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High school lessons on human sprawl in the Inland Empire

Anieno Abasiofiok Ibekwe

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HIGH SCHOOL LESSONS ON HUMAN SPRAWL
IN THE INLAND EMPIRE

A Project
Presented to the
Faculty of
California State University,
San Bernardino

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts
in
Education:
Environmental Education

by
Anieno Abasiofiok Ibekwe
June 2008
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Approved by:

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June 13, 2008
ABSTRACT

The aim of this project was to develop curriculum that educators could use to assist high school students (ages 14 - 17 years) in the Inland Empire of Southern California to apply critical thinking skills to understanding the negative effects of uncontrolled urban sprawl. The problems and issues which result from sprawl are emphasized in the learning activities.

For these students, not so much has changed about the population and landscape of Western Riverside and San Bernardino County since they were very young. Sprawl has always been a part of their lives. By understanding the adverse effects of sprawl through analyzing environmental issues, high school students may be motivated to conceptualize ways of maintaining a balance between regional population growth and environmental integrity in the future.
ACKNOWLEDGMENTS

I would like to first thank God for giving me the ability to finish this project. I would also like to thank Dr. Stoner for her support, guidance, and patience specifically shown to me throughout my time in the Environmental Education program, but more so in the writing of this project. Her dedication to the health of our environment has done, and continues to do, enormous good to so many. I would like to thank Dr. Negin for his support as a second reader for this project.

Finally I would like to thank my parents, Amos and Grace Ideh, whose vision of the importance of education has brought me to where I am today.
DEDICATION

To Abasiofiok, Mfon, Emem, Idara, Erikan, and Ubong
whose love, support, and sacrifices made this project
possible.
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CHAPTER ONE

INTRODUCTION

This was a little little town, a general store under a tree and a blacksmith shop and a bench in front on which to sit and listen to the clang of hammer on anvil. Now little houses, each one like the next, particularly since they try to be different, spread for a mile in all directions. I remember..., the town of my birth, when it proudly announced four thousand citizens. Now it is eighty thousand and leaping pell mell on in a mathematical progression - a hundred thousand in three years and perhaps two hundred thousand in ten, with no end in sight. (Steinbeck, 1962, p. 174-175)

In this quote, John Steinbeck is reminiscing about Salinas, his hometown in the 1950s. It is easy to tell that he was worried about the impact of the growth and the future consequences of growth on his little town. But what Steinbeck experienced pales in comparison to what we are experiencing today, not just in Southern California, but all across cities and towns in the United States.

I, myself, remember moving to Riverside County in 1998. The landscape then was significantly different from
what it is today. There were fewer homes, shopping malls, and schools. The change in the landscape has been so significant that, driving through some neighborhoods, it has become very easy to get lost because of the sudden presence of structures that were not there in the near past. Many new neighborhoods have sprung up from left to right. River Oaks Condominium, Siena in Corona Hills, Aspen Hills, Hampton Roads, Magnolia Court Townhomes, Georgetown Square, Somerville, Spring Mountain Ranch, Silverhawk Summit, just to name very few, are some of the very newest around Western Riverside. Why do we have all these new developments and what impact do these have on the existing communities? The answer comes from exploring the word sprawl.

Sprawl has been defined in many ways over the years. Sprawl is often defined using the following characteristics: low population densities; segregated land uses; emphasis on automobile for transit; loss of agricultural space; homogenous population, and local government’s inability to agree on policies to address the consequences of growth (Johnson, 2001).

The term sprawl became part of our vocabulary recently after Smart Growth America teamed up with Rutgers and Cornell universities to publish a report called
Measuring Sprawl and its Impact. This report listed ten of the most sprawling regions in the United States. According to this report, “the Riverside-San Bernardino area topped the list as the worst case of urban sprawl in America” (Ewing, Pendall, & Chen, 2002). One of the reasons people have moved to this area is most likely the ability to buy big houses on big lots at a price they can afford. And, as long as there is demand for housing and open space is available, chances are that builders and local officials will continue to favor building.

The report, Measuring Sprawl and its Impact also defined sprawl in terms of four related characteristics: “a population that is widely dispersed in low-density development; rigidly separated homes, shops, and workplaces; a network of roads marked by huge blocks and poor access; and a lack of well-defined, thriving activity centers” (Ewing et al., 2002, p. 3). National Geographic (2001, p. 1 & 2) identified sprawl with the following similar characteristics: high volumes of traffic; spread out businesses, shops and homes; lack of adequate public transportation; isolation of retail and residential complexes; streets that discourage walking and bicycling; zoning laws that prohibits developers from building shops, restaurants, or offices inside residential neighborhoods;
and widespread parking lots that push buildings farther apart from each other.

The impacts of sprawl on health are enormous. Evidently, urban sprawl and high levels of smog go hand in hand in Southern California. “Closely linked with traffic congestion is unhealthful air quality, which is prevalent in many parts of California” (Goldman, 2006, p. 23). The American Lung Association’s annual report cited by Cable News Network (CNN) (2004) stated that Southern California is at the top of the list of cities and counties in the United States with the most air pollution. Goldman (2006) held that the incidence of asthma, due in part to air pollution, is increasing rapidly. Asthma is already known to affect 1.8 million Californians and to cause $350 million in direct hospitalization costs each year.

All of my high school students are between the ages of 14–17 years. For them not so much has changed about the population and landscape of Western Riverside County since they were very young. There have always been new developments at every corner in the community. For my students, sprawl has always been a part of life. These are students who have not been exposed to wild places outside of home and school. Sprawl has taken wild places away from most of them. In the Geography of Childhood: Why Children
Need Wild Places, Nabhan and Trimble (1994) argued that natural habitat is important to a child developing a sense of place in the world. Ryden (1993) described a sense of place as that which results gradually and unconsciously from living in a certain place over time, becoming familiar with its outward features, and developing memories and history relative to the place. It can be thought of as simply those things that create and promote the feeling that a certain community is a special place, distinctly different from anywhere else.

Sprawl has led to the disappearance of huge tracts of open space, which results in the destruction of very crucial wildlife habitats. This can potentially lead to a reduction in biodiversity. Sprawl has also led to the loss of various ecosystems, including the woodland, prairie, and even wetland ecosystems that many threatened and endangered species depend on for their very survival. The patches of green space left behind in between many buildings like homes and shopping centers are not enough to deter the disruption of migratory corridors and breeding patterns of many crucial species, therefore, it is fair to say that sprawl contributes to habitat fragmentation and destruction. Many farmlands, which provide habitat for grassland species as well as migratory
birds after crops are harvested and while the land is being temporarily left fallow are now more than ever built over by developers. "The expanding footprint of development will put additional pressure on diminishing wildlife resources and their habitats and has the potential to drive more plants and animals towards extinction" (Ewing et al., 2002, p. 13).

The aim of this project was to develop curriculum that educators could use to motivate young high school students of Western Riverside County to take a look at some of the debilitating effects of uncontrolled urban sprawl. These lessons are also applicable for students in Western San Bernardino County as well. Through these lessons, students will be able to understand the effects of sprawl. The project focuses primarily on the sprawl that has and continues to occur in the Inland Empire region. By understanding the adverse effects of sprawl, teenagers may be motivated to understand the balance necessary between regional population growth and environmental integrity.

