KEY LARGO
NATIONAL ENVIRONMENTAL STUDY AREA
GUIDE

Everglades National Park
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This booklet has been produced for the use of the National Environmental Study Area (NESA) at the Key Largo Ranger Station. This handbook is "activity-oriented" and is designed to give the teacher information concerning:

1. The objectives of each activity.
2. The format of each activity.
3. The ecological concepts and facts supporting each activity.
4. Pre-site and post-site programs to prepare for and to perpetuate each activity in the classroom.

In preparation for the field trip to the Key Largo NESA, the Teacher and Key Largo Environmental Education Specialist will plan the pre-site and on-site program according to grade level, student interest and capability. The Teacher and E.E. Specialist will select suitable activities; all of the activities in this booklet will not used by any one teacher in a single session. This guide is designed to give you a selection of programs in order to further enhance your own environmental education curriculum. Trail use has been limited to third through sixth grades.

A teacher workshop will be conducted to introduce instructors and student aides to the activities in this booklet.

We are hopeful that this program will continue to grow with the revision of old activities and the addition of new ones each year. We welcome your suggestions and criticisms towards this end.

"The Universe is full of magical things patiently waiting for our wits to grow sharper."

E. Phillpotts.
What is a National Environmental Study Area (NESA)?

At the beginning of the 1970's, a growing demand for Environmental Education (EE) programs surfaced in our nations schools. To help meet this need, the National Park Service helped develop EE materials called the National Environmental Education Development (NEED). Physical sites were designated for using the curriculum materials and philosophy of NEED. These sites are known as NESA's.

Everglades National Park has several NESA's. One is located at the Key Largo Ranger's Station. At this site hammock, mangrove, and bay communities are available for study. These natural environments allow easy comparison and contrast with the student's environment. These areas also demonstrate man's impact upon natural systems.

By agreeing to be in the NESA program at Everglades National Park, a teacher makes a commitment; he or she will attend a park-sponsored workshop. The Park Service in turn makes a commitment; it will do all it can to make the field trip meaningful by providing coordination, resource materials like this guide, and an environmental education specialist to assist the group. Teachers must prepare their students before coming to the park, and conduct follow-up activities on their own. They must also help conduct the field trip while at the NESA.

A NESA, then, is a physical site where environmental education programs take place. This guide explores the NESA at the Key Largo Ranger's Station. It is primarily intended for third, fourth, fifth, and sixth graders.

Share this outdoor classroom with your students. You may come to view each other in a new manner, and it is likely to be a positive one.
ENVIRONMENTAL EDUCATION AND THE EVERGLADES

Everglades National Park is the last remnant of a unique wilderness which once extended from Lake Okeechobee to Florida Bay. Probably no other resource area in the United States is more suited for environmental education experiences than the everglades. The environmental movement of the late 60's and early 70's practically launched itself by focusing on the jet port controversy. The proposal to create an enormous aviation complex in the heart of the everglades only a few miles from the park boundary stirred the public to examine this and countless other environmental issues, many of which still continue today.

In earlier times, the everglades had similar impact. At the turn of the century, Congress and the country could no longer ignore or condone the mass slaughter of wading birds in the everglades. The practice of attaching bird feathers to women's hats and clothing practically exterminated several bird species due to hunting pressures. The federal government eventually passed protective laws for the birds and created Everglades National Park in 1947. Today's Rare and Endangered Species Act is a direct result of this early environmental issue. Everglades National Park now harbors more rare and endangered animal species than any other area of the country.

Likewise, numerous other environmental issues of grave importance have occurred or are now occurring in the everglades. And all of them somehow involve the adverse effects that man causes when his actions change a delicate natural area. A decade ago, the pressures of reduced fresh water supply and illegal poaching nearly pushed the American alligator and crocodile to extinction. Channelization of Southern Florida for flood control has depressed the fresh water table several feet below historical levels and has consequently reduced everglades wildlife by as much as 95% compared to thirty years ago. The rapid urban development of Miami and Dade County is approaching the park boundary from several directions and will influence the character of the park immensely in the next twenty-five years, unless wise management is practiced. With these issues and others at stake, the everglades serves as an ideal laboratory for environmental education programs.

Keeping these ideas in mind, how do they mesh with the goals of environmental education? If the widely accepted goals of EE as outlined by William Stapp at the University of Michigan are accepted, they mesh perfectly. Stapp's goals of environmental education are to develop in individuals:

(a) An awareness, understanding, and concern for the environment with its associated problems, and:

(b) The knowledge, skill, motivation, and commitment to
work towards solutions to these current and projected problems.

To achieve these two goals, Stapp says that the following structure and processes are needed to help individuals and groups:

(a) Obtain an understanding that humans are inseparable parts of an environmental system and that whatever they do alters their surroundings.

(b) Obtain a basic knowledge of how environmental problems can be solved, and recognize the responsibility of individuals and each segment of society to cooperate in their solution.

(c) And develop thinking and action skills for the prevention and correction of environmental abuses.

These are worthy goals. And there is no way that a teacher can expect to achieve them in one short visit to a NE3A. But if they are constantly in mind and an effort is made to focus on them throughout the school year, then the NE3A experience can play a vital role in an overall program.

Indeed, environmental education is not a subject: it is a process, a way of thinking. This process crosses many disciplines, involves people and the way they interact with various environments, and is problem-focused.

But how does one use all of these great ideas in a teaching situation? One way which came out of the development of the Park Service's EE program is to use an underlying framework known as the SPICE Strands, described in the following section.
THE SPICE STRANDS

There are many productive ways in which to make use of the environment as an educational tool. One approach is strictly classification; everything has a name and a specific way of interacting with the universe. This method has a drawback for the teacher with a limited scientific background, who may not know the multitude of specific names and conditions with which to describe the environment scientifically.

Another way of approaching environmental study is through an investigative, completely open-ended method. The teacher guides students in their attempts to discover what is present in their surroundings and to place their discoveries into some kind of perspective. The advantage of this method is it provides the kind of study that activates sensory awareness and enables the student to develop creative problem-solving techniques. The difficulty rests with the development of research skills. Research skills are another tool of the scientific investigator, and although they would provide a good background in problem-solving for the student, it takes time to develop them.

The SPICE Strand approach draws upon the advantages of both of these methods while eliminating the disadvantages. It incorporates both the specific and the investigative approaches into a third approach with which both student and teacher can feel more comfortable. It requires identification and classification, but on a modified basis. It also requires open-ended investigation leading to problem-solving. Yet, all of its requirements can be taught by a teacher and fulfilled by a student who has little of the rigorous scientific training demanded by the other approaches.

