetlands are areas that are covered or soaked by water enough to support plants that grow only in moist ground. Some examples of wetlands are bogs, swamps, marshes, and edges of lakes and streams. These are what people think of when they hear "wetland". But vernal pools are different than these other types of wetlands. They are located on dry and flat places. No one would expect to find a wetland in such a dry area!

San Diego vernal pools are surrounded by small mounds called "mima mounds". The name mima mounds come from the Mima Prairie near Olympia, Washington. People don't know for sure how mima mounds are formed. Some think that they were formed by gophers piling up the earth. Others think that ice wedges from glaciers caused the upheaval, or maybe the wind pushed loose dirt, catching in clumps of shrubs. Mounds can be found on prairies or terraces with a hardpan or clay layer underneath.

Vernal pools are depressions between the mima mounds. In winter the pools are filled by rain storms. In spring the pools look their best, when plants are in full splendor. By summer the pools are dry and look only like a dry pothole, (See illustration of pool cycles and typical cross section.) A vernal pool does not dry by soaking into the ground; the layer of clay or rock underneath the pool prevents the water from soaking through. Instead they dry out from evaporation, or use by the plants. The mima mounds are not impervious so one pool tends to drain into another. Therefore, the pools have to be on flat land; the pools cannot be on a slope or the water would run off, and the pools would not be filled.

[Illustration here]

Typical Cross Section of Vernal Pool

[Illustration here]

Vernal Pool Cycle

WHY VERNAL POOLS ARE SO IMPORTANT

Vernal pools are a very rare, specific habitat. Hardly any are left, so we don't have many to lose. There used to be vernal pools on many of the mesas and terraces of San Diego County, and the Central Valley of California. Now there are almost no vernal pools in the Central Valley, and an estimated 97% have been lost in San Diego County. An estimated 80% of the remaining pools in San Diego are located on Miramar Naval Air Station. (See map, next page.)

[Illustration here]

Vernal Pool Distribution, San Diego County

It does not take much to disturb a vernal pool. Even grazing or off road vehicle use in the summer, when pool species are dormant and people could think they are just a dry hole, can damage them. Most are disturbed by grading and flattening of their habitat, or by breakup of the impervious layer. With just flat land there would be no depressions for vernal pools to form; what would form would be "vernal mud". With no impervious layer the water would just sink into the ground, and would be there only for a short period of time, not enough for wetland plants.

The mima mounds have to be protected too. If the watershed for the pools is changed, the condition of the pools changes. If there isn't enough water from runoff, then all plant or animal life in them disappears, because they need enough moisture at the right time, to live. If there is too much water, then the pool may turn into another kind of wetland, such as a bog.

Although people have begun to study them, there is still a lot to learn. One thing scientists know is that they are a part of a larger environment. Many animals travel from other areas to feed on plants or animals, or drink from the vernal pools. For example, water fowl from many other places will stop at the pools to eat the fairy shrimp and snack on the plants.

Vernal pools have a large assortment of rare and exotic flora and fauna (plants and animals). Five of them are on the federal list of endangered species, and one more is a candidate for listing. The plants and animals in vernal pools are unusual because they have only developed recently compared to other changes in evolution. As scientists study the pools more intently they are finding more and more unknown species. There are temporary pools in other places around the world, but California's vernal pools are different because of their long drought phase, which causes the plants and animals to adapt to the climate. They go into a dormant phase. For example, fairy shrimp lay eggs before the drought which hatch when it gets moist enough to be active. Some plants, in a short period of time, develop seeds; others appear to die out, but quickly spout again from the rain. Many of these species cannot survive outside vernal pools, and some are "endemic" (species found only in a very restricted geographical area).

PROTECTION TECHNIQUES

The first step is to try to keep development away from vernal pools. But to do this you first need to know where the pools are. Thanks to regional mapping efforts, existing vernal pools have been fairly well identified in San Diego County.

There are already laws against disturbances of vernal pools. You could go to jail or get fined a large sum of money for disturbing a wetland. The U.S. Fish and Wildlife Service protects the listed endangered species present, and the U. S. Army Corps of Engineers makes sure you don't fill any kind of wetland habitat, including vernal pools. The local office of the U.S. Army Corps of Engineers has submitted a proposal to Washington for a stricter permit process for vernal pools.

When possible the vernal pools should be part of a large preserve of open space. That way the pools would not be isolated islands, but part of their natural communities, and would be protected by a buffer of distance. Fences should not be put directly around the vernal pools unless it cannot be avoided, because it would keep some animals out, such as rabbits which spread plant seeds around when they eat them.

It is important to educate people about vernal pools so they know how important they are and what they look like, and so they know how to preserve them. To see how much education may be needed in San Diego, I surveyed ninety-two people (forty-two adults and fifty elementary students to try to cover all age groups). I asked them if they had heard of vernal pools, and if they knew what they were. About 21% thought they had heard of them, but only 7% really knew what they were. (See pie chart.) I found that much education is needed.

[Illustration here]

Survey Results

At N.A.S. Miramar the Station botanist has been putting articles dealing with vernal pools in almost every issue of the base newspaper. Now most people on the base know about vernal pools, and know how valuable they are.