This project is divided into five chapters. Chapter one provides a general introduction to sprawl, and includes the purpose and significance of the project. Chapter two includes the review of relevant literature
related to the definition of sprawl, environmental impacts of sprawl, health and economic impacts of sprawl. Chapter three focuses on understanding sprawl through environmental education, and includes the definition of environmental education, and some of the goals of environmental education as stipulated by The Tbilisi Declaration. Chapter four focuses on the design of project and provides brief descriptions of the lessons. Chapter five provides discussion and conclusion. It includes recommendations on how the lessons in the project can be used. The appendices for the project consist of: Appendix A, Sprawl and its General Impacts lesson; and Appendix B, Environmental Issues Lesson. Project references come after the appendices.
CHAPTER TWO

LITERATURE REVIEW ON SPRAWL

Introduction

This chapter consists of the discussion of relevant literature as it relates to sprawl. First, the meaning of sprawl is established as simply the uncontrolled spreading of developments where none existed before. Next, the impact of sprawl on the environment is also discussed in terms of causing some species to be threatened, air pollution, water pollution, landscape and environmental degradation. The third section focuses on the health impact of sprawl as it relates to respiratory diseases from pollution, stress from long distance driving, and increase in fatal automobile crashes. Finally, the fourth section is based on the economic impact of sprawl as it leads to increased financial burden on cities for providing and maintaining public services.

Understanding Sprawl

Sprawl can be defined as "the uncontrolled expansion of low-density, single-use suburban development into the countryside" (Saunders, 2005, p. vii). According to Burchell, Downs, McCann, and Mukherji (2005), sprawl is a type of development with several key characteristics or
traits, and these traits are what make it so costly. The three traits used to define sprawl by Burchell et al. (2005) are: uncontrolled outward expansion into areas not previously developed, low population density, and leapfrog development. Sprawl also involves strict segregation of housing and commercial development by race, socioeconomic status etc., often through the construction of standardized development types, dependence on automobile, and deeply fragmented governance and planning.

The first characteristic in this definition of sprawl has led to the loss of a vast amount of agricultural lands because these types of land are often the cheapest for development. Secondly, lands that house fragile ecosystems have fallen victim too because sometimes they are part of these developable tracts. Furthermore, as a result of sprawl, population densities in the areas experiencing sprawl are typically lower than those in metropolitan areas. Lastly, the third element of Burchell et al.’s definition asserts that sprawl results in developments built in isolated areas, thus creating a patchwork in which working farms are right next to suburban housing developments, or in which shopping malls border open fields.
Merriam-Webster’s Online Dictionary (2005) defined urban sprawl as the “spreading of urban developments (as houses and shopping centers) on undeveloped land near a city.” This same dictionary also defines sprawl as “a pattern and pace of land development in which the rate of land consumed for urban purposes exceeds the rate of population growth and which results in an inefficient and consumptive use of land and its associated resources.”

Environmental Impacts of Sprawl

Shopping centers and homes are often built where wildlife call home. Ewing, Kostyack, Chen, Stein, and Ernst (2005), in a study titled Endangered by Sprawl, wrote that the conversion of green space to urban and suburban uses is one of the greatest threats to wild species in the United States, and that 60% of the rarest and most imperiled species in the United States are found in designated metropolitan areas. This same report showed that sprawl is the leading culprit in causing species imperilment in California. According to this report, “outranking 17 other factors including road construction and outdoor recreation, sprawl threatens 188 of California’s 286 federally listed species (66 %)” (Ewing et al. 2005, p. 2).
Landscapes and wildlife are lost as a result of sprawl. As new buildings emerge, spaces that originally were occupied by native species are taken up. “Three fifths (60%) of the nation’s rarest and most imperiled species are found within designated metropolitan areas with the 35 fastest growing areas home to nearly one-third” (Ewing et al. 2005, p. viii). Action by local authorities is therefore necessary to protect green infrastructures and fragile habitats and therefore protect the species that are being threatened.

Each year, development disrupts wildlife habitat by claiming millions of acres of wetlands and forests. This loss often results in habitat fragmentation, in which animals are forced to live in smaller areas isolated from other members of their own species and sometimes unable to forage or migrate effectively. (Burchell et al., 2005, p. 43)

Air pollution is another cause for worry, a result of sprawl as homes, workplaces, and stores demand an ever-increasing need for an automobile-dependent lifestyle. “Vehicles are responsible for an estimated 80% of the air pollution in metropolitan regions” (Wright, 2008, p. 607). Increased use of gasoline products leads to an ever-increasing amount of carbon dioxide released into
the atmosphere. Carbon dioxide is one of the most serious greenhouse gases. According to Withgott and Brennan (2007), across the United States, during the 1980s and 1990s the average length of work trips rose by 36%, and total vehicle miles driven increased at three times the rate of population growth. Wright (2008, p. 607) wrote that “U.S. oil consumption has tripled while population only doubled between 1950 and 2005. This is a 63% increase in per capita consumption.”

An automobile-oriented culture also increases dependence on nonrenewable petroleum, with the attendant economic and environmental consequences. Sprawl’s effects on transportation give rise to increased pollution. Carbon dioxide emissions from vehicles exacerbate global climate change while nitrogen- and sulfur-containing air pollutants contribute to tropospheric ozone, urban smog, and acid precipitation. (Withgott & Brennan, 2007, p. 380)

Thus, sprawl can be a factor in depleting energy resources, which in turn results in environmental degradation.

Sprawl also leads to water pollution and degradation of water resources. Conditions favorable to water runoff
are created by sprawl. "All the highways, parking lots, driveways, and other paved areas associated with urban sprawl lead to a substantial increase in runoff resulting in increased flooding and erosion of stream banks" (Wright, 2008, p. 607). Runoff from lawn fertilizers, motor engine oils, and pet droppings are known to degrade local water resources.

Waterways are polluted by substances such as motor oil and road salt form roads and parking lots. Runoff of polluted water from paved areas is estimated to be about 16 times greater than from naturally vegetated areas. Such air and water pollution has been shown to degrade natural environments and pose risks to human health. (Withgott & Brennan, 2006, p. 380)

Wetlands work as natural sponges, soaking up and storing rain and runoff while also cleaning storm water of pollutants. This is a very cost-effective way of improving water quality and managing storm water. Building on wetlands can disrupt this scenario. "Sprawling development can destroy or impair wetlands, increasing the amount of polluted runoff flowing into rivers and lakes and increasing the risk of flooding" (Burchell et al., 2005, p. 43).
Health Impacts of Sprawl

"Sprawl leads to increased driving, and increased driving leads to vehicle emissions that contribute to air pollution and its attendant negative impacts on human health” (Bray, Vakil & Elliot, 2005, p. 8). “Automobiles produce more than half of carbon monoxide emissions and about a third of oxides of nitrogen and volatile organic compounds, precursors to the formation of ground-level ozone pollution” (Burchell et al., 2005, p. 109). Being exposed to pollutants in the air even on the short term may lead to increased symptoms of respiratory diseases and subsequently diseases like coughing or wheezing, aggravation of asthma; increased medication use, increased absence from school for children or work for adults, and increased admissions to hospitals for respiratory illness. These kinds of “pollutants can aggravate respiratory illness, increase respiratory infections, and even cause decreased lung function and lung inflammation” (Burchell et al., 2005, p. 109).

