CHAPTER 1

STUDYING; INFORMATION SOURCES; SCIENCE AND REASONING; ADVOCACY AND CONSERVATION

1. 1. OUR INVITATION TO YOU

1. 1. 1. Introduction

Greetings, HAFA ADAI, and TIROW WÓÓMI. We the authors invite you to learn about the details and explore the processes we discuss in this book. We enjoyed putting it together. We hope this work will help you in your goal of learning more about our islands' ecology, our environmental problems, and our attempts to resolve them through our resource management programs.

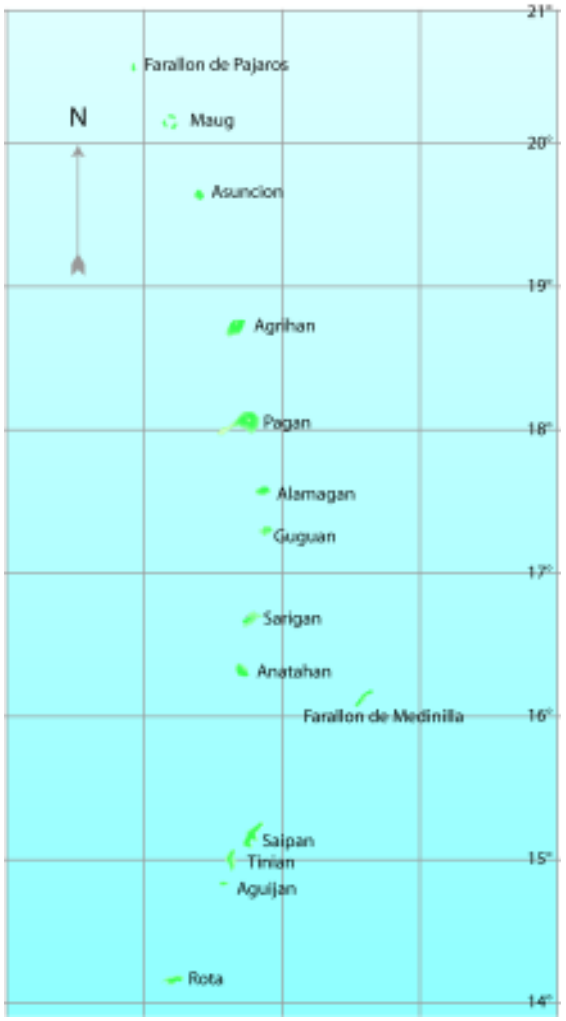
This is a different kind of textbook from most you have read before. For one thing, this book cannot be found anywhere else. It was developed here in our islands: It was made for you.

After reading it, you may determine that we, the authors, also wrote it for ourselves and for our children. This is because it is you, this class' students, who will soon become the leaders, teachers, and resource managers of our islands. Soon your decisions will affect us all.

By *our islands* we mean **Saipan**, **Rota**, **Tinian**, **Alamagan**, and **Belau**, **Chuuk**, **Pohnpei, Yap**, **Kusaie**, **Majuro**, **Guam**, and any of the many other islands of our region. We especially focus upon the islands and nearshore seas of the US Commonwealth of the Northern Mariana Islands.

We sincerely hope that your generation will do a better job managing our islands' resources than ours has. There are many current unsolved problems. Our human population is growing. Our pollution levels are growing. Our demands upon our natural resources are increasing rapidly.

For future generations to survive and prosper, we must all learn how to better manage our lands, our fragile reefs, our forests, and our other important ecological resources. In this book, we share the information, the vocabulary, the perspectives, and the ecological processes you will need to understand to better manage our Commonwealth's vast and fragile natural resources.



This book focuses upon the islands and nearshore seas of the US Commonwealth of the Northern Mariana Islands.

1. 2. STUDY SKILLS

1. 2. 1. Active Reading

To get the most from this book, we encourage you to begin your reading in an organized manner. Keep a notebook beside you when you read your text. In it, outline what you consider to be each section's main points and its key supporting ideas and facts. At first, quickly read the assigned sections without taking notes. Then re-read the sections, taking good notes as you read.

To get the most from this book, we encourage you to begin your reading in an organized manner.

Follow a standard note-taking format. Use our paragraph and section numbering sequence to keep track of what you are reading and to manage your notes efficiently. When you do not fully understand a point, make marginal questions for that section in your notebook. Afterwards, use an outline form to recopy these reading notes.

Whenever possible, read each assigned section before the teacher begins to discuss it in class. You will have a much better understanding of the topics and this will help you to be a more **active listener**.

Re-read all sections as they are assigned. If you wish to, read ahead as well. This can help you anticipate new information. Analyze the graphics for each section you read. Try to determine why we included them and how they illustrate the points we make in the text.

1. 2. 2. Active Listening

As your teacher discusses information, pay close attention. Recall what you had read earlier. When your teacher calls for questions, refer to the notes you have already prepared in your reading notebook. They should now contain questions about the ideas that you did not completely understand.

Finding facts and figuring things out can be fun.

Do not expect the teacher to have all the answers, however. Nobody has all the answers. Be prepared to search for information about some of the topics on your own. Remember that the key part of the word research is the root word *search*. Finding facts and figuring things out can be fun, and remember, knowledge is power.

Take careful notes during all in-class presentations, whether they be from a lecture, a film, or a guest speaker. Your teacher will expect you to be responsible for the information presented. After the class is over and you have free time, re-organize your notes into a carefully written outline while the ideas are still fresh in your mind.

Notes that we scribble quickly during class often cannot be read later when we will need them to study for a test. Rewrite them carefully at your first opportunity while the content is fresh in your mind. Date each entry and be sure to record the names of films, guest speakers, and contact agencies. Use major topic headings and identify each topic's key supporting ideas and facts. Carefully redraw all presented graphics and label the important features.