RECOGNIZING AN ASSET

Education is a key to preserving vernal pools. Vernal pools are very unique and we do not have many to lose. Making new ones does not work. Studies done at the University of California, Santa Barbara, have shown that after five years their complexity goes down.

First, vernal pools must be protected. There could be different ranges of accessibility, from remote (available to research only), somewhat accessible (good for guided seasonal visits), to readily accessible (which may have to be protected by fencing or supervision). The most accessible ones would be a great educational opportunity for the general public. The pools closer to development could be developed into nature centers, with raised boardwalks to protect the habitat, as is done over the hot springs in Yellowstone. (See illustration.)

[Illustration here]

Cross Section of Possible Nature Center

Interpretive signs and docents could provide information. Being very unique, vernal pools would make interesting learning centers. People would learn how the plants and animals adapt to the seasonal changes. This would teach people the importance of vernal pools, how complex they are, how to identify them, and how to preserve them when wet or dry. A park in the Sacramento area has an adjacent vernal pool with hiking trails around it; and it seems to work there because the people there know how important and delicate it is.

Ecotourism, a popular concept now, would be another idea. San Diego is a place where tourists already come. The very climate and geography that brings people here is what created vernal pools. Ecotourism would be easy to add to the other attractions, and would indirectly benefit the city. A tour company might be authorized to place advertisements to bring people to learn the importance of vernal pools and their ecosystem. With many people outside San Diego knowing about vernal pools and concerned about their well-being, there would be widespread support for vernal pool protection.

CONCLUSION

The problem of endangering vernal pools will not go away, because the City will need more land to develop. However, vernal pools remain a rare and unique wetland, and need protection. Even though there are laws made to protect them, pools are still being lost. Education is needed. Widespread education showing how important vernal pools are, and how easy they are to disturb, will create widespread support for protection.

A balance between expansion and preservation will not come easily, but if the public views vernal pools as a geographical asset, the balance will shift toward long-term vernal pool preservation.

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Annotation

The writer of this piece

- **introduces the topic clearly, previewing what is to follow.**
    - *My report is on a very rare and unique wetland that many people do not even know exists. . . . Vernal pools in San Diego occur only on the local mesas and terraces, where soil conditions allow, but these are the ideal place for much of the city's urban and*

agricultural development. Is it possible to find a balance between the two conflicting purposes of expansion and preservation?

- **organizes ideas, concepts, and information, using strategies such as definition, classification, comparison/contrast, and cause/effect.**
    - Definition: *Vernal pools are a unique and rare form of wetland. . . . Vernal pools are depressions between the mima mounds. . . . Vernal pools are a very rare, specific habitat.*
    - Comparison/contrast: *Some examples of wetlands are bogs, swamps, marshes, and edges of lakes and streams. . . . But vernal pools are different than these other types of wetlands. They are located on dry and flat places.*
    - If/then and cause/effect: *If the watershed for the pools is changed, the condition of the pools changes. If there isn't enough water from runoff, then all plant or animal life in them disappears, because they need enough moisture at the right time, to live.*
- **includes formatting and graphics when useful to aiding comprehension.**
    - The writer uses a number of headings to help section off the text: *METHODS*, *WHAT VERNAL POOLS ARE*, *WHY VERNAL POOLS ARE SO IMPORTANT*, *PROTECTION TECHNIQUES*, *RECOGNIZING AN ASSET*, and *CONCLUSION*.
    - The writer offers a cross-section of a vernal pool, an illustration of the vernal pool cycle, a map of the distribution of vernal pools in San Diego County, a pie chart of responses to a survey, and a cross-section of a possible nature center.
- **develops the topic with relevant facts, definitions, concrete details, quotations, or other information and examples.**
    - *Vernal pools are a unique and rare form of wetland. Wetlands are areas that are covered or soaked by water enough to support plants that grow only in moist ground. Some examples of wetlands are bogs, swamps, marshes, and edges of lakes and streams.*
    - *San Diego vernal pools are surrounded by small mounds called "mima mounds".*
    - *. . . the layer of clay or rock underneath the pool prevents the water from soaking through. . . . an estimated 97%* [of vernal pools] *have been lost in San Diego County.*
- **uses appropriate transitions to create cohesion and clarify the relationships among ideas and concepts.**
    - *Vernal pools are a very rare, specific habitat. Hardly any are left, so we don't have many to lose.*
    - *First, vernal pools must be protected.*
    - *Ecotourism, a popular concept now, would be another idea.*
- **uses precise language and domain-specific vocabulary to inform about or explain the topic.**
    - *Vernal pools . . . habitat . . . wetland . . . bogs . . . mima mounds . . . pool cycles . . .*
- **establishes and maintains a formal style.**
    - *Vernal pools are a unique and rare form of wetland. Wetlands are areas that are covered or soaked by water enough to support plants that grow only in moist ground.*
    - *Vernal pools have a large assortment of rare and exotic flora and fauna (plants and animals). Five of them are on the federal list of endangered species, and one more is a candidate for listing.*
- **provides a concluding section that follows from and supports the information or explanation presented.**
    - *A balance between expansion and preservation will not come easily, but if the public views vernal pools as a geographical asset, the balance will shift toward long-term vernal pool preservation.*
- **demonstrates exemplary command of the conventions of standard written English.**