The Strand approach uses five broad, universal concepts as a way of drawing the environment under a total, integrated "umbrella." They are known as the SPICE Strands because the first letter of each concept makes up one of the letters of the word SPICE. These concepts or Strands are:

SIMILARITIES AND VARIETY: Many likenesses and differences occur among living and nonliving things. A variety of functions, sizes and structures exist in plants and stars, rocks and animals, processes and people. Yet there are sufficient similarities to permit their classification into orderly patterns. These classifications increase one's understanding of this world.

PATTERNS: Organizational patterns are kinds of structures that may be found in rock formations as well as in social groups of people and animals. Functional patterns include traffic movements and classroom schedules. Spatial arrangements are patterns that often please us. Such patterns occur both in nature and in artistic design.
INTERACTION AND INTERDEPENDENCE: Nothing exists in isolation. Each individual is constantly interacting with living and nonliving things: his family, his belongings, his friends, his world. These people and things also depend on the individual in order to function properly. The process is continuous (as part of the life cycle) even after death, for dead life-forms nourish the living.

CONTINUITY AND CHANGE: Both living and nonliving things are constantly changing—whether among galaxies and planets or within body cells and body systems. Some things remain the same in spite of change. Matter and energy may change in form, but they can never be created or destroyed.

EVOLUTION AND ADAPTATION: Over centuries and centuries, living and nonliving things alter and develop in the process called evolution. Probably the greatest number of changes over the longest periods of time come about in order to enable an organism to adapt to the environment. Hereditary factors then preserve the continuing elements. The characteristics that enable the organism to adapt best (for example, the best food finder) are apt to be the traits passed on from generation to generation, thus ensuring survival of the species.

Similarities and variety means the simple recognition of each organic and inorganic thing. A classification is derived by noting similar characteristics in distinct objects. Once a classification is made an object's patterns can be identified. What is the nature of its design? Of its function (what does it do?) Of its organization? The functional pattern leads directly to Interaction and Interdependence. How does the specific variety interact with air, water, earth, (other) populations? As it continues to change, it is constantly undergoing Evolution and Adaptation, according to how it fits into the Pattern of existence. If a substance does not adapt in its present form, it evolves, through continuity and change, into a new Variety, with a new Pattern of Interaction and Interdependence.

Teachers should think of themselves as catalysts—permitting the students to develop the answers themselves whenever possible, which will result in a greater retention of the basic understandings. Once the basic Strand understandings are established with the students, they will continue to seek new examples in new environments, leading to a keen awareness of man's interactions with the world.

The Strands can be disastrously misused. The danger inherent with any methodology is that the methodology can be used as a thing in itself, for its own sake. There have been unfortunate examples where the Strands were taught as a subject, instead of used to integrate discipline or to understand processes. Other times, students were told to
memorize and parrot them like multiplication tables. Avoid these dangers. The Strands are a framework. You may never have to mention them at all. Like the girders in a building, they are hidden from view, but keep everything from collapsing.

There is one thing about the Strands never to be forgotten: the Strands exist simultaneously in all things at all times. You will find that while using the Strands, one irresistibly leads into the others. Often one becomes indistinguishable from another. The Strands always reinforce one another.

This is as it should be. In a world of process, it is inevitable that an honest framework is as dynamic as the world it views.
One easy way to remember the SPICE Strand framework is to examine the Strands Pocket Model. There are five fingers on your pocket model, one for each Strand.
Similarity and Variety -- There are five projections on your hand that are so similar to each other, they are called fingers. But there is so much variety in them that no two are exactly alike. In fact, no two fingers in the world are exactly alike. Once this similarity and variety is observed, we can identify patterns.

Patterns -- There is a pattern on the end of every finger called finger prints. There is an endless variety of finger prints, though they all follow a similar pattern. There is a pattern in the way the blood flows through your hand, from the heart to arteries to tiny capillaries in the hand, and back to the heart through veins. These patterns lead directly to interaction and interdependence.

Interaction and Interdependence -- There is interaction when the blood in your hand delivers sugar to every tiny cell in exchange for waste material. Your fingers interact, though independently, when they are playing a guitar or holding a hamburger. Your hand interacts when it is cold and by perspiring when it is hot. Interaction and interdependence subjects our hands to continuity and change.

Continuity and Change -- The veins and arteries in your hand change as the temperature changes. The cells in your hand are constantly dying and being replaced by new cells. In fact, the hands you put in your pocket today are not the same hands you had six weeks ago. As your hands continue to change, they constantly undergo evolution and adaptation.

Evolution and Adaptation -- Over long periods of time
SAFETY CHECK LIST (FOR THE STUDENT AND THE TRAIL)

The Study Area

The study area includes a trail through the hammock, an observation dock on the bay, a mangrove zone and the grassflats of Florida Bay. A large field is available for picnicking and recess activities.

Outdoor onchemical toilets are available. If a day trip is planned, students should bring bag lunches and enough to drink for the entire day as there are no water facilities. (Perhaps the teacher could arrange for coolers) Also, large tablecloths or blankets or towels should be brought by students for picnicking.

Reminders

1. Students should always remember that they are visiting a National Park; "souvenirs" are not to be taken. Also in any collecting activities the animals are to be returned alive.

2. The teacher should invite parents to the field trip, (a ratio of one adult to ten students). As it will be necessary to divide the class into smaller groups, the extra supervision will be very helpful.

3. Comfortable clothing should be worn. Girls should not wear dresses or skirts. Students should wear "grubbies" with sneakers. Long jeans are recommended.

4. If you are planning a day trip, protection against sunburn should also be a consideration.

5. Mosquitoes are not usually a problem in the winter months, but bring repellent just in case.

6. The students should be impressed thoroughly with the idea of staying with the group and not wandering off.

7. Students should know not to throw rocks, break branches of shrubbery, or engage in any other form of abuse of nature (which also can cause personal harm).

8. Two honey bee hives are located on the trail—an observation hive and a wild hive. The teacher is to inform the Ranger.
of any child who is allergic to bee stings at the beginning of the day. Proper precautions will be taken.

9. Students should bring towels in case they get wet during water activities.

10. Anytime students are in the water they will wear life jackets. No swimming will be allowed. (The water is about 2 to 2½ ft. deep in some places). During canoe activities one adult will be in each canoe with two children. Canoeing will be limited to fifth and sixth graders.
MAP OF TRAIL THROUGH HAMMOCK OF KEY LARGO NESA (National Environmental Study Area)
A hammock is a hardwood forest of tropical and subtropical vegetation. It provides homes and food for many organisms. Indeed, the tropical hardwood hammock is quite rare in occurrence, found only in North America in extreme southern Florida, and the Florida Keys. The hammock community contains a great number of plant species—many rare tropical plants—and supports several endemic animals. "The Florida Keys hardwood hammocks support a considerable number of endemic, endangered, threatened, and rare species of animals and plants. Keys hammocks are habitat for certain mammals found nowhere else in the world." (Phase I Summary Report of Florida Keys Hardwood Hammock Project)

Key Largo, the highest and largest of the Florida Keys, is closer to the mainland than the other keys and enjoys greater rainfall than the remainder of the keys. Hardwood hammocks have attained their greatest development in this area. This area has the highest plant diversity.