You will do well on your exams if you understand the information presented in classes and in the reading assignments. Before exams, study your reading and in-class notes to recall the earlier presented material. If you organized and outlined them well, all of these notes will help you get good grades.

1. 2. 3. Field Trips

Field trips are an important part of an environmental studies course and it is common for these classes to take numerous field trips throughout the term. These can even include short walks around the school grounds.

Field trips are the center of much scientific discovery in ecology. They often encompass only short periods, yet much time and expense is often involved in making them happen. Therefore, one's time in the field is extremely valuable and should be spent in a very efficient manner. Be prepared for all field trips with appropriate dress and equipment. Always stay very close to your instructor and any guest field trip guides to hear everything they have to say.

Field trips are an important part of an environmental studies course.

Be very well behaved—always, always, and always. Field study time is *not* playtime. Be courteous to all guest speakers and respectful of others' property rights. Always obtain permission before entering another's property. Obtain a Division of Fish and Wildlife (DFW) scientific collecting permit if you are collecting specimens for later study. If requested, DFW will issue one to your teacher to cover your whole class when you are all in the field together.

Observe standard safety rules and report any injuries immediately. Learn how to use field instruments properly. Always return them promptly and in as good condition as when you received them.

Once again, develop and maintain good note-taking habits. In the field, use a pencil since ink runs if a paper gets wet. Use a mechanical pencil since it always stays sharp. Make sure it has plenty of lead and a good eraser. Get a good field notebook with a stiff backing that is both easy to write in and easy to protect from the rain. In it will be the information you recorded during your valuable field time. Secure it as you would any of your most treasured items.

When taking notes, always record the date, time, location, weather conditions, terrain and habitat information (flat, hilly, wetland, forest, beach, etc.), and the tide and lunar phase if appropriate. During your first few field trips, your teacher will likely discuss how to use your notebook to record your observations. Learn this well the first time and you will have an important skill that will last the rest of your life.

One's time in the field is extremely valuable and should be spent in a very efficient manner.

1. 3. OUR SCHOOL, COMMUNITY, AND EVEN GLOBALLY AVAILABLE LEARNING RESOURCES

1. 3. 1. The Library

Your teacher will probably arrange a class visit to your school or the community library during the first couple of weeks of school. The librarians will give you a tour of the library's facilities. They will also explain the physical organization of the books, and the card catalogue. Listen carefully.

The heart of the library is the **card catalogue**. Today many libraries also have a **computerized database**, an **on-line card catalogue** of library volumes and other learning resources. Learn how to use these research tools.

Your teacher will probably arrange a class visit to your school or the community library.

The Internet is a relatively new, and already very important research tool.

The Two Main Library Organizational Systems

Both the Library of Congress and the Dewey Decimal systems of cataloguing are used in our islands. Each library will only use one system so find out which is used. Northern Marianas College uses the Library of Congress system while Marianas High School uses the Dewey Decimal system. What systems are used at our other libraries?

Look over the section of the library's shelves where the science books are kept. Under the Dewey Decimal cataloguing system, these have the call numbers between 500 - 599 for the *pure sciences* (astronomy, physics, chemistry, geology, biology, botany, and zoology); and between 600 - 699 for the *applied sciences* (inventions, engineering, aviation, agriculture, etc.). Under the Library of Congress cataloguing system, biological and environmental science articles, books, and journals are found under the classification "Q".

Learn where the science journals are kept. Become familiar with these journals. Visit the library often when you have free time. Since it is quiet, the school's library is also a good place to study. In addition, you will learn to appreciate how others use the library's resources and how librarians can provide you with help when you are researching.

1. 3. 2. The Internet

The **Internet** is a relatively new, and already very important research tool. The "Net" is a world-wide system of fast computers providing rapid electronic access to websites. Websites are maintained locations of electronic databases, including text and graphic files. Individuals, companies, and institutions maintain websites by connecting a modem to an *always on* computing system.

One accesses *The Net* by connecting through an Internet service provider. By "surfing" the Internet (looking at one or more websites), students can find files containing an enormous variety of information. Several local libraries have Internet connections. Librarians regularly conduct classes in its use.

1. 3. 3. Other Departments and Faculty

In most schools it is the science department which teaches island ecology and resource management. However, various other academic subjects are important to good environmental management.

Resource management involves several social studies subjects. These are civics, history, law, anthropology, sociology, and geography. We also need to study issues in economics, education, and engineering.

Ecology students who seek assistance from other departments and their faculty are often rewarded with new and important perspectives. Students who discuss the environmental issues of the day with politicians and business leaders soon learn that there are no easy answers.

You will learn that there are differences of opinion on what the right thing to do is, and on how best to pay for such matters as the costs of toxic cleanups and environmental enforcement programs. Most will agree that answers to our problems can be found if we

were all willing to pay the costs. Are we all willing to pay these costs? Why should we pay to clean up someone else's mess?

For example, it is estimated that each current resident's share of the overall cost to manage our present solid waste problem will equal $1,000 per person. This is approximately 60 million dollars divided by the CNMI 1990 population of 60,000. What would you do with your share of this money if we did not need to spend it to manage our solid waste better? Should those who contribute larger amounts of waste be required to contribute more?

Would someone else have a different opinion than yours? Why? Explore the issue further. You will see that history, politics, economics, cross-cultural understanding, and engineering all have roles to play in resolving this crucial issue.

1. 3. 4. Our Communities' Available Learning Resources

Government Agencies
You will become familiar with many individuals representing numerous government agencies during this course. Each official plays a role in our government structure. Officials also have a role in protecting our natural environment.