Stress is another direct result of sprawl. Any long distance driver can attest to the fact that the longer one drives, the greater the chances that one gets stressed. “More time spent in an automobile exerts a stress cost, which includes effects on blood pressure, tolerance for
frustration, and negative mood” (Burchell et al., 2005, p. 110).

Since people living in more sprawling areas drive more and have fewer alternate travel options, they also have fewer opportunities to get healthy physical activity as part of everyday life. “Physical inactivity clearly influences obesity and also plays a role in a host of diseases, including diabetes, colon cancer, and high blood pressure” (Burchell et al., 2005, p. 108).

People from the most-sprawling U.S. counties weigh 2.7 kg more for their height than people from the least-sprawling U.S. counties. Over 23% of people from the most-sprawling counties showed hypertension (high blood pressure), whereas fewer than 23% of people from the least-sprawling U.S. counties showed this condition. (Withgott & Brennan, 2007, p. 382)

The study, “Relationship between Urban Sprawl and Physical Activity, Obesity, and Morbidity” by Ewing, Schmid, Killingsworth, Zlot, and Raudenbush (2003), showed that unlike people that live in counties with more compact developments, people who live in heavily sprawling counties are more likely to weigh more because they drive more and take less walks. Also, hypertension is more
common in people who live in more sprawling areas than in those living in more compact areas.

Sprawl also leads to greater risk of fatal crashes. A study by Ewing et al. (2003) showed that people living in more sprawling areas run a higher risk of dying in an automobile accident. "In the nation’s most sprawling region, Riverside County, California, 18 of every 100,000 residents die each year in traffic crashes. The eight least-sprawling metro areas all have traffic fatality rates of fewer than 8 deaths per 100,000." (Ewing et al., 2002, p. 5). Increased rates of death in more sprawling areas is most likely due to an increased amount of driving, and increased speed when driving on high-speed freeways, compared to driving on smaller city streets with significantly lower speed limits. Pedestrians are also believed to be in danger of getting hit by vehicles in sprawling areas.

While walking clearly has health benefits, sprawl also has been accused of making it more difficult and dangerous to walk. More pedestrians die in places where more people walk, but when exposure is controlled for, sprawling metropolitan areas have proven more dangerous for pedestrians because of their wide, high-speed arterial streets and lack of
sidewalks and safe crossings. (Burchell et al., 2005, p. 108)

Economic Impacts of Sprawl

Sprawl impacts county and town budgets and thus causes taxes to escalate. "More compact forms of development are less expensive to service" (Wright, 2008, p. 608).

Sprawl drains tax dollars from existing communities and funnels them into infrastructure for new development on the fringes of those communities. Money that could be spent maintaining and improving downtown centers are instead spent on extending the road system, water and sewer system, electricity grid, and telephone lines to distant developments, and extending police and fire service, schools, and libraries. (Withgott & Brennan, 2007, p. 384)

Using data from the U.S. Census of Governments, Burchell et al. (2005,) determined that the cost of public service per resident increases while revenues from real estate taxes and other sources decrease.

The next chapter focuses on how students can achieve an understanding of the problems associated with sprawl through environmental education.
CHAPTER THREE
UNDERSTANDING SPRAWL THROUGH
ENVIRONMENTAL EDUCATION

Being smart about growth means revitalizing existing cities and suburbs and making efficient use of land, rather than building in outlying farm fields and forests. It means making cities and suburbs affordable places to live, so that everyone can participate in and benefit from this revitalization.
(Ewing et al., 2005, p. vi)

Possible solutions to sprawl damage, as suggested by Ewing et al. (2005), include involving individuals and government (local, state and federal) in working towards minimizing the impact of sprawl. For instance, local governments should be encouraged to devise a means to keep track of local species and natural resources by using satellite imagery and accessible mapping technologies which can be used to understand and map significant biological resources; establish and maintain local cooperation to protect natural resources and species; come up with plans to protect green infrastructure, with established performance goals and measurements; set urban
growth and service boundaries; and specifically find ways to protect critical natural habitats.

The above list of solutions echoes one of the objectives of environmental education as stipulated by The Tbilisi Declaration (Intergovernmental Conference on Environmental Education, 2001, p. 15) which stated: "To make an effective contribution towards improving the environment, educational action must be linked with legislation, policies, measures of control and the decisions that governments may adopt in relation to the human environment."

"A concern for the land and its resources is basic to our survival, both as individuals and as a nation; for we cannot live apart from our planetary home. Environmental quality and human health and well-being are interdependent" (Council for Environmental Education, 1992, p. viii). Therefore, as individual citizens we can build coalitions and work together to promote better land use practices and a better quality of life in our region by helping to educate our elected officials and fellow citizens about our region’s native species and habitats and the benefits they provide, and by encouraging government officials to defend existing habitat protection
laws such as the Endangered Species Act when there are debates about them in federal and state legislatures.

Environmental education is the key tool through which the damage that excessive sprawl, partly caused by an explosive human population growth, could be minimized. Environmental education, defined by William Stapp et al. (as quoted in Disinger, 1993, p. 35) "is aimed at producing a citizenry that is knowledgeable concerning the biophysical and its associated problems, aware of how to help solve those problems, and motivated to work toward a solution." Stapp believed that the aim of environmental education is to promote responsible individual and societal environmental behavior.

Considered by many to be a critical tool in developing environmental awareness in the public conscience, environmental education is also aimed at producing a citizenry who have the skills to make informed decisions regarding real issues of ecological sustainability. Westing (1993, p. 4) noted that "one of the most formidable and ever more intractable challenges facing humans today is coexisting with the other living creatures on Earth."

The goals and guiding principles of environmental education, as stipulated by The Tbilisi Declaration
(Intergovernmental Conference on Environmental Education, 2001), best sum up how to approach solving the problems of sprawl using environmental education: "Environmental education should consider the environment in its totality – natural and built, technological and social." One of the goals of environmental education in the Tbilisi Declaration is "to foster clear awareness of, and concern about, economic, social and political and ecological interdependence in urban and rural areas" (Hungerford et al., 2001, p. 15).

The constructivist approach to learning is frequently used in teaching environmental education. Stoner (in Project Learning Tree, 1996) described the constructivist theory of learning as one that allows educators to facilitate learning experiences which enable students to manipulate materials, consider different viewpoints, participate in group work, and focus on learning concepts. Stoner further recommended the following techniques to be used by educators to implement constructivist learning:

- Use local emphasis for activities as much as possible;
- Assess prior knowledge by asking students their ideas about concepts before beginning instruction;
• Guide students' learning using words like analyze, classify, and predict;
• Allow students' thinking to guide lessons;
• Base curriculum on needs and responses of students;
• Ask open ended questions and encourage students to ask questions of other students. (Project Learning Tree, 1996, p. 11).