The Calusa Indians were the first known men to take advantage of the hammock's resources. The Indians moved up and down the islands according to the "easiest abundance." Various Indian mounds on Key Largo reveal that small tribal groups lived here 500 years before Ponce de Leon first visited the Keys in 1513. Indians built their mounds near sink holes where the water was often sweet. (We have several sink holes in the hammock: later settlers planted bananas in these holes as soil and water were available and they gained the name, Banana Holes.) The diet of the Keys Indians included cocoplum, sea grapes, and palm berries. Mostly their food came from the vast abundance of the sea. They supplemented their diet with bears, raccoons, and small deer.

Others were to reap the plenty of the hammocks. Virgin forests of mahogany and dogwood were the first to go. Bahamian boat builders stripped the best mahogany mahoganies for vessels they built in the 18th century. Early settlers destroyed many more trees as they cleared land in the 19th century. Charcoal was made from the buttonwood trees and sold to fishermen. Even the East Coast Railway posed a threat to the hammocks as sparks from the train set many fires.

Mexican Lime later to be called Key Limes were long a commercial crop in the Keys (you will see Key Lime trees in our hammock). The famous Key Lime Pie came along in the days of no refrigeration; the original Key Lime Pie contained eggs, fresh lime juice, sugar, and thick sweetened condensed milk. It was cooked by the chemical action of the lime juice.
Geology

All the rocks of the Keys are made of limestone. The rock of the Upper Keys is an ancient coral reef rock known as Key Largo Limestone. One wonders if this reef is a thin layer of coral reef limestone deposited over some other kind of rock or if it is very thick. Did the reef exist only for a short time or for a very long time? Core samples have been taken; a core taken near the northern tip of Key Largo showed the limestone to be 145 feet in thickness. Yet, ten miles further south on the same Key it thins to 75 feet. From this and other samples it appears that the formation is of variable thickness, that it rests upon an irregular surface, and that it must have been in existence many hundreds of years in order to have built such a thickness. Briefly, then these Keys were made of ancient coral in shallow water; the sea level lowered and left the reef high and dry. In addition, shells of animals, silt in the water, and the remains of marine animals all helped in the formation of limestone.

Wildlife

Key Largo Grey Squirrel

If you look very carefully you may see a grey squirrel or two and will certainly see evidence of the squirrel in the nests which they build. The leaf nest that they construct may be for a single night’s shelter, for a season’s shelter, or for a year-round home. The building of the dray or nest may take from 2 to 5 days. The inside of the dray is lined with grass, bark fiber, and soft material. Squirrels feed on the fruits of the hammock trees—pigeon plum and sassafras. They even like fresh meat now and then and will feed on both eggs and baby birds.

The tail of the squirrel is an interesting adaptive tool. It serves as an umbrella when the squirrel feeds in the rain. It is a blanket as it curls it around itself to cover its nose and feet; it is a parachute to soften the animal’s fall if it misses its footing; it is a rudder when the squirrel swims; and it is a glider’s wing to give it lift in the air.

Honey Bees

The honey bee is a social insect. It has been estimated that our wild hive has about 20,000 bees and the domestic hive 25,000. Bees do contract diseases: American Foul Brood kills the pupa and larvae and is an epidemic disease; Nosema apis (a protozoan infection) is a debilitating disease of the adult. Both of these hives have been treated
to protect not only these bees, but also the hives of domestic bee keepers.

Only one of the bees of the hive is a fully developed female. This is the queen—the only egg-laying insect in the colony. The males (drones) are larger, more plump, and a little lazy. All of the remaining bees are workers. The workers are not able to produce eggs in most cases because their ovaries are small and undeveloped. Yet, they are females and they do all the work in the hive. They feed the larvae, build the honeycomb, and keep the hive clean; it is only the worker bees that fly out to gather honey and pollen as food for the colony.

The worker bees find food by visiting flowers. At the flower some gather nectar droplets with a high concentration of sugar. Others collect pollen—protein for the growing larvae. The bees perform a service for the plants by affecting pollination. When a bee visits flowers, it usually restricts its visits to a single species of plant. This is important for the bee and the flower—the bee encounters the familiar mechanism within the blossoms and the pollen carried by the bees originates in other flowers of the same species.

**White-Crown Pigeon**

In the Keys James Audubon first found the White-Crown Pigeons. The body of the bird is dark with a white crown in the adult (the immature lacks the white crown.) They feed on various hammock fruits including the fruits of the Poisonwood Tree. This is a West Indian species which reaches its northern limit in the Florida Keys. However, the bird is declining in numbers over most of its range. White-crowns breed offshore from the main chain of islands, but are entirely dependent on the fruits of hardwood trees for food.
**Common Nighthawk**

The Nighthawk becomes active at night and is an insect feeder with a large flat head, tiny bill, enormous mouth, long pointed wings, slightly forked tail, and white wing patches. It sits lengthwise on limbs during the day in the hammock; by day its eyes are a mere slit, but huge and round at night.

**Liguus Tree Snail**

As some of the 52 color forms of the Liguus tree snail are in danger of extinction, we have attempted to "plant" snails of a particular color form in this hammock. Unfortunately these snails have many enemies--rats, raccoons, some birds, and man. Occasionally a snail may be seen. In the dry winter the snails are higher up in the trees estivating--that is, the snails are in a dormant state. With the summer rains they will feed again on the tree lichens.

![Image of Liguus Tree Snail](image)

**Hermit Crab**

From time to time we encounter Hermit Crabs in the Hammock. This crab lives in the shells of dead animals. As he grows he adopts a larger shell. We have found Crabs in the Hammock that have adopted not shells, but glass jars for homes. The crab's abdomen, or "tail" fits nicely into the interior of a shell. The end of the crab's abdomen has little clasps that grip the inside of the shell, often so tightly that the animal's body may be pulled apart before it will relinquish its grip on its home.
Land hermits are primarily vegetarians. Yet, they will eat meat if vegetable matter is not available. When food is scarce they will not hesitate to kill and eat members of their own species.

Only one species of land hermit (*Coenobita clypeatus*) is found in the western hemisphere. They must have daily access to water--either fresh or salt--but they seldom enter the water voluntarily, except when the females liberate their young at spawning time.

Unfortunately, there has been intense collecting pressure during the last few years on the land hermit crab.
Hammock Trees
(This information will be of value in the "Tree Hunt" activity that follows.)

Brazilian Pepper
(Schinus terebinthifolius)
This tree can grow to 40 ft.; it is low branching and bushy.