Some employees work for a municipality, some work for the Commonwealth as a whole, and others work for US Federal agencies. See our list below: [Ed. note: Many resource management agencies are commonly referred to by their particular initials. The most commonly used initials are indicated in parentheses below].

Important Resource Management Agencies and Individuals:

A. Municipality Resource Management Authorities:
   1) Mayors and Resident Directors for public service programs
B. Commonwealth Resource Management Authorities:
   1) Governor and Lt. Governor
   2) Coastal Resources Management (CRM)
   3) Division of Environmental Quality (DEQ)
   4) Department of Lands and Natural Resources (DLNR)
   5) Division of Fish and Wildlife (DFW)
   6) Department of Public Works (DPW)
   7) Historic Preservation Office (HPO)
   8) Commonwealth Utilities Corporation (CUC)
   9) Forestry Section of the Division of Plant Industry
   10) Department of Commerce (DOC)
   11) NMC Research, Education, and Extension Services (CREES)
   12) Department of Public Lands (DPL)
C. Federal Resource Management Authorities:
   1) President, Vice President, and Cabinet
   2) US Environmental Protection Agency (EPA)
   3) US Fish and Wildlife Service (USFWS)
   4) US Army Corps of Engineers (ACOE)
   5) US Natural Resources Conservation Service (NRCS)
   6) US Forest Service
   7) US Geological Survey (USGS), Water Resources Division

8) US Geological Survey, Biological Resources Division
9) US National Marine Fisheries Service (NMFS)
10) US National Oceanic and Atmospheric Administration (NOAA)/Office of Oceans and Coastal Resources Management (OCRM)
11) US Coast Guard (USCG)
12) US Federal Emergency Management Agency (FEMA)
13) US National Park Service (NPS)
14) US Bureau of Land Managment (BLM)

Private Firms
Resource management also involves persons working in the private sector. Both our business and our government leaders often make critical decisions about our resources. Sometimes they make decisions separately. At other times these sectors work together to decide the actions to take.

Private environmental consultants and engineers often help resource managers. They provide critical information needed to make decisions. They can also make recommendations to both sectors in the environmental impact assessment reports they write.

Private organizations such as the Rota, Tinian, and Saipan Chambers of Commerce often sponsor community planning efforts. They also take part in beautification projects. Adopting a public area for a monthly cleanup is becoming a common practice for businesses.

Government agencies are regularly undertaking cleanups, too. Many private and public sector employees take part in them. Through cleanups, business leaders and employees demonstrate a commitment to contribute to our community's well being.

1. 4. SCIENCE AS A DISCOVERY PROCESS AND SCIENTIFIC KNOWLEDGE

1. 4. 1. Introduction

The word **discovery** means not knowing what something is at first, then finding out. Science is a process of discovery.

Science is not just reading information learned by *others*. Scientific learning often involves finding things out for ourselves. Science requires us to follow a process called the **scientific method** that will lead us to answers that we can be confident of.

Scientists are often called *experts*. They are not born experts; they simply follow the commonly accepted scientific method of discovery and proof and become knowledgeable.

Roger Bacon (1214-1294)
Roger Bacon was born and raised in England. He studied and later became a teacher. For a period, he taught at the University of Paris in France. The Europe of Bacon's day was undergoing a revival of learning—mostly based on the rediscovery of the written works from ancient Greece and Rome.

Most scholars of Bacon's day simply accepted and re-taught this new *knowledge* from the ancient world. Bacon had a different ap-

proach. He felt that one should not only learn by reading the earlier works, but that one should also learn by direct observation of nature.

In doing so, Bacon questioned several of the superstitious yet common beliefs of his day. As a teacher, he performed simple but revealing demonstrations for his students. He also employed careful measurements during his work. These demonstrations clearly refuted the validity of several of the superstitious beliefs.

The questioning of superstitions and the performance of these demonstrations became Bacon's trademark. They represent the principal reason he is honored today as an early pioneer in the world of science. Bacon's demonstrations introduced the concept of performing well-designed tests upon ideas, beliefs, and explanations to determine whether they are true or not.

1. 4. 2. Repeatable Results

Information about things and processes is usually considered reliable if the scientific method is used. How do we know it is reliable? One requirement of scientific knowledge is that a scientist's results can be repeated by others who duplicate the scientist's methods. This is the **repeatable** or **reproducible results** rule.

1. 4. 3. Hypotheses vs. Theories

Scientists are often asked to present their explanations about something that is unknown. **Explanations** in a sense, are the heart of science. An explanation that is not yet fully reviewed, tested, and accepted by others is called a **hypothesis**. We write a hypothesis as an explanatory statement in order to test it.

Scientists are constantly testing their own hypotheses and they test those of others as well. They do so in a carefully planned effort designed to either **prove** or **disprove** the hypothesis.

Most scientific explanations are not *proven* in the exact sense of the word. Tests are often designed to *disprove* a hypothesis. A hypothesis becomes a scientific **theory** if it survives a series of careful attempts (tests) to disprove it.