The constructivist approach to teaching is adhered to by the lessons included in this project. In these lessons, students are assessed on their background knowledge on sprawl, given general information on sprawl, and then asked to analyze the information and the problems caused by sprawl, and come up with solutions to these problems.

The next chapter applies literature review to the design of project.
CHAPTER FOUR

DESIGN OF PROJECT

The steps taken in developing this project are described in this chapter. To develop this project, I first took a series of long slow drives around Western Riverside County, first alone, and then with a good friend who has lived in this area for over 15 years now. The purpose of taking the friend with me was to find out from her what changes she has noticed since she first moved to this area. From the information gathered casually from her and with my personal experience after living in Riverside County for the past eight years, I was able to determine that there has been a perceived significant change in the landscape of this area over the past few years as a result of sprawl.

Local library and Internet resources were also used in the design of this project and development of the lesson plans. By studying and comparing the maps of some areas of Riverside County from the past and the maps from the present, I was able to further ascertain that sprawl has changed this area enormously. For instance, a lot of the open areas are now covered up with buildings that were not there before.
As a high school biology teacher, the lessons included in this project are designed to meet some of the standards that are outlined in the *Science Content Standards for California Public Schools* (California Department of Education, 1998), grades nine through twelve - biology/life sciences. Some of the lessons actually cover a wide variety of other subject areas, including earth science and social studies, showing that environmental education is just not only restricted to biological science classrooms. This idea was best conveyed by Iozzi (as cited in Disinger, 1993, p. 38), when he wrote, “Environmental education should be approached in an interdisciplinary manner and infused in all content areas.”

Human beings need to be guided and encouraged through the extraordinary process of becoming aware, informed, and motivated to make necessary environmental changes and decisions that not only affect them today, but also in the future. This thought echoes the Piagetian constructivist approach to teaching and learning which is utilized on the lesson plan titled “Sprawl and its General Impact” on Appendix A. This lesson uses an anticipatory guide to assess students’ position regarding sprawl prior to the lesson and after the lesson. The Environmental Issues
Lesson on Appendix B also utilize a constructivist approach to teaching by asking questions at the beginning of each lesson to find out students’ prior knowledge on the subject of sprawl and related issues before starting the lesson. Ornstein and Levine (2006, p. 151) described constructivism as a way in which “children interact with their environment and construct knowledge of their world through a process of creative invention.” As part of the constructivist theory, Piaget reasoned that people construct new knowledge from past experiences. People tend to absorb and incorporate new experiences into an already existing idea. By accommodating new experience and reframing their model of the way the world works, they learn from the experience.

Graphic organizers are very useful because they help the learner to comprehend, summarize, and synthesize complex concepts in ways that surpass verbal statements. A concept map, which is an example of a graphic organizer, is used by the lesson titled “Sprawl and its General Impact” (see Appendix A). This lesson is author (self) created. In the lesson, students are able to describe sprawl, its characteristics, and causes. "Constructing and analyzing graphic organizers helps students become
actively involved in processing a text” (Jones, Pierce, & Hunter, 1988-89, p. 21).

A cooperative learning model is employed on the Environmental Issues Lesson on Appendix B. “Cooperative learning is an instructional method in which students work together in small groups to achieve common goals” (Bridenbecker & Stoner, 1999, p. vii). The specific model used is called the Think, Pair, Share model. In the lesson, students are asked to work in groups to come up with issues, players and positions, as well as values that drive the players' positions and solutions. Each group then gives a presentation on their findings to the class. “Think, Pair, Share model leads to increased student participation and improved retention of information” (Gunter, Estes, & Schwab, 1999, p. 279).

The lessons in Appendix B are based on local issues that result from sprawl. Thus, these lessons are important because they deal with issues in local areas that students are very familiar with. These particular lessons were created following the format used by Bridenbecker and Stoner (1999).

The lesson titled “sprawl and its general impact” in Appendix A was designed using a constructivist model as described above. First, students' prior knowledge is
assessed by using an open-ended question 'what do you know about the word sprawl and how do you feel about it.' An anticipatory guide used in this lesson is another means of assessing prior knowledge. General information on sprawl is provided to the students, they are then asked to synthesize and analyze the information. Lastly, keeping the focus on local issues, students are asked to reflect on the impact of sprawl on the local environment.

Included in Appendix B are lessons on local issues associated with sprawl. In these lessons, students work in groups using the cooperative learning model to analyze and identify local issues related to sprawl, determine the players and positions regarding the issues, problems associated with the issues, beliefs and values that players hold regarding the issues, and possible solutions to the issues.
CHAPTER FIVE
DISCUSSION AND CONCLUSION

The very survival of human species depends on our understanding of the interconnectedness of both natural and human-made systems. We depend on our environment for all our basic needs: air, water, food, shelter, and many other things essential for our survival. In addition, the actions we take directly impact our environment, whether we intend or do not intend for them to do so. Some of these make our lives more comfortable, enable us to live longer and healthier lives, and sometimes brings us wealth. At the same time, we degrade the natural systems that sustain our lives, (e.g., by polluting our water, scaring the soil, taking away species' habitats and thereby exposing them to extinction). Urban sprawl is a familiar issue of the Southern California lifestyle. Pollution, habitat destruction, species extinction, overpopulation, energy use - all directly or indirectly caused by sprawl - are just some of the fundamental issues now and for generations to come.

The lesson plans in this project, designed to address the impacts of sprawl from different perspectives, can be used in any high school biology or environmental science
class as part of teaching a unit in ecology. For instance, the lesson titled, "Sprawl and its General Impact," can be used to stress how habitat destruction, which is the hallmark of sprawl, limits or puts pressure on biodiversity. The lessons are easy to follow and could be easily adapted for use in middle school.

Through the lessons, students can become familiar with sprawl and its associated issues and develop skills to address and respond to issues related to sprawl. Thus, students may become motivated to learn how they can help make a positive difference in the local environment by understanding the impact of sprawl.

Indeed, today's youth will face, as adults, some of the most challenging environmental issues ever, and thereby must be both knowledgeable and skilled to make sound environmental decisions. By making students aware of the environmental challenges posed by sprawl to their local communities, we give them the opportunity to care about local, national, and possibly international issues in the future. These lessons also provide students with the needed skills, knowledge, values, and thinking strategies to be effective environmental stewards.
APPENDIX A

SPRAWL AND ITS GENERAL IMPACT LESSON
Sprawl and its General Impact Lesson

Objectives:

Students will:

• Complete an anticipatory guide related to sprawl
• Define the term sprawl
• Use a concept map to show the relationship between sprawl and its impact
• Reflect, through journaling, on the impact of sprawl on the local environment

Materials:

• Activity I: Sprawl concept map student page – copy for each student
• Anticipatory guide – copy for each student
• Literature Review titled “Sprawl” – copy for each student
• Pen or pencil

California Science Standard Covered:

Standard 6c: Students know how fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration, and death.

Standard 6b: Students know how to analyze changes in an ecosystem resulting from changes in climate, human activity, introduction of nonnative species, or changes in population size.