The leaves are aromatic, compound with a red midrib and 5-9 leaflets.

The seeds of this aggressive Brazilian tree were introduced through the United States Department of Agriculture in 1898. The plant attained popularity as a dooryard ornamental and fruiting sprays have been used for Christmas decorations. Too late, people have realized that it is not a shrub, but a fast growing tree, and it is difficult to cut down because of its immense tangle of intertwining branches. Too much contact with the tree can produce an itching rash. The tree is also responsible for respiratory problems.

Cinnamon Bark
(Canela winterana)
The bark is light gray; it is thin and broken into numerous short thick scales, exposing a yellow inner aromatic bark.

The leaves are dark green and shiny with curled under margins.

It is usually produced in the shade of other trees and is characteristic of dry areas. The wood is very hard and very heavy. The bark has served in medicine as an aromatic stimulant, a slight tonic, and a condiment. The leaves have been used as a fish poison. It is a honey plant. When the leaf is snapped in half and the margin rubbed against the tongue there is a sharp peppery taste.
Crabwood
*(Gymnanthes lucida)*

The leaves are alternate with a toothed edge. A good way to identify this tree is to scrape your fingernail over the top of the leaf and stem. Crabwood will "catch" your nail.

The wood is very fine-grained, very hard, very heavy, and durable and takes a fine polish. The wood is made into small novelties such as canes, and backs of brushes and mirrors. The poisonous milky sap may irritate the skin and smoke from the burning wood may irritate the eyes. Crabwood is indicative of a reasonably old hammock.

Jumbo Limbo
*(Bursera simaruba)*

The bark is smooth, peeling red brown.

The leaflets are odd in number.

The crushed leaves, fruits and cut twigs smell like turpentine.

This wood is very susceptible to attack by termites and other insects and is perishable. The wood is used for boxes, matches, and toothpicks. The resin has been used in medicine, as glue, varnish, coating for canoes, and incense. A tea substitute has been made from the leaves. The trees are used in Puerto Rico as "living fenceposts." They can serve as living telegraph poles.
ACTIVITY: "TREE HUNT"

Objectives: 1. To identify common hammock species
2. To describe the characteristics of a leaf so that the child will be able to remember it
3. To determine if a leaf is simple or compound; if the leaf is opposite or alternate
4. To demonstrate a leaf rubbing.

Time: about 30-45 minutes

Grade: 3-6

For the "Tree Hunt" each student will need a clip-board, pencil, and a bare crayon (anything but white). As we discuss each tree, the students will do a rubbing of the leaves and bark (except for the Poisonwood Tree). They will write down bark and leaf characteristics that will allow them to remember the tree. Leaf samples will be given to the group in order that one notebook may be compiled for classroom use. Students will learn 7-10 species (this depends upon the grade level and student interest).

At the completion of the Tree Hunt students will play "Tree Tic-tac-toe." Cards with riddles giving information about the trees discussed will be handed out. Students will be given leaves with labels. They must match the correct leaf with the correct riddle. Just like tic-tac-toe, the students that complete 1 line of the card win (if answers are correct).

ACTIVITY: LEAF FRIEND

Objectives: 1. To describe the similarities and differences of a producer (green plant) and a consumer (man).
2. To heighten awareness of the sense of touch.

Time: about 15 minutes

Grade: 3-6

Each child will be given a leaf which is his "leaf friend." The child will examine the leaf with his hand lens and will study the structure of the leaf. We will discuss how the leaf is similar to and different from us. All leaves will then be collected into a pile. Students must again find their leaf friend. The first time they may use their sense of sight as well as touch. However, the second time they will be blindfolded and must find their leaf by touch alone. They will be asked to leave their friend somewhere on the Trail so that when they return there will always be a friend waiting for them.
ACTIVITY: DESIGN A SEED

Objectives: 1. To define the concepts of competition and adaptation.
2. To discuss seed dispersal mechanisms.
3. To design a seed that may be dispersed by various natural forces.

Time: about 20 minutes

Grades: 3-5

A seed dropped directly under the parent plant may have trouble surviving as the parent will compete with new plants for food, water, sunlight, and room. One of the adaptations of plants which allows for the continuation of the species is a mechanism which disperses seeds to other growing sites.

For this activity we will first discuss how various plants in the hammock distribute their seeds. A student will be given a dried bean with various supplies: glue, rubber bands, feathers, cork, balloons, etc. They will be given specific instructions as to how to modify their seed. For example: Modify your seed to float on water at least five minutes. (Hint: air bubble, raft.) Modify your seed to attract a bird or other animal. (Hint: bright tasty fruits with seeds inside.) After students design their seed they will be required to demonstrate their dispersal invention. Real examples from the natural world will also be demonstrated.

ACTIVITY: "TREE TIC-TAC-TOE"

Objectives: 1. To review trees previously discussed.
2. To describe the various uses of hammock trees.

Time: 20 minutes

Grades: 5-6

Following are the riddles which will be used in the Tree Tic-Tac-Toe:

1. I'm called an exotic
   Even somewhat toxic
   I'll take all that's there
   I'm not likely to share

   I'm hardy and aggressive
   I spread and grow
   And I'll take over your land
   If you let me go.
   Brazilian Pepper
2. I'm Crabwood
Get to know me well
For I'm common here indeed
Examine my rough veined leaf
For the clue you'll need.
Crabwood catches your nail where the leaf joins the stem.

3. I'm a Gumbo Limbo tree
So easy to remember me
What gives away my identity? (leaves, bark, roots, twigs) Bark

4. Your fishing pole
You can leave at home
My crushed leaves
Will catch fish, alone.
Jamaica Dogwood

5. Once important as a farmer's crop
In large groves I was tended
But land became scarce.
To the Bulldozer I lost
And now I'm remembered in pie and sauce. Key Lime

6. A bark dark and ridged
And leaflets small and many
My seed pod shaped like a funny brown pear
And seeds with wings to carry them in the air.
A useful tree
I've been found to be
My wood for ships for furniture, too
But in my shade you'll find
I'm especially kind.
Mahogany

7. Our leaves may confuse you
Devise a test
That you can do
Your sense of taste
Will give you the Clue.
The two trees one may confuse are Marlberry and Cinnamon Bark. They may be distinguished by snapping the two leaves in half and tasting the edge of the break; Cinnamon Bark will give a sharp, peppery taste.