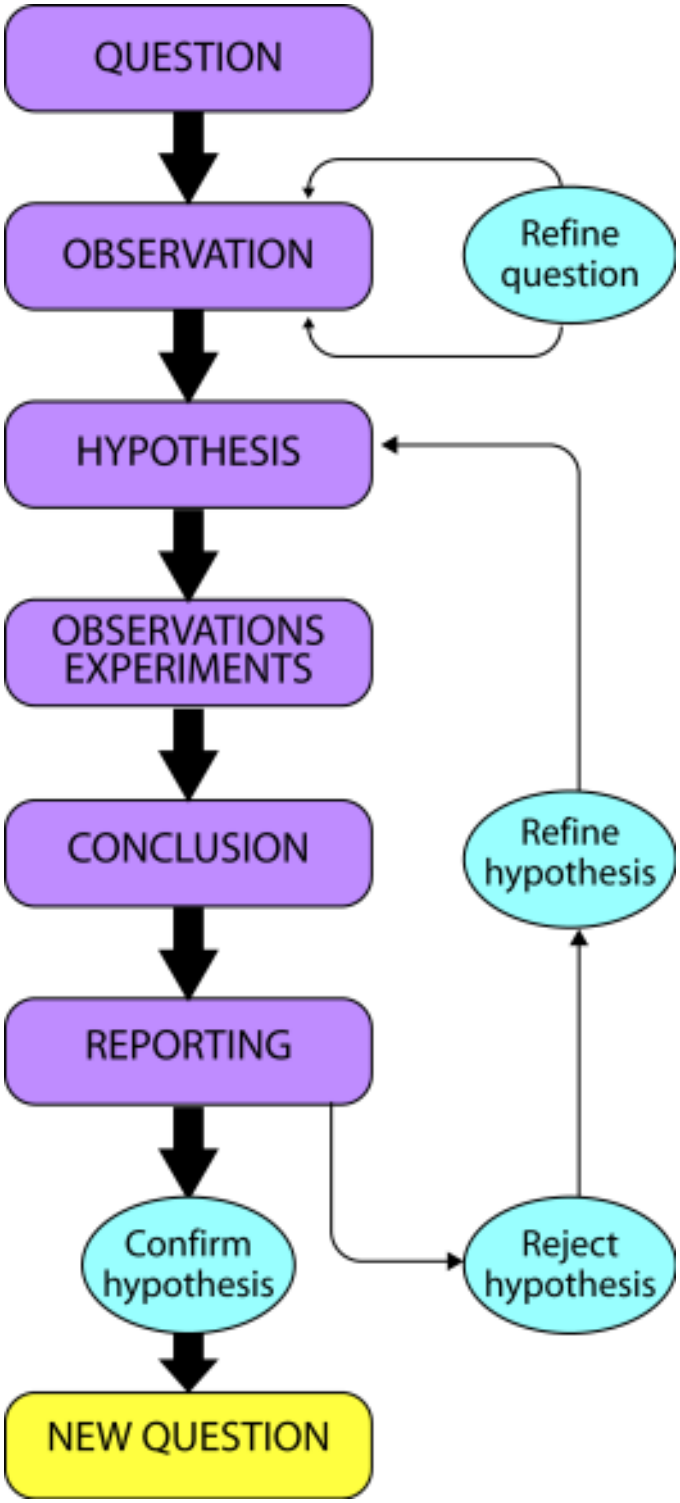
If a test shows that a hypothesis is incorrect, it is discarded. A **revised hypothesis** must be developed and new testing is begun. When a hypothesis survives testing, it is usually tested several more times before being written into a **scientific article** and **published**.

Publishing shares the explanation with other scientists. If theories and hypotheses are both explanations, how are they different from each other? Re-read this section again and see if you can find the answer.

1. 4. 4. Science vs. Faith

This brings up another essential feature of scientific knowledge. Scientific principles must be **observable** and **testable**. If they are found to be incorrect, they *must* be discarded. This demand separates science from many other academic fields and disciplines. The mandate also separates science from other learned systems that teach *knowledge*. Some of these systems include organized religions, cultural legends, and superstitions.

Roger Bacon believed that one should learn by direct observation of nature.



The scientific method involves a logical sequence of events, including reporting. The events do not always occur in the same sequence, however.

Many belief systems are based on **dogmas** that are not testable, nor are they even allowed to be considered refutable. They must be accepted only on the basis of **faith**. At the heart of most organized religions is a **central belief system** with dogmas that are rarely observable, let alone testable.

On the other hand, every idea in science is subject to challenge. Many scientific explanations of the past have been proven wrong and have been discarded. Most religions do not allow their beliefs to be challenged or discarded.

Our book has no intention of challenging anyone's faith or beliefs. What people believe is up to each person as an individual. **Anthropologists** think that many oral legends stem from an event that was observed long ago. Many plants used in traditional medicine, for example, have now been found to contain important medicinal qualities. We must remember that oral history was the only form of knowledge in our islands' early days and its present value to our society is still immense: We learn from our elders.

Many scientists have religious beliefs. If they are dedicated scientists, however, when they work and write as scientists, dogma and faith are never allowed to become part of their reasoning. They strictly follow the discovery process of science and then determine their results. Their final conclusions follow from their observations, never the other way around.

1. 4. 5. Scientific Method and Key Science Terms

Scientists spend much of their time writing their explanations into questions that can be tested. They use these explanations, both hypotheses and theories, to **predict** their test results.

Prediction is another key element of the scientific method. A prediction must be carefully tied to a hypothesis. If the hypothesis is correct, then when one conducts *such and such* a test, *such and such* will be the result. If the hypothesis is incorrect, then a different *such and such* will be the result.

Also, it is mandatory that the prediction be made before the test. Why? Only by making a prediction in advance can a test confirm if it was a good prediction (true) or a bad one (false).

These tests themselves are given a special and honored name in science. Such carefully structured tests of hypotheses are called **experiments**.

You will recall that such tests are exactly what Roger Bacon performed in his *demonstrations,* which clearly refuted the superstitious beliefs. This is why we honor him as one of the principal founders of the scientific method. Bacon introduced the critical scientific concept of experimentation.

Often scientists conduct several experiments in a session, changing only one part of the experiment at a time. These elements that are changed in an experiment are called **variables**.