Subject Areas:

Environmental Science, Biology

Vocabulary:

Sprawl, air pollution, habitat loss, surface runoff

Skills:

Analyzing, interpreting, writing, predicting, categorizing, synthesizing and creating
Procedure:

1. Ask students what they know about the word sprawl and how they feel about it. Write down their responses on the board.

2. Hand out the Anticipatory Guide and ask students to respond to the first part under "before reading sprawl."

3. Give students a copy of the handout titled "Sprawl," and give them a chance to read it.

4. Ask students to now go back and complete the Anticipatory Guide by responding to second part under "after reading sprawl."

5. Give students a copy of Activity I: Sprawl Concept Map. Instruct them to complete the concept map based on the information in the handout titled "Sprawl."

6. Discuss possible answers on the concept map. (Teacher's Guide provided.)

7. Have students compare their finished concept map to their Anticipatory Guide and their earlier responses written on the board.

8. Ask students what they found to be most interesting and discuss any misconceptions.

9. Have students journal their thoughts about and response to sprawl related to the following quote: "Human beings need to be guided and encouraged through the extraordinary process of becoming aware, informed, and motivated to make necessary environmental changes and decisions that not only affect them today, but also in the future. A concern for the land and its resources is basic to our survival, both as individuals and as a nation; for we cannot live apart from our planetary home. Environmental quality and human health and well-being are interdependent" (Council for Environmental Education, 1992, viii).

Evaluation:

Students will be evaluated on the accuracy of their concept map and appropriate journal responses.
**Time Considerations:**

- Anticipatory Guide: 15 minutes
- Reading “Sprawl”: 20 minutes
- Anticipatory Guide: 5 minutes
- Activity I (sprawl concept map): 20 minutes
- Discussion: 10 minutes
- Journaling: 10 minutes
## Anticipatory Guide:

<table>
<thead>
<tr>
<th></th>
<th>Before Reading “Sprawl”</th>
<th>After Reading “Sprawl”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agree</td>
<td>Disagree</td>
</tr>
<tr>
<td>People should be allowed to build their homes wherever they want to.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sprawl is not a problem at all; it just adds to the landscape</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cities make more money when new residential houses are built.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malls and shopping centers improve the outlook of neighborhoods.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Activity 1: Sprawl Concept Map
Student Page

Sprawl

- Environmental impact
  - Habitat destruction
  - Threatened species
  - Air pollution

- Water runoff from paving
- Higher taxes
  - Extra services

Defined as

- Respiratory illnesses
- Lack of physical activity
- Greater risk of fatal crashes

- Diabetes
- High blood pressure
Activity I: Sprawl Concept Map
Teacher's Guide

Sprawl

Environmental impact
- Habitat destruction
- Threatened species

Automobile oriented culture
- Air pollution

Water runoff from paving
- Water pollution

Health impacts

Economic impacts
- Higher taxes
- New roads and schools
- Extra services

Defined as

Uncontrolled expansion of low-density, single-use suburban development into the countryside

Respiratory illnesses
- Stress
- Lack of physical activity
- Hypertension
- Greater risk of fatal crashes

Obesity
Diabetes
Colon cancer
High blood pressure
Sprawl – Student Handout

Sprawl can be defined as the uncontrolled expansion of low-density, single-use suburban development into the countryside. Sprawl is a type of development with several key characteristics that make it so costly. Some of these characteristics that sprawl can be associated with are (1) unlimited outward extension into undeveloped areas, (2) low density, and (3) leapfrog development.

Sprawl also includes strict segregation of housing and commercial development, often through the construction of standardized development types, automobile dependence, and fragmented planning and governance. The first characteristic in this definition of sprawl has led to the loss of a vast amount of agricultural lands because these types of land are often the cheapest for development. Secondly, land that house fragile ecosystems have fallen victim too because sometimes they are part of these developable tracts. Furthermore, as a result of sprawl, population densities in the areas experiencing sprawl are typically lower than those in metropolitan areas. Lastly, the third element asserts that sprawl results in developments built in isolated areas, thus creating a patchwork in which working farms are right next to suburban housing developments, or in which shopping malls border open fields.

Urban sprawl can also be defined as the spreading of urban developments (as houses and shopping centers) on undeveloped land near a city. Also, sprawl is a pattern and pace of land development in which the rate of land consumed for urban purposes exceeds the rate of population growth and which results in an inefficient and consumptive use of land and its associated resources. The Sierra Club described urban sprawl as irresponsible, often poorly planned development that destroys green space, increases traffic and air pollution, crowds schools and drives up taxes.

Environmental Impacts of Sprawl

Shopping centers and homes are often built where wildlife call home. This is habitat destruction. It is worth mentioning that the conversion of green space to urban and suburban uses is the fastest growing threat to the nation’s wild species and that 60% of the nation’s rarest and most imperiled species occur in designated metropolitan areas. Sprawl is also believed to be the leading culprit in causing species imperilment in California. Outranking 17 other factors including road construction and outdoor recreation, sprawl is known to threaten 188 of California’s 286 federally listed species (66 %).

Landscapes and wildlife are lost as a result of sprawl. As new buildings emerge, spaces that originally were occupied by native species are taken up. Studies have shown that the 35 fastest growing metropolitan areas are home to nearly one-third of the nation’s rarest and most endangered species of
plants and animals. Action by local authorities is necessary to protect green infrastructures and fragile habitats and therefore protect the species that are being threatened.

Air pollution is another cause for worry as a result of sprawl. Vehicles are responsible for an estimated 80% of the air pollution in metropolitan regions. Increased use of gasoline products leads to an ever-increasing amount of carbon dioxide released into the atmosphere. Carbon dioxide is one of the most serious greenhouse gases. Across the United States, during the 1980s and 1990s the average length of work trips rose by 36%, and total vehicle miles driven increased at three times the rate of population growth.

An automobile-oriented culture also increases dependence on nonrenewable petroleum, with the attendant economic and environmental consequences. Sprawl's effects on transportation give rise to increased pollution. Carbon dioxide emissions from vehicles exacerbate global climate change while nitrogen- and sulfur-containing air pollutants contribute to tropospheric ozone, urban smog, and acid precipitation.

Sprawl also leads to water pollution and degradation of water resources. Conditions favorable to water runoff are created by sprawl. All the highways, parking lots, driveways, and other paved areas associated with urban sprawl lead to a substantial increase in runoff resulting in increased flooding and erosion of stream banks. Runoff from lawn fertilizers, motor engine oils, and pet droppings are known to degrade local water resources.

Waterways are polluted by substances such as motor oil and road salt form roads and parking lots. Runoff of polluted water from paved areas is estimated to be about 16 times greater than from naturally vegetated areas. Such air and water pollution has been shown to degrade natural environments and pose risks to human health.