8. Bird and squirrel and soon and man
Alike have eaten the fruit I command
Before you sample a purple berry
Be sure you see the green bracelet
my twigs carry.
Pigeon Plum
9. My leaves are dark and shiny
   My sap dries black on bark
   Though pigeons eat my berries orange
   Your touch may gain my mark.
   Poisonwood

10. You will have no trouble
    In remembering me
    Check the undersides of my leaves
    And a difference you'll see.
    Satin Leaf

11. I'm large and sturdy
    My leaves feel like leather
    With my roots I'll entwine
    Till the host tree is mine.
    Strangler Fig

12. My leaves are soft and shiny
    My berries brightly red
    Part of my name—a popular drink
    Black as lead.
    Wild Coffee

13. I'm a weed, I'm a weed
    At nothing I'll heed.
    Yank up my roots
    And you'll understand
    The name I claim in this hammock land.
    Yellow root
Follow-up ACTIVITY: LEAF PRINT WITH PAINT

Students may want to further investigate trees by learning those around their school or on their own nature trail. A more sophisticated leaf print may be accomplished with paint. These leaf prints may be used to make Mother's Day cards, spring cards, etc.

Leaf print with paint:

1. Apply oil paint evenly with a rubber roller to the backside of a pressed leaf. Lay the leaf on a flat, smooth surface to do this.

2. Lay the leaf with the inked side down on paper and cover it with a layer of newspaper. Press on the leaf to keep it from shifting and roll over the entire leaf.

3. Remove the leaf and newspaper carefully. Use a fast-drying spray varnish on the leaf print to protect the paint.

ACTIVITY: "TRANSPIRATION STUDY"

Objectives: 1. To define transpiration.
2. To compare transpiration among leaves of various conditions.

Time: 30 min.

Grade: 4-6

Transpiration is the evaporation of water from plant surface primarily leaves, into the air. Most plants transpire about 75% of the water taken in by their roots. Most water is lost through small openings on the leaf and stem surfaces called stomates; these stomates regulate water loss.

Transpiration is not always constant. Fluctuations occur seasonally and daily according to environmental factors such as wind, light, moisture, and temperature.

Students will measure the moisture released from different kinds of leaves by observing the color change of cobalt chloride paper. Students will be told to compare dead leaves with live ones, thick leaves with thin ones, leaves in the sun and those in the shade, small leaves and large ones on the same tree. Students will paper clip dry cobalt chloride paper on living leaves that are attached to trees or bushes. The leaf will be enclosed in a plastic bag. Students will measure how long it takes for the leaves to turn the blue paper to pink.
ACTIVITY: "PIGMENT ART"

Objectives: 1. To experiment with natural objects and colors.

Time: about 15 minutes

Grades: 3-6

Students will each be given a white piece of paper. They will be instructed to very carefully select 1 or 2 natural objects with which to produce a picture or design. They will be able to experiment with the colors that natural things produce such as a leaf, grass, soil, burnt wood, etc. With these natural pigments they will produce their designs.

ACTIVITY: "SOIL STUDY"

Objectives: 1. To take a soil sample correctly
2. To perform a chemical test to determine the soil's reaction.
3. To experiment in associating plant growth and pH.

Grades: 5-6

Time: 20 minutes

Soil is produced by the weathering (action of wind, water, etc.) on rock. Depending upon the chemical make-up and hardness of the rock, the formation of a foot of soil could require from 100 to 100,000 years or more. Plant growth, too, works with weathering to produce soil. So soil is made up of both mineral matter and organic matter.

When we ask what is the reaction of a soil, we mean is the soil acid (sour) or basic (alkaline). To measure the soil reaction a scale of 1-14 is used. If a soil registered 14 then it would be as basic as it could be; if it registered 1 it would be as acidic as it could be; and if it registered 7 it would be neutral. To make this clear to students, we will use a large pH chart and discuss items with which they are familiar (such as lemon, bleach, distilled water, blood) in relation to their pH.

The soil's pH is extremely important to plants, because it affects what nutrients the plant can receive. (Just as we require nutrients to grow so do plants.) A soil that is too acid or too basic will not allow a plant to take up from the soil the nutrients it requires. Therefore, most plants prefer soils that are neutral or at least near neutral. And a soil's
reaction is dependent in part upon the kind of rock from which the soil was born. The weathering of limestone commonly results in basic soils. Yet in humid areas rain over a period of time will remove the lime from the soil and its reaction will be acid.

Why is it so important to study the pH of a soil? Because a knowledge of the chemical properties of soil is vital to the successful growth of all plant life.

Students will properly take soil samples from different areas in order to compare and contrast different communities. They will apply the pH indicator solution and from the scale determine the correct pH of the soil. A discussion of the different values will follow.

**ACTIVITY: "MINI-WORLD"**

Objectives: 1. To use the various senses (sight, touch, smell, and hearing) to locate various things in a mini-study area.
2. To sharpen the powers of observation and develop skills in touching, smelling and hearing natural occurrences.
3. To classify all the different things found in the mini-site.

Time: about 30 minutes

Grade: 4-6

Students will be divided into teams of two. Each team will be given a hanger which will be thrown randomly into a designated area. Given a hand lens, the students will explore the area enclosed by the hanger and will complete the Data Sheet. A discussion of finding with the entire group will follow the activity.

"The true mystery of the world is the visible, not the invisible." Oscar Wilde

**ACTIVITY: "JAGGAGE TAGS"**

Objectives: 1. To review the concepts of food chains (producer, consumer, decomposer), animal homes, camouflage, adaptation.
2. To explore the mysteries of the hammock at his own speed.

Time: about 30 minutes

Grade: 3-4

Students will each need a clipboard, paper, and pencil. After discussing various things on the trail, students will get the opportunity to review what they have learned by the
Baggage Tag technique: Students will work in partners. Along an established section of the trail baggage tags will be attached by various trees, shrubs, rocks, logs, etc. The tag will have one statement. For example, "If I am a food-maker (producer) take the letter "K," if not take the letter "W." This baggage tag will be attached to a green plant. Each tag will have a statement and the child will be given a choice of two letters. If the child has selected the correct answer then at the end of the activity, with the letters he has chosen he will be able to unscramble them and spell: Key Largo, Fla.

**ACTIVITY: SENSORY SCAVENGER HUNT** "Hot, cold, bitter, sweet, acid, spicy—all these are the taste of life."

**Objectives:**
1. To develop (or redevelop) awareness of the senses of hearing, taste, feeling, sight, and smell.
2. To demonstrate the different qualities of each of the senses.
3. To develop a vocabulary to describe the activities of the senses.

**Grade:** 3

**PRE-SITE**

Before coming to the trail students will be presented with "sense boxes." There will be a box for each sense. Students will have a worksheet to fill out regarding the items in the box; they will be required to use various "sense terms" to describe these items. Students will work in groups of 5-6 around each box.

For example the taste box may contain—sugar, lime, pretzels, salt, etc. The items would be numbered. On the worksheet beside #1, students would have to determine if that numbered item was sweet, sour, salty or bitter. Then they would sample the item marked #2 and record their observations.