1. 4. 6. Controls

A good experiment always has a **control** standard that is also tested. Controls duplicate the conditions of the test, but without any change in the variables.

Controls help keep us from reaching incorrect conclusions about what we observe in our experiments. With a control, a scientist can see if a variable is what really caused the result, or if it came from the general condition of the test itself.

1. 4. 7. Data and Records

When conducting experiments, or when otherwise making careful observations to discover information, scientists often use instruments. The observations they make are written down. They are then referred to as **data**. A single entry of data is called a **datum**. A datum can be a number, a word, or many words and many numbers.

The process of writing observations down, or placing them into an electronic database, is called recording data or making a **record**.

1. 4. 8. Numbers Count

Scientists often record their observations with numbers. Understanding what the numbers show is important in science. It is also important to learn to use numbers to find answers to questions. Being able to work with numbers and to solve math problems is very helpful in science.

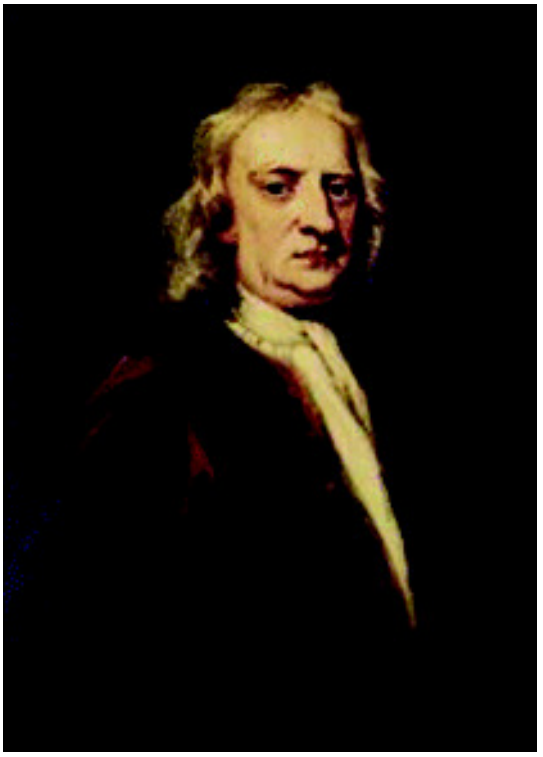
Statistics is the branch of mathematics that focuses on working with large amounts of numerical data to answer questions. **Graphing** data and statistically obtaining results helps us to see relationships between our recorded variables' characteristics.

1. 4. 9. Scientific Theories and Laws

As indicated earlier, a theory is an explanation that has survived much testing. After an overwhelming majority of leading scientists accept a scientific theory, it is often called a **scientific fact** or a **scientific law**. Almost everyone doing research in a particular field of science will refer to it this way.

The term *law* is actually reserved for fundamental explanations in science that are universally demonstrable as holding true. Scientific laws include the foundations for explanations that are widely used to predict many future experimental and observational results. An example is the **universal law of gravity**. Sir Isaac Newton developed it in 1687. He wrote about it in his publication *Principia Mathematica*. Newton offered it as an explanation of what held our universe together.

Newton's law of gravity is still the basis of our calculations of the orbits of planets and other solar system events. In 1915 Albert Einstein's **general theory of relativity** gave a more accurate explanation of the causes and nature of gravity. His findings made it possible for **physicists** to make even more accurate calculations on the nature of energy and matter.



Sir Isaac Newton, the author of Principia Mathematica

Albert Einstein developed the general theory of relativity.

1. 5. SCIENCE INCLUDES PEER REVIEW

1. 5. 1. Publishing in Journals

Scientists share their results by publishing their findings and explanations in scientific books and **journals**. The reason for the name *journal* is clear if we stop to think about it. Journal means *a daily or otherwise regular* record of happenings, like a diary, newspaper or periodical. Each journal is the *periodical reporting* by and to a group of persons interested in the same topic.

Each journal contains the experiences, methods, and findings of those who engage in a certain field of study. Examples of such fields include geology, biology, human history, etc. In fact, there are numerous journals in each of these fields.

Journals are subscribed to by institutions, research libraries, and interested individuals. By reading journals, scientists can learn about the work of other scientists, provide them with comments, and re-test their experimental methods to see if the published results are repeatable.

Each scientific journal contains the experiences, methods, and findings of those who engage in a certain field of study.

1. 5. 2. Competition to Publish

To some extent, scientists compete with one another to publish their work. This is because there are fewer commonly-read journals than there are scientists who wish to publish in them. The people who decide what to put into scientific journals are called **editors**. Usually several editors make up an **editorial review board**.

Standards are high. Since the journal's name is on the cover of the published articles, each review board's credibility and reputation are at stake. Review board members look for top quality writing, reliable research methods, and clear illustrations.

1. 5. 3. Give and Take and Accountability

Journal editors seek articles that discuss new and interesting science findings. They also look for new explanations that are well supported by scientific research. In this way, the journals help to advance the scientific learning process.

Scientists seek to learn from each other as much as possible. Scientists count on journals to provide them with the latest information about what has been discovered or refuted in their field.

Scientists and institutions pay for the journals. If they are not satisfied, they may cancel their subscriptions. Journal editors keep this in mind when choosing articles to publish. As a result, each scientist is also part of the scientific community's oversight service. Each helps to ensure that only good, accurate science is being advanced.

1. 6. LOGICAL REASONING IS A PROCESS

1. 6. 1. Introduction

Formulating and supporting new explanations is the very essence of science. Reaching correct conclusions in a logical manner is the foundation of a good explanation. Developing correct conclusions is called logical reasoning or just **logic**.