**Health Impacts of Sprawl**

Sprawl leads to increased driving, and increased driving leads to vehicle emissions that contribute to air pollution and its attendant negative impacts on human health. Automobiles produce more than half of carbon monoxide emissions and about a third of oxides of nitrogen and volatile organic compounds, precursors to the formation of ground-level ozone pollution. These kinds of pollutants can aggravate respiratory illness, increase respiratory infections, and even cause decreased lung function and lung inflammation. Being exposed to pollutants in the air even on the short term may lead to increased symptoms of respiratory diseases and subsequently diseases like coughing or wheezing, aggravation of asthma; increased medication use, increased absence from school for children or work for adults, and increased admissions to hospitals for respiratory illness.
Stress is another direct result of sprawl. Any long distance driver can attest to the fact that the longer one drives, the greater the chances that one gets stressed. More time spent in an automobile exerts a stress cost, which includes effects on blood pressure, tolerance for frustration, and negative mood.

Since people living in more sprawling areas drive more and have fewer alternate travel options, they also have fewer opportunities to get healthy physical activity as part of everyday life. Physical inactivity clearly influences obesity and also plays a role in a host of diseases, including diabetes, colon cancer, and high blood pressure. People from the most-sprawling U.S. counties weigh 2.7kg more for their height than people from the least-sprawling U.S. counties. Over 23% of people from the most-sprawling counties showed hypertension (high blood pressure), whereas fewer than 23% of people from the least-sprawling U.S. counties showed this condition.

According to studies, unlike people that live in counties with more compact developments, people who live in heavily sprawling counties are more likely to weigh more because they drive more and take less walks. Also hypertension is more common in people who live in more sprawling areas than those living in more compact areas.

Sprawl also leads to greater risk of fatal crashes. People who live in more sprawling areas run a higher risk of dying in an automobile accident. In the nation’s most sprawling region, Riverside County, California, 18 of every 100,000 residents die each year in traffic crashes. The eight least-sprawling metro areas all have traffic fatality rates of fewer than 8 deaths per 100,000. Increased death rates in more sprawling areas is most likely due to an increased amount of driving, and increased speed when driving on high-speed freeways, compared to driving on smaller city streets with significantly lower speed limits.

**Economic Impacts of Sprawl**

Sprawl forces county and town budgets and subsequently taxes to escalate. More compact forms of development are less expensive to service. Sprawl drains tax dollars from existing communities and funnels them into infrastructure for new development on the fringes of those communities. Money that could be spent maintaining and improving downtown centers instead spent on extending the road system, water and sewer system, electricity grid, and telephones lines to distant developments, and extending police and fire service, schools, and libraries.

Using data from the U.S Census of Governments, it has been determined that the cost of public service per resident per worker as well as revenues from real estate taxes and other sources increase and decrease respectively.
APPENDIX B

ENVIRONMENTAL ISSUES LESSON
Environmental Issues Lesson

Background

Students will read and discuss information on at least one local issue associated with sprawl. There are two additional issues provided that could also be utilized. They will use the issue information to identify the problem; issue; players and their positions, beliefs, and values. They will also propose solutions to these real life problems.

Objectives:

- Students will identify an environmental problem.
- Students will identify the issue(s) associated with the environmental problem.
- Students will identify the players and their positions on the issue, along with their possible beliefs and values.
- Students will analyze and propose one or more solutions to an environmental issue.
- Students will journal their thoughts and feelings about proposals to resolve environmental issues.

Materials:

1. Student Page: Components of an Environmental Issue (one copy per student)
2. Student Page: Value list (one copy per group)
3. Student Page: What are the Issue's Components? (one copy per student)
4. Activity I: Inland Leaders Object to Cost of Utility Pollution Rules (one copy per student)
5. Teacher's Guide: Analysis of Activity I: Inland Leaders Object to the Cost of Utility Pollution Rules

California Science Standards Covered:

Standard 6a: Students know biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.

Standard 6e: Students know a vital part of an ecosystem is the stability of its producers and decomposers.
Subject Areas: Environmental Science, Social Sciences.

Vocabulary: Pollution credit, biosolids, sludge, open-air sludge facility.

Skills: Analyzing, comparing and contrasting, defining problems, identifying attributes and components, interpreting, synthesizing, and creating.

Procedure:

1. Sprawl has a lot of issues associated with it. Ask students what issues they think are associated with sprawl. (Answers include pollution, habitat destruction, threat to endangered species, etc.) Explain to students that a good way to understand an issue and its possible solutions is to use a procedure that helps analyze its components.

2. Give to each student a copy of “Components of an Environmental Issue,” and “Value List.” As a class, go over the components of an environmental issue (problem, issue, players and positions, beliefs, values, and solutions). Discuss Value List as needed.

3. Next, divide the class into groups of five students and give each group a copy of “What are the Issue’s Components?” and, for each student, a copy of “Activity I – Inland Leaders Object to Cost of Utility Pollution Rules.” This activity is based on a local environmental issue related to sprawl in Southern California.

4. Explain that each group should read the activity background and identify the components of the issue and propose a solution for it. They are to designate a spokesperson that will identify the components of the issue and share the group’s solution with the rest of the class. Each group should be ready to explain how its solution was selected. Point out that there is not a right or wrong answer and that usually the only workable solution is a compromise.

5. Give students time to read the activity and complete “What are the Issue’s Components?” (The Teacher’s Guide provides an analysis of the possible answers for “What are the Issue’s Components” for this activity.)

6. Allow each group time for presentation on this issue. You can assess students’ performance by observing how well each group linked its solution with the beliefs and values of the players involved in the issue.
Evaluation

1. After all the groups have made presentations, have the class come up with some advantages and disadvantages of each proposed solution. If possible, encourage students to suggest solutions that might combine two or more of the original proposed solutions and have the students vote on a possible solution. It is very likely that not all students will agree on one solution, so more than one solution may be the outcome.

2. Have students each write down in a journal their personal feelings or responses to the proposed solution or solutions.

Time Considerations:

a. Components of an environmental issue: 20 minutes
b. Group preparation: 50 minutes
c. Presentations: 50 minutes
d. Class solution: 15-20 minutes
e. Journaling: 10-15 minutes

Additional Environmental Issues Activities:

Two additional local environmental issues are provided: “Activity II: Lawsuit Filed to Block High Desert Open-Air Sludge Facility,” and “Activity III: Groups threaten Suit Over March Land Swap, ENDANGERED: The Stephens' kangaroo rat.” These activities could be used as additional class activities and/or as homework assignments. A “Teacher's Guide” with possible answers is provided for each of these activities.
Components of an Environmental Issue

Problem: Arises when something of value is thought to be at risk.

Issue: A problem becomes an issue when differences in beliefs and values exist.

Players and Positions: People connected with the issue and how they look at the issue.

Beliefs: Ideas held by players about an issue.

Values: The importance a player places on something (see value list below).

Solutions: Proposed possible solutions to an issue.
Value List:

1. Aesthetic
2. Ecological
3. Economic
4. Educational
5. Egocentric
6. Environmental
7. Ethical/Moral
8. Ethnocentric
9. Health & Safety
10. Legal
11. Political
12. Recreational
13. Religious
14. Scientific
15. Social
16. Technological

What are the Issue's Components?

Problem:

Issue:

Players & Positions:

Beliefs/Values:

Solutions:
Activity I: Inland Leaders Object to Cost of Utility pollution Rules
(Student handout)

Definitions:

Greater Riverside Chambers of Commerce is an organization that works to promote business interest in the Greater Riverside area.