**ON-SITE**

Students will work in groups of "four." They will be presented with a box which will contain instructions for finding natural items with their senses. It will be a "sensory scavenger hunt." For example, for the sense of sight, students will find 3 photographs in their box:

- a water view
- a tree
- something man-made

While exploring a predetermined area they must identify the
place in which these pictures were taken (they will have to pay close attention to detail).

The sensory education they developed in the classroom will be transferred to the outdoors.

**ACTIVITY: "CREATIVE WRITING"**

**PRE-SITE**

If the activity is selected, students should be told in advance that this will be one of their activities. They should be made familiar with cinquain and haiku and any other literary forms you would like them to use in this program.

**Grades:** 3-6

**Time:** about 30 minutes

**Objectives:**
1. To give creative expression (write a story, descriptive paragraph, poem, haiku, cinquain, etc.) to one of the following experiences:
   a. An animal seen or discussed on the nature trail.
   b. An object seen or discussed on the trail (rock, leaf, shell).
   c. A personal reaction to the trail.

This will be programmed as a closing activity. Students will need clipboards, pencils and paper and will be allowed to choose from one of the above topics. He will be allowed to select his own form of expression.

**POST-SITE**

Back in the classroom students may want to draw a picture about their story, poem, etc., and display this in the room. Students should be given some time to share their stories, poems, etc., with one another.

**ACTIVITY: "ARE YOU REALLY LISTENING?"**

"Nature speaks to us if we listen"

--C.G. Rossetti

**Objectives:**
1. To develop a listening sensitivity to what is around us.
2. To identify the effects of noise upon the individual.
Time: about 15 minutes

Grades: 4-6

Students will be requested to sit in a "listening circle" facing away from the circle. Students will just sit with eyes closed for several minutes. We will then discuss what sounds were heard. The concepts of pitch and intensity will be introduced. Students will be given a Data Sheet and will complete it for the outdoor experience.

POST-SITE ACTIVITY

In order to complete the Data Sheet, students should be allowed time for "listening circles" in the classroom, in a crowded cafeteria, on the playground, etc. After completing a number of listening circles, students may compare sounds and the "quality" of sounds from the different "test-areas." This would be a good time to discuss the idea of noise pollution and the effects of noise on the individual.

ACTIVITY: "THE SOUND OF MUSIC"

Objectives: 1. To explore the natural environment for objects with which to make music. 2. To experience how early man searched for music in his environment.

Grade: 3-4

Time: about 30 minutes

Students will be asked to find natural objects from which they could devise a musical instrument. (Example: knocking 2 sticks or rocks together, crushing dead, dried leaves, raking a stick over a rock, etc.) Students will then put on a "natural concert" with their home-made or "natural-made" musical instruments.

ACTIVITY: "FOCUSING ON A . . ."

Objectives: 1. To heighten perception of detail. 2. To develop a clearer understanding of the intricate order of the natural environment.

Grade: 3-6

Time: about 30 minutes

Students will select 2 or 3 interesting natural objects which exhibit a great deal of detail. Objects with a considerable
amount of intricate details are: leaves, coral rock, a piece of bark that has come off the tree (students may not remove bark from the tree), shells. Students will then do intricate drawings or paintings of the natural object.

POST-SITE:

Back in the classroom all drawings may be collected and made into a collage entitled:

"The Artistry of Nature"
"Detail in Nature"
or whatever title the class selects.

**There are two worlds: the world that we can measure with line and rule, and the world that we feel with our hearts and imaginations. Leigh Hunt**

ACTIVITY: "THE COMPASS"

Objectives: 1. Given a premeasured 100 ft. distance, to determine the length of his average step.
2. Using the length of his step—to determine the dimensions of any given room, building, etc.
3. To identify the 3 major parts of the compass.
4. To accurately set a given bearing and follow that bearing for a short distance.
5. To follow a compass course with a fair degree of accuracy.

Time: 45-60 min.

Grade: 5-6

A compass is used for determining directions on the earth's surface. By using a compass and knowing the length of his step, a person can determine distances and directions of many objects. After students have determined the length of their step, and are able to follow a bearing, their skill will be tested by having them follow a compass course.

(If students show a great deal of interest a second session on mapping with the compass can be arranged.)

This activity will be conducted in a large field—not in the hammock.
the information, keep the file open. Use the file to save your work. If you need to save your work, you can use the file to save your work. If you need to save your work, you can use the file to save your work.

ACTIVITIES: THE CAPTAIN

COORDINATOR

I. Maintain a record of all trips.
II. Maintain a record of all trips.
III. Maintain a record of all trips.

The CAPTAIN will follow a procedure until all tasks are completed.

The CAPTAIN will follow a procedure until all tasks are completed.
MANGROVES

Mangroves are very salt-tolerant plants. Different species form zones in the intertidal region. The Red Mangrove forms the outermost zone, and is followed shoreward by the Black Mangrove, and finally the White Mangrove. The mangroves serve many purposes: land building, shore protection and stabilization, food and shelter for young fish and shrimp (a nursery area). Mangroves protect the coast from excessive erosion which might otherwise be produced by fierce tropical storms. Mangroves also provide the material for an important detritus food chain (to be discussed later).

Red Mangrove
(Rhizophora mangle)

The Red Mangroves are easy to identify because of their long prop roots which grow from the branches of the tree and arch into the water. They also have long green seed pods which are often found floating in Florida Bay. (These seed pods may float a year before taking root.) The leaves are dark green and leathery. The dried and ground leaves can be made into a tea. The bark contains 20-30% tannin which is used for dyes, tanning and folk medicine.

Black Mangrove
(Avicennia nitida)

The Black Mangrove may be identified by 3 characteristics:
1. It has a darker bark than the Red or White Mangrove.
2. It has breathing roots called pneumatophores which stick up out of the soil around the base of the tree.
3. Its leaves are green on the front and silvery on the back. Many times the back-side of the leaf will be covered with salt crystals. (The old timers used to throw these leaves into their soup for seasoning.)

The bark is important for tanning leather and for red dye. The wood is very durable and the gum has medicinal uses.
White Mangrove (Laguncularia racemosa)

The White Mangrove may be identified by its leathery oval leaves. The leaf is usually notched at the tip. On the leaf stem at the base of the leaf blade there are also 2 little swellings. The White Mangrove also has pneumatophores present underground but they seldom project above the ground. The bark is 12-24% tannin and is used for tanning leather.

Buttonwood (Conocarpus erecta)

This tree is usually found on the landward side of tidal mangrove forests. Its bark is gray and brown and very rough and furrowed. The leaves are light green, but when one observes the tree from a distance its canopy is fall-like with a sprinkling of red and orange leaves among the green. This tree is a shore builder with an extensive root system which binds muddy saline shores.
Mangrove Food Chain

In the mangrove system there is a detritus food chain. Debris is decomposing dead plant material such as mangrove leaves, twigs, and fruits. Detritus is a product of the breakdown of debris. As debris is changed into detritus, it acquires a "coating" of bacteria and fungi which actually increases its total protein value.