Logic is defined as the science of reasoning. The processes of logic were re-discovered during the Renaissance era (1300-1700A.D.) from Ancient Greek writings. The heart of logical reasoning is the development of a sound **argument**.

1. 6. 2. Elements of Reasoning

Reasoning occurs when one statement, the **conclusion**, is affirmed on the basis of one or more preceding statements. These statements are the **premise(s)**. The premise statements leading to the conclusion plus the conclusion make up the argument.

The process of logic has a number of formulas and rules, but the most fundamental one is this: If the conclusion follows from the premise(s), then the argument is sound or correct. If the conclusion does not follow from the premise(s), then the reasoning is incorrect. Mistakes in reasoning are often called logical **fallacies**.

1. 6. 3. Approaches to Reasoning

Logical arguments are formed in one of two ways:

Deductive reasoning claims that if the premises are true, they provide *certain* grounds for the truth of the conclusion.

Inductive reasoning only claims that if the premises are true, they provide *partial* rather than conclusive grounds for the conclusion statement. This makes the conclusion *probably true*.

Both methods of reasoning are important to scientists and resource managers. Inductive reasoning is much more commonly applied. This is because we must often make decisions when not all the information desired to support and completely test our premise statements is available.

For example, forest managers want to know the healthiness and size of all the trees in the forest area assigned to them to decide if allowing the harvest of some trees is prudent. But checking and measuring each tree is not practicable and would be far too costly.

Water quality agencies want to know the quality of each drop of water throughout an entire lagoon area to decide whether or not to post warnings concerning swimming and fishing. Again, checking out each drop or even each gallon is just not practicable.

Instead, we most often decide when we are *reasonably sure* that we are *probably* correct. In resource management work, this is due to the fact that we almost always have time and funding constraints. We often must only **survey** land or reef resources. We record our findings as **samples**.

We can usually conduct the studies for only a brief period. We then make **inferences**, hoping that our sample was very similar to the much larger, unstudied areas, which our management decisions would affect. Inferences are conclusions we make at the end of a survey. They come from the information gained from our limited-sized samples.

Since measuring every tree in the forest is not practical...

...we use statistical reasoning to reach correct conclusions.

1. 6. 4. Statistical Reasoning

Numerical data are often used to support an inferred conclusion. The organization and the use of numerical data is called **statistics**. As mentioned earlier, it is a branch of mathematics. **Statistical reasoning** is following proper statistical methods to reach correct conclusions. Many scientists use statistics to support their explanations.

1. 6. 5. Being Thorough

When a person makes observations and gathers survey evidence to show support for an explanation, this is a form of inductive reasoning. The resulting support effort often includes the application of statistical reasoning.

If it is done correctly, the statistical method gives a result that is probably true. The evidence should be of the right type, carefully documented, and as accurate as possible to provide a strong level of support for the conclusion. If it is done incorrectly, however, the result is a logical fallacy.

"Examine every possibility in your attempt to disprove your hypothesis" is common advice. Scientists do not want to present their conclusive finding of a *surviving hypothesis* with any obvious flaws in their reasoning (statistical or otherwise). This would be 'fallacious reasoning' and would undermine the conclusion.

After seeing the negative efffects of clear cutting, Theodore Roosevelt established the U.S. Forest Service.

1. 7. SOUND SCIENTIFIC RESOURCE MANAGEMENT

1. 7. 1. The Teddy Roosevelt Era and the Original U.S. Conservation Movement

Theodore (nicknamed "Teddy") **Roosevelt** traveled to and observed America's vast wilderness areas when he was only a youth. He would later become the 26th President of the United States.

Roosevelt observed areas where strip mining and vast area 'clear-cut' logging had **deforested** countrysides. He saw eroded topsoils and observed polluted streams and rivers that had formerly been abundant with fish.

Roosevelt knew that for generations, profit-seeking miners, ranchers, and lumbermen had helped themselves to our country's natural resources. By the turn of the century, eighty percent of our nation's forests were gone.

After his travels, Roosevelt resolved that if he had the opportunity he would ensure that proper resource management would be the norm for the public lands of our country. He hoped that such a plan would also become a model for private lands. When Roosevelt became president, he put his plan into effect. He served as president from 1901 to 1909. Later, many countries around the world adopted the programs that Roosevelt had fostered.

1. 7. 2. Sustainable Resource Management

A major focus of Roosevelt's plan was to establish professional government resource management agencies. These agencies managed America's public lands and natural resources. They were responsible for insuring the availability of these resources for current and future generations.

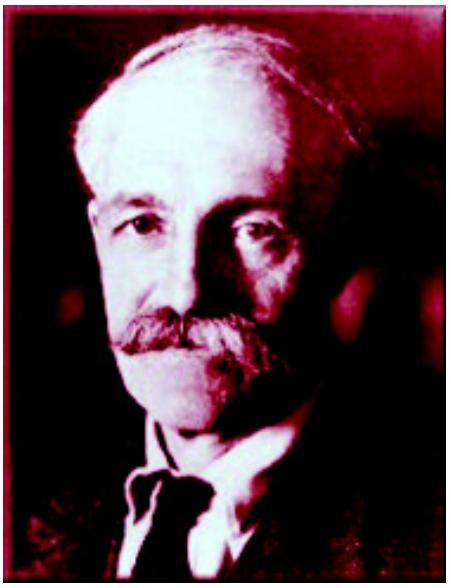
A second element of the conservation movement was the identification and establishment of certain unique, protected land areas. These were called **parks** and **wilderness** areas.