AQMD is the air pollution control agency for all of Orange County and the urban portions of Los Angeles, Riverside and San Bernardino counties.

Pollution Credit is the basis for amount of pollutants that a given industrial firm or utility can deposit into the atmosphere within a given year. If a firm or utility produces less than its allotted quota, then it can sell its extra pollution credit to other companies.

As a result of sprawl, the population in the City of Riverside has risen tremendously in recent years, leading to the need for a significant increase in demand for electricity. Riverside business and utility leaders recently stepped up their opposition to proposed air pollution rules that could add an estimated $10 million to the cost of building a power plant city officials say is needed to prevent power shortages. “We can’t afford to have rolling blackouts,” Cindy Roth, president of the Greater Riverside Chambers of Commerce, told the South Coast Air Quality Management District (AQMD) board, which met in Riverside.

At present, City of Riverside’s power comes from a coal-burning generation plant in Utah, hydroelectric plants (especially Hoover Dam), nuclear generation, purchases from other utilities, local gas-burning plants, and small contributions from green power sources like solar panels.

At issue is Riverside City’s plan to build a 96-megawatt power plant in time to meet the city’s electricity demands for the summer of 2009. The city’s plan has been thwarted by AQMD’s efforts to discourage construction of power plants and other polluting facilities in areas that have poor air quality. Under AQMD’s proposal, the city would have to buy high-priced pollution credits. AQMD would then invest the pollution credit money on pollution-cutting measures in the Riverside area. Because the Riverside area has some of the worst air quality in Southern California, the City of Riverside would pay a higher price for its pollution credits than utilities in places with cleaner air. AQMD’s board is expected to vote in on the pollution credit plan. City of Riverside officials say the $10 million expense would add 15 to 20 cents a month to the average household electricity bill. The power plant would be built near Van Buren Boulevard and the Santa Ana River.
AQMD’s spokesman Sam Atwood said the money from the pollution credits could pay for commercial or household solar panels, for example, or pollution-control devices for school buses or other vehicles.

Bob Stockton, a City of Riverside utilities board member, told AQMD officials that it’s unfair for Riverside to pay extra for high-priced pollution credits because pollution mostly blows in from Los Angeles and other communities to the west. Cindy Roth agreed that pollution credit cost should be paid across the board by all polluters.

But Atwood said it would be practically impossible to determine who is responsible for pollution in the inland area. “Beside, polluters to the west pay for pollution reductions through permits fees and other programs,” he said.

AQMD believes that a new power plant in Riverside would produce substantial amounts of fine-particle pollution, which has been linked in health studies to heart attacks, premature deaths, stunted lung development in children, and other maladies. Most inland communities fail to meet state and federal health standards for particulate pollution. The highest concentrations of particulate pollution are in Rubidoux and Mira Loma, a few miles from the Riverside plant site.

Teacher's Guide

Analysis of Activity I: Inland Leaders Object to the Cost of Utility Pollution Rules

Problem: Construction of a new power plant in the City of Riverside, in response to increased energy demand caused by sprawl, is likely to worsen air pollution.

Issue: Already a polluted city, should the City of Riverside be allowed to build another huge polluting power plant? Should they be required to pay extra for pollution credit since some of the pollution blows in from cities to the west?

Players and Positions:

1. City of Riverside utility board leaders want to build a 96-megawatt power plant to meet the electricity demand of the summer of 2009 because of sprawl. They also oppose air pollution rules that could add about $10 million to the cost of building the power plant.

2. South Coast air quality management district (AQMD) board wants to discourage and prevent construction of power plants in areas that have poor air quality. For this reason, AQMD wants the City of Riverside to buy high priced air pollution credits. The money obtained from this deal would then be used to invest in pollution-cutting measures in the Riverside area.

3. City of Riverside Chamber of Commerce and business leaders want to prevent power shortage and/or a rolling blackout by building a 96-megawatt power plant to meet the city's electricity demand.

Beliefs/Values:

1. City of Riverside utility board leaders believe they are responsible for providing electricity to citizens of the city at an affordable price. Their beliefs might be based on economic, political and legal values.

2. South Coast Air Quality Management District board members believe they are responsible for preventing or minimizing air pollution. They also believe it is their duty to enforce rules put in place to curb air pollution. Their beliefs might be based on aesthetic, legal, economic, ethical/moral, health and safety, environmental, recreational, ecological and scientific values.
3. City of Riverside Chamber of Commerce and business leaders believe they have the right to maintain a steady supply of electricity to businesses and homes in the area. They also believe that a blackout would hurt the city’s economy. Their beliefs might be based on aesthetic, economic, ethical/moral, political, and legal values.

**Solutions:** Solution will vary from group to group. Students should be reminded that there is no right or wrong solution and that most solutions result in a compromise.
Activity II: Lawsuit Filed to Block High Desert Open-Air Sludge Facility
(student handout)

Definitions:

An open-air sludge facility recycles dewatered sludge into compost by mixing it with green waste like yard trimmings, wood chips, etc. This mixture has to be turned regularly, and releases a very unpleasant smell which attracts flies. Because the mixture is not covered, the smell and flies can become unbearable to neighbors.

Sludge is the residual semi-solid material resulting from the treatment of domestic, office, and industrial sewage in a treatment facility. After being treated and processed at the waste water treatment plants, sludge can be recycled in a composting facility to make compost used to fertilize soils.

Biosolid is a politically correct public relations term that has replaced the word sludge and is increasingly used by water professionals in the place of sludge.

The influx of people into Southern California has led to a dramatic increase in population in the area and caused sprawl. Increase in population is directly proportional to increase in sewage waste (biosolids) produced; therefore, there is an inherent need for new sewage waste treatment plant for the area. Unfortunately, no one wants a sewage waste treatment plant in their backyard for a variety of reasons.

An open air sludge facility, located in the High Deserts, which is on 160 acres near Highway 58, about 8 miles West of Hinkley, was approved by the San Bernardino County supervisors recently. Not too long after this approval, the residents from neighboring Hinkley challenged the project. Two groups, HelpHinkley.org and the Center for Biological Diversity (CBD), teamed up to file a lawsuit against the operator of the sludge facility (Nursery Products) and the County of San Bernardino.

The Environmental Law and Justice Clinic at Golden Gate University and the Center on Race, Poverty, and the Environment represent HelpHinkley.org and CBD. They accuse the County of San Bernardino of not properly studying the effects building a sludge facility so close to residential areas in its Environmental Impact Report (EIR). An EIR is a study conducted when permitting and zoning oversight of the property is in question. The EIR analyzes potential environmental impacts of the project and renders a determination whether they are less than significant or significant. The results
of the study help provide scientific information to the elected leaders who are charged with determining whether the site should be permitted.

The County of San Bernardino Planning Commission initially approved the project. HelpHinkley.org and CBD appealed the approval. At a hearing called by the County of San Bernardino Board of Supervisors and attended by over 100 Hinkley and Barstow residents who oppose the decision, the approval was reaffirmed.