The food chain is illustrated below:

Mangrove debris and detritus----- bacteria and fungi-----

Sailfin Molly (organisms which feed-----wading birds such as-----on detritus) Herons, Egrets, and Sport fish species

American Crocodile, Bald Eagle Osprey

My purposes in illustrating this food chain are first, to demonstrate the very critical interdependence of plants and animals, and secondly to emphasize the importance of the mangroves. It was once believed that mangroves served no function at all in the natural system; finally, man is hopefully coming to the realization that all things belong and serve in the "whole." Indeed, the survival of the Bald Eagle is linked to that of the lowly bacteria and fungi. "You cannot pick a flower without disturbing a star."

Nonetheless, this food chain exists in our mangrove study area to a limited degree.

Another food chain of our area would be:

Mangrove leaves----- mud crab----- mangrove snapper-----
heron(feeds on small snapper)

A mangrove-associated mud crab is the only known macro-organism that feeds directly on the mangrove leaf without the leaf undergoing decomposition first.
ACTIVITY: MANGROVE STUDY

Objectives: 1. To distinguish the Red Mangrove, Black Mangrove, White Mangrove, and Buttonwood.
2. To complete a weather data sheet which requires the temperature, salinity, current and turbidity of the water.
3. To study any organisms around the mangrove roots.
4. To determine the dissolved oxygen, carbon dioxide, and pH of water around the mangroves.

A good preparation for this activity would be Mangrove Communities—a 4th grade study designed by Martin County. However, this workbook was designed for a particular area, and needs to be adapted to our own mangrove community.

For this activity students will be divided into four groups. Four different activities will be going on at the same time and students will rotate through these four activities.

Station 1. On the boardwalk, students will learn the Red, Black, and White Mangrove and the Buttonwood. They will do leaf rubbings.

Station 2. Students will examine the area around the mangrove roots with glass-bottom buckets. They will be required to record any organisms they encounter.

Station 3. Students will determine the dissolved oxygen, carbon dioxide and pH of the water around the mangroves. They will take numerous readings and record on Water Data Sheet.

Station 4. Students will fill out weather data sheets. (These have been adapted from Martin County’s material).

At the end of the separate sessions, we will come together as a group and discuss our findings.
ACTIVITY: "WATER TESTING"

Objectives:
1. To properly take a water sample.
2. To demonstrate the presence of O₂ and CO₂ and to relate these gases to the process of photosynthesis.
3. To determine the pH of the water and relevance of pH to living organisms.

Grades: 4-6

Oxygen:

The oxygen supply in water comes from 2 sources: from the air and from the plants in the water (by photosynthesis). Oxygen moves from the air into the water very slowly unless it is helped by wind and water movements. Sunlight is the primary factor in plant production of oxygen. Results will vary depending upon what time, what season, and where oxygen measurements are taken.

Also, water cannot "hold" as much oxygen as the atmosphere. Oxygen dissolves in water and this ability is affected by salinity. Normally, low water temperatures allow more oxygen to be dissolved in the water while in high salinities the reverse is true.

The Key Largo study site represents an area of high salinity. A measurement taken in September revealed a salinity of 42.3 parts per thousand; sea water is 35 parts of salts by weight per 1,000 parts of water or 3.5 percent. The salinity will increase with the dryness of winter; this is attributed to the decreased rainfall and the decreased water run-off from the land. Then what of the dissolved oxygen?

We said that oxygen is produced through photosynthesis. There is a great deal of submerged vegetation in our study area, so there is much photosynthetic activity. With so much activity a great deal of oxygen is produced.

In some parts of the Bay the dissolved oxygen reading in the afternoon is 7 milligrams per liter. At night it is about 1 or 2 mg/l. The difference is that the process of photosynthesis requires sunlight. At night plants are unable to produce the oxygen, but continue the process of respiration thus consuming most of the available oxygen. Plants consume oxygen and produce carbon dioxide but at rates much lower than the rates of carbon dioxide uptake and oxygen production during photosynthesis.

Further more oxygen is required by fish and other animal life in the water. The required concentration varies from
species to species but most fish need at least 4.0 mg/l for survival and may require more for rapid growth and other activities. Therefore, dissolved oxygen readings help to determine the health of the community.

**Carbon Dioxide**

Carbon dioxide is essential for the growth of water plants—phytoplankton (microscopic plant life suspended in the water) as well as rooted plants. The process of photosynthesis requires carbon dioxide; with this carbon dioxide and sunlight the plant produces oxygen and builds its own body tissues.

The addition of carbon dioxide to the system will lower its pH (make the system more acidic) and the removal of carbon dioxide from the system can raise its pH. Carbon dioxide combines with water to form a weak acid.

**pH**

In waters of high salinity you may have a higher pH (more basic). Very high salinity waters cause the calcium to precipitate out and combine with the carbon dioxide to produce calcium carbonate. So by removing the carbon dioxide you get higher (more basic) pH readings.

The pH of the water (how acidic or basic) is very important to the well-being of marine organisms. They would be unable to survive in either extreme of the pH scale.

**Activity**

Students will take a water sample and using the Hach Kit will determine the oxygen, carbon dioxide, and pH of various water depths and areas.
THE GRASSFLAT

The marine sea grasses which make up most of the grassflats in our area are a valuable resource which produce both food and shelter for fish and invertebrates. The shallow grass beds provide food for many species of birds which prey upon small fish and invertebrates.

Sea grasses are marine flowering plants. They spread by production of long runners or rhizomes. These produce roots and leaves. The rhizomes and roots form dense networks which bind the bottom muds and sands together and thus prohibit or greatly reduce erosion from waves or tidal currents.

Few animals feed directly upon marine grasses; sea turtles, manatees, a few fishes and certain sea urchins do. The grasses are a natural nursery area for commercial and sport fish such as mangrove snapper, snook, pink shrimp, and spiny lobster. The sea grasses also provide surface for attachment of many sessile (immobile) plants and animals. For example, at least 113 species of algae are known to grow on turtle grass leaves. The following are sea grasses that we may expect to find in our study area:

Turtle Grass (Thalassia testudinum): This has long, flat leaves about 3/16 in. wide and 1-2 ft. long. This grass prefers a salinity of 25 o/oo to 38 o/oo and the st temperature for growth is 68-86 degrees F. A turtle grass community is highly productive.

Shoal Grass (Halodule wrightii): This grass has flat leaves about 1/16 in. wide. This grass can tolerate a wide range of temperatures and salinities from 10 o/oo to 60 o/oo. Shoal grass density depends largely upon the local concentrations of Turtle Grass and Manatee Grass. When these grasses are absent or scarce, shoal grass tends to form dense growths.