During Roosevelt's time in office, the number of national parks doubled, and 51 wildlife refuges were created. Roosevelt also set aside 150 million acres of forest and 75 million acres of mineral deposits on public lands under the U.S. Bureau of Land Managment. America's first national park, Yellowstone, was established in 1872, actually before Roosevelt's presidency. At these protected parks no logging or mining was to be allowed. The land was to remain undisturbed so people could go there and visit nature in a way least disturbing to the area's soil, plants, and animals.

1. 7. 3. Forest Service Establishment

One of the professional agencies Roosevelt established was the US Forest Service. It was charged with managing America's forest lands. Before this, America's forests were given little regard.

Gifford Pinchot, an early Forest Service Director (then Bureau of Forestry), served under Roosevelt. He helped to ensure that the principal focus of a forest's management would be for its continuing long-term use. We now use the word **sustainable** to describe what he meant.



Gifford Pinchot helped to ensure that the principal focus of a forest's management would be for its sustained use.

Pinchot required that forests be managed for the benefit of all the public, not just mining firms and logging companies. Pinchot encouraged training programs for the forests' managers, collectively called **rangers**. In these programs, rangers learned about the importance of conserving soil and the best methods to put out forest fires.

Mapping and surveying methods were taught as well. Forest tree planting programs were initiated to replace trees that were cut. Hiking trails were blazed and maintained. Forest ranger headquarters and fire watch towers were built and staffed.

1. 7. 4. Fish and Wildlife Service Establishment

The U.S. Fish and Wildlife Service is another agency established in the early conservationist era. This service is charged with protecting and enhancing wildlife habitats and ensuring against overfishing and overhunting.

Wildlife rangers learn to survey fish and wildlife populations. The goal is to carefully determine sustainable fish catches and hunting levels and not allow any animal takes above these levels. The Service establishes hunting and fishing seasons. Requirements for waterfowl and deer hunting and fishing **licenses** are also established.

U.S. Fish and Wildlife Service agents conduct surveys of wildlife populations to determine their status.

The Fish and Wildlife Service deputizes its wildlife rangers and trains them in the use of firearms. Persons caught hunting out of season are arrested and fined. Hunters who have animals in their possession beyond their **bag limits** face the same punishments. More recently, this agency has become charged with ensuring against the **extinction** of America's **endangered species**.

Later presidents, congresses, and state governments expanded on the ideas of Roosevelt and the other early conservationists. Governors and legislatures of states and insular areas established their own protected areas. They also established local professional resource management agencies.

1. 7. 5. The Soil Conservation Service and the Natural Resource Conservation Service

Theodore Roosevelt's cousin was Franklin D. Roosevelt. He became America's 32nd president. Franklin Roosevelt established the Soil Conservation Service. Its recently-changed name is now the Natural Resources Conservation Service. This agency provides landowners with workable measures to protect and conserve soil and water quality.

1. 7. 6. The 1960's Environmental Movement and the EPA's Establishment

In the 1960's, many protest movements occurred throughout the United States. Two of them were the anti-war and the pro-civil rights movements. Another, a new **environmental movement**, focused public attention on key resource management issues.

Rachel Carson wrote Silent Spring, a seminal work which helped to launch the environmental movement.

A certain *call to arms* developed in response to a book called ***Silent Spring***. It was written by a biologist named Rachel Carson. It was widely read. The book clearly implicated the overuse of strong and persistent agricultural pesticides in the deaths of many wildlife species.

One of the animal's being poisoned was America's emblem and national bird, the American bald eagle (*Haliaeetus leucocephalus*). Due to pesticides, overhunting, and habitat loss, several of America's wildlife species had already become extinct. Many more were in immediate danger of this fate.

Water pollution had gotten very bad as well. A section of a river in the U.S. state of Ohio, the Cuyahoga, actually caught on fire and burned a bridge. Oily pollutants floating on the river's surface provided enough burnable fuel to ignite the surface of the river.

Air pollution alerts due to increasing levels of **smog** were often sounded in the Los Angeles area of California. New York and other large cities of the US also had frequent **smog alerts**. The alerts required factory shut downs. Other air pollution control actions were taken as a result of the smog.

At one place, ironically called **Love Canal**, an entire community had to abandon its homes. The people were forced to move away from the area when it was discovered to have been built on a toxic waste dump. Children and other people were becoming sick because they lived so close to the toxic waste.

As a result of public protests, certain powerful reform laws made their way through the US Legislature. Congress enacted the Clean Air Act, the Clean Water Act, and the Endangered Species Act.

An Environmental Protection Agency was established. It was empowered to reverse the trends of increasing water pollution and diminishing air quality.

Every state, commonwealth, and territory is now required to set pollution standards. The federal government provides for provisions for their strict enforcement. Congress established a pollution **Superfund**. This fund pays for the costs of cleaning up toxic waste sites if no responsible party can be identified.

1. 7. 7. More National Parks and Wilderness Areas

Since the early conservationist era, many lands of the US have been designated as national, state, territory, and commonwealth parks and wilderness areas. Large tracts of parklands were established in the southwest deserts of Arizona, Utah, Nevada, and California.

New parklands were established in the mountains and forests of Wyoming, Montana, and Washington. Florida's watery everglades now has several large tracts of parklands. Many smaller national parks have also been established, protecting unique natural and cultural resources. Here in the Pacific, national parks are located in Hawaii, American Samoa, the CNMI, and Guam.

In 1979, large stretches of Alaska's public lands were declared national monuments by the 39th President, Jimmy Carter. Others were later legislatively designated as wilderness areas. These actions almost doubled the extent of America's park and wilderness regions. Carter's land designations generated a great deal of controversy. Many Alaskan citizens felt that too much of their land was being *locked up*.

1. 7. 8. The Reagan Era Backlash and Interior Secretary Watt

In the early 1980's, the American public elected Ronald Reagan to be the 40th President. He defeated Jimmy Carter. Reagan was a staunch fiscal conservative.

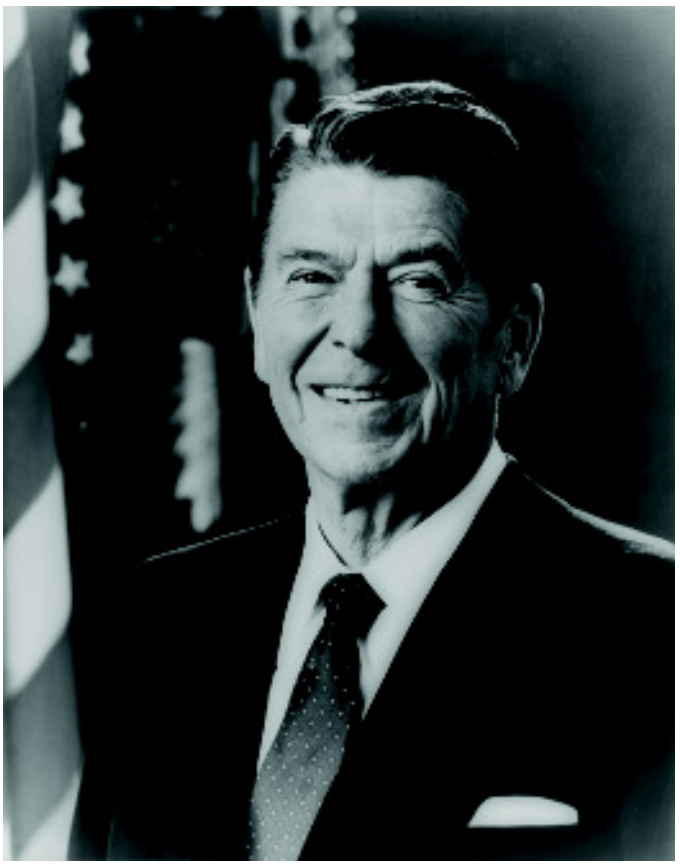
Reagan once stated in his presidential campaign that he was an **environmentalist**. However, many recalled that when he was the governor of the State of California, he had proclaimed that if a person saw one redwood tree, they had seen them all. This was when nationwide efforts were underway to protect that state's remaining majestic redwood forests.

The election of Reagan was seen as a backlash against rising inflationary costs and high taxes. These had lowered the buying power of the US dollar at home and abroad.

One of Reagan's Cabinet appointees was Interior Secretary James Watt. Watt was the leader of an anti-environmental campaign known as the '*wise use movement*'. Watt blamed the environmental movement for America's money woes. He sought to roll back the legal protections for conservation land areas and to open up public lands for large-scale resource exploitation.

As Secretary Watt tried to put his *rollback* plan into effect, Americans across the country told their congressional representatives that they valued the environment and their parklands highly.

Public surveys confirmed America's pro-environment attitude. Congress intervened in Secretary Watt's rollback attempt. He was eventually replaced.



Former Governor of California and U.S. President Ronald Reagan once stated that if a person saw one redwood tree, they had seen them all.

1. 8. OUR COMMONWEALTH'S ENVIRONMENTAL ISSUES MIRROR OUR NATION'S

1. 8. 1. Introduction

Long term residents of our islands have witnessed many of the same situations we've discussed above. Like the rest of the United States and the world in general, our population is growing rapidly. With population growth comes an increased use of our resources. The steeper the population growth curve is, the faster the resources get consumed. Sometimes this use becomes more than nature can bear.

With population growth comes an increased use of our resources.

If allowed to, island pollution rates could increase just as quickly. When we develop our economy with an inadequate infrastructure, we witness both resource shortages (such as water and power) and serious public health concerns (such as sewage-borne diseases).

It isn't as though we have not done very much planning, however. One of our chapters will show that we developed numerous professional infrastructure plans, special area management plans, and many other resource development plans over the past twenty years.

Our problem has been a lack of a consistent *political will* to carry out the recommendations of these plans. Likewise, we allow far too much of our islands' income to be exported instead of being recycled as it should be to provide for our society's needs.

Political fights over capital improvement funds, tax levels, immigration policies, and land use controls occur far more than cooperative work aimed to implement plan elements and foster sustainable growth patterns. As mentioned earlier, learning about the environment and becoming a responsible island steward includes learning about politics, economics, and planning in addition to ecology.

In 1978, the Marianas Mallard became extinct.

1. 8. 2. Species Extinctions

In 1978, a local species of duck, the Marianas Mallard, became extinct. This was due to over-hunting and the degrading of its habitat. Endemic species have become extinct on nearby Guam island, these directly due to the Brown Treesnake. Several of the life forms in our Commonwealth are listed on both the CNMI and the US Federal endangered species lists. Such listing indicates they are in serious threat of becoming extinct in the near future.

1. 8. 3. Sewage

In 1990 and 1991, over one and a half million gallons of raw sewage was pumped into the Saipan Harbor each day. It was pumped into the lagoon just north of the beautiful Micro Beach area. In the late 1980's and the 1990's, water pollution alerts caused the Division of Environmental Quality (DEQ) to threaten beach closures.

The US Environmental Protection Agency (EPA) issued administrative orders to the CNMI to upgrade its sewage treatment capacities. DEQ and the Commonwealth Utilities Corporation (CUC) worked with the EPA and other governmental agencies to effect the needed upgrades. The orders were eventually lifted.

1. 8. 4. Toxic Pollution

At the time of this book's writing, the CNMI was also under an order from the EPA to follow a time frame to close the toxic Puerto Rico shoreline