The approved open-air sludge facility would process about 2,000 tons of biosolids from nearby sewage treatment plant every day. About 400,000 tons of waste would be processed every year producing compost that Nursery product plans to sell for agricultural purposes. HelpHinkley.org and CBD are worried that dust and bacteria from the sludge facility would be carried by air to communities around the facility risking the health of their residents.

Kassie Siegel, an attorney working with the CBD, is concerned that the County of San Bernardino did not study enough the option of covering the sludge facility with a dome, nor did they pay attention to the greenhouse-gas emissions by the facility and the air quality concerns of the Hinkley residents.

Norman Diaz, a Hinkley resident who started and organized HelpHinkley.org and is leading opposition to the project, said the group members believe the County of San Bernardino Board of supervisors paid little or no attention to the group's concerns. Diaz indicated that HelpHinkley.org is hoping to convince the County of San Bernardino Board of Supervisors to add conditions such as enclosing the sludge facility in a dome to their list of concerns. Safety, Diaz said, is his major concern.

The project manager for Nursery Products, Chris Seney believes that the EIR will stand up in court. "I feel it's more of a delay tactic," responding to the lawsuit. "All of those issues were addressed in the EIR by the county."

The open-air sludge facility has not yet been approved by the California Regional Water Quality Control Board (Lahontan Region) and the Mojave Desert Air Quality Management District. Facility operators will also need to obtain a permit from the U.S. Fish and Wildlife Service.

Teacher's Guide:

Analysis of Activity II: Lawsuit Filed to Block High Desert Open-Air Sludge Facility

Problem: There are concerns about building an open-air sludge facility near Hinkley because of health risks to residents.

Issue: Is it safe to build an open-air sludge facility so close to residential neighborhoods?

Players/Positions:

1. San Bernardino County supervisors – approve the building of an open-air sludge facility in the High Desert.

2. HelpHinkley.org – oppose the building of the open-air sludge facility.

3. Nursery Products – support the building of the open-air sludge facility.

4. Center for Biological Diversity - oppose the building of the open-air sludge facility.

Beliefs/Values:

1. San Bernardino County supervisors believe that a sludge facility is needed to handle the biosolids in the High Desert region. Their belief might be based on legal and economic values.

2. Hinkley and Barstow residents believe that the county did not properly study the open-air facility’s effects in its environmental review, and that dust and bacteria from the facility would blow onto neighboring communities, posing health risks to residents. Their belief may be based on environmental, aesthetic, economic, ethical/moral, health & safety and social values.

3. Nursery Products believes that the facility is safe and would generate compost that can be sold for agricultural use from the waste. Their belief may be based on economic, legal, and environmental values.

4. Center for Biological Diversity believes that the county should analyze greenhouse gas emissions from the facility, address air quality concerns and fully study the option of enclosing the facility with a dome. Their belief may be based on scientific, ecological, environmental, legal, aesthetic, health and safety, and social values.
Solutions: Solution will vary from group to group. Students should be reminded that there is no right or wrong solution and that most solutions result in a compromise which meets the objectives for managing the resource.
Activity III: Groups Threaten Suit Over March Land Swap; ENDANGERED: The Stephens' Kangaroo Rat
(student handout)

Landscapes and wildlife are lost as a result of sprawl. As new buildings emerge, spaces that originally were occupied by native species are taken. Native species are key to maintaining ecological balance in any area. To keep native species, citizens have to be educated at all levels to minimize activities that threaten species survival and endanger them.

Sprawl, caused by encroaching urbanization and agricultural development of land has eaten into the habitat of the endangered Stephens' Kangaroo rat and restricted them to isolated populations in the San Jacinto Valley range. The Stephens' Kangaroo Rat is on the U.S. Endangered Species List and also classified as endangered in California.

Two environmental groups - the San Bernardino Valley Audubon Society and the Center for Biological Diversity (CBD) - recently announced their intent to sue the U.S. Fish and Wildlife Service approving extensive development on a very important endangered species preserve in the Inland Empire, even though another area in Potrero Canyon has been reserved for the species.

The CBD in conjunction with the San Bernardino Valley Audubon Society claim that Stephens' kangaroo rat preserve located at the former March Air Reserve Base in Riverside was established in 1990 in lieu of series of improvements made to the nearby Interstate 215. They are strongly opposed to the present move to swap the preserve at former March Air Reserve base for land bought in Potrero Canyon south of Beaumont.

The groups, CBD and the San Bernardino Audubon Society, allege that this swap has not been studied enough, and that proponents have not followed the stipulations set forth by the federal Endangered Species Act. CBD and the San Bernardino Audubon Society claim that the preserve at former March Air Reserve base is one of the largest and most intact reserves for the endangered kangaroo rat, and destroying and losing it would harm the ability of the Kangaroo rat to recover from its endangered status. "Our concern is that there's never been a close look at the effects of that tradeoff," said John Buse, an attorney with the Center for Biological Diversity and the San Bernardino Valley Audubon Society.

Jane Hendron, a spokesperson for the U.S. Fish and Wildlife Service, said that the long-term conservation value of the 1,170-acre preserve at the former March Air Reserve base was limited because of all the new developments in the surrounding area. The U.S. Fish and Wildlife Service
agreed with local agencies that offsetting the loss of that land with at least 2,488 acres of habitat already occupied by Stephens' kangaroo rat in Potrero Canyon was acceptable. Lori Stone, the interim executive director of the March (Air Reserve Base) Joint Powers Authority, said that the preserve at the former March Air Reserve Base is tagged for future development.

Teacher's Guide

Analysis of Activity III: Groups Threaten Suit Over March Land Swap

Problem:

A development on a key endangered species preserve might further threaten the endangered kangaroo rat.

Issue:

Should March Air Reserve Base Stephen’s Kangaroo rat preserve be swapped for a land in Potrero Canyon?

Players/Positions:

1. Center for Biological Diversity and San Bernardino Audubon Society oppose the land swap deal and development on March endangered species preserve.

2. U.S. Fish and Wildlife Service approve development on March endangered species preserve.

3. March Joint Powers Authority supports the development on March endangered species preserve.

Beliefs/Values:

1. Center for Biological Diversity and the San Bernardino Audubon Society believe that the March Preserve is one of the largest, farthest north and most intact reserves for the endangered kangaroo rat, and its loss could harm the species’ ability to recover from its slip toward extinction. Their belief may be based on environmental, social, moral/ethical, ecological, aesthetic, legal, and scientific values.

2. U.S. Fish and Wildlife Service believes that development on the kangaroo rat preserve is imminent, whether now or in the future; therefore it would be best to swap the land for another one in an effort to preserve the endangered kangaroo rat. Their belief may be based on scientific, legal, environmental, social, aesthetic, and economic values.

3. The March Joint Powers Authority believes that the March preserve is tagged for future development; therefore offsetting the loss of that land with at least 2,488 acres of habitat in Potrero Canyon was acceptable.
Their belief may be based on economic, legal, social, political, and recreational values.

**Solutions:** Solution will vary from group to group. Students should be reminded that there is no right or wrong solution and that most solutions result in a compromise which meets the objectives for managing the resource.
REFERENCES