This grass community provides a valuable habitat for fish, shrimp, and spiny lobster.

Manatee Grass (Syringodium filiforme) This grass has thin cylindrical leaves. This grass does not tolerate very low salinities and is primarily found in waters of 20 o/oo to 34 o/oo. It is also important in erosion control, and providing habitat.
Food Chains of the Grassflat

A food chain is defined as a sequence of organisms starting with the green plant in which each is food for a higher or more complex organism. Let's consider the various plants and animals of the Grassflats and discover "who eats who out in the turtle grass."

1. Detritus----- Sailfin Mollies----- Mangrove Snapper--
   This is contributed by the sea grasses and mangroves.
   Heron

2. Phytoplankton----- Zooplankton----- Silversides-----
   Barracuda*
   *(In various growth stages, barracuda eat fish of different sizes according to their particular size.)

3. (Dominant Food Chain)
   Phytoplankton----- Zooplankton----- Silversides-----
   Needlefish----- Large Barracuda

4. Turtle Grass----- Halfbeaks
   Turtle Grass----- Pinfish

5. Phytoplankton----- Zooplankton----- Anchovies-----
   Mangrove Snapper

Organisms of the Grassflat:

Horseshoe Crab: It eats tiny fish and just about anything it finds on the bottom.

Pipefish: This is the cousin of the seahorse. It feeds on micro-crustaceans and larvae fish. The seahorse and the pipefish have a long snout used like a drinking straw by sucking water through the snout.
they pull in their prey.

Seahorse: Seahorses have great maneuverability. They feed only on moving prey. Their pectoral fins (located behind their heads) flutter as fast as 70 times per second.

Cassiopeia: This jellyfish lies upside down on the bottom in quiet, shallow water, slowly pulsating to force food-laden currents across the "mouths." This is a very common jellyfish in the sometimes stagnant and nutrient-enriched high salinity waters of our area.

ACTIVITY: GRASSFLAT EXPLORATION

Objectives: 1. To explore the grassflats with canoes and glass-bottom buckets.
2. To discuss food chains in the grassflat area.
3. To discuss various organisms in the grassflats.
4. To discuss the condition of the turtle grass in the study area.
5. To discuss the Reverse Osmosis Plant.
6. To discuss the impact of man upon the Buttonwood Sound Area.

Grades: 5-6

The Martin County series on the Grassflat would be a good preparation for this study. However, the material must be adapted to our Keys's environment.

For the activity, students will fill out the Weather Data Sheet, and will list all organisms (or descriptions of organisms) which they find in the area. Although there will be a variety of fish, identification will not be heavily stressed. Instead, we hope that students through studying the role of these little fishes in the food chain will come to understand their importance to the Bald Eagle, American Crocodile, and Great White Heron.
DATA SHEET

ACTIVITY: SENSE BOXES (PRE-SITE ACTIVITY FOR SENSORY SCAVENGER HUNT)

TASTE (sweet, sour, salty, bitter)

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SIGHT (distant, close, bright color, dull color, blurred, clear)

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SMELL (strong, medium, mild, no smell)

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HEARING (high, low, loud, soft, no sound)

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FEELING (temperature-hot, cold; texture-rough, smooth; size-long, short, wide, narrow; weight-heavy, light)

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Any time that you can recognize exactly what the object is, write that down too.
ACTIVITY: "MINI WORLD"

List all the different items you can find inside of your hanger. If you cannot give the item a name, then in a few words, describe it. Circle whether the item is an Animal, a Plant, or a Mineral and if it is Living or Dead.
DATA SHEET

ACTIVITY: MINI WORLD (cont.)

1. Connect items that need each other with lines. Many items will have several "need" lines.

2. Which items are: (write under block)
   a. producers (food-makers)
   b. consumers (food-takers)
   c. decomposers (food-breakers)

3. How many of one item are there within your boundaries? Can you count them and write the number beside each item.

4. What would happen if one item was removed from your area? (Describe below):

ACTIVITY: POSE-SITE

When you return to school write a one page story about your mini-world. It can be either imaginative or factual.
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<tr>
<th>TEST SITE</th>
<th>DESCRIBE THE SOUNDS YOU HEARD. (1 SOUND/LINE)</th>
<th>IF MAN-MADE (check space)</th>
<th>IF NATURAL (check space)</th>
<th>PITCH (check one)</th>
<th>INTENSITY (check one)</th>
<th>HOW PAR</th>
<th>WAS THE SOUND PLEASANT? (check one)</th>
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WEATHER DATA SHEET
MANGROVE STUDY AREA

STUDENTS' NAMES ____________________________

DATE: __________________

1. The weather today is: ____________________________________

2. The temperature of the air is: ____________________________

3. The salinity of the water is:
   hydrometer reading ________________
   temperature of the water ________________
   salinity ________________

4. Which is warmer, the air or the water? ________________
   How much warmer? ______________________

5. Find something that will float and put it in the water around the mangroves. Is there much of a current? ______________________

6. Turbidity means how cloudy the water is. Put your foot about 30 cm under the water.
   How well can you see your foot? ________________
   Would you say that the water is very turbid? ________________
WATER DATA SHEET

(to determine dissolved oxygen, carbon dioxide, and pH)

1st Sample:
Are there a lot of water plants in the area?
Water depth:
Is the area from which you are removing the water sample in shade or sunlight?
Dissolved oxygen mg/l.
Carbon dioxide mg/l.

2nd Sample:
Are there a lot of water plants in the area?
Water depth:
Is the area from which you are removing the water sample in shade or sunlight?
Dissolved oxygen mg/l.
Carbon dioxide mg/l.

3rd Sample:
Are there a lot of water plants in the area?
Water depth:
Is the area from which you are removing the sample in shade or sunlight?
Dissolved oxygen mg/l.
Carbon dioxide mg/l.

STUDENT'S NAME ____________________________
SOIL DATA SHEET

Record the following information about the soil in your study area.

1. Describe your study area (include plants)

2. TEMPERATURE:
   - Air temperature
   - Surface temperature
   - 5-inch temperature
   - 10-inch temperature (if possible)

3. pH:

4. TEXTURE: (check one)
   - Sand
   - Silt
   - Clay

5. COLOR OF SOIL
   - (dark, grey brown to black
     dark brown to yellow-brown
     pale brown to yellow)

6. CONTENTS OF MATERIAL ABOVE THE SOIL

7. TYPE OF ROCK

8. DEPTH OF SOIL

*To determine the texture, push and rub moistened sample between thumb and forefinger:
   - If it feels gritty... sand
   - If it feels smooth and slick, not very sticky... silt
   - If it feels smooth, plastic, very sticky... clay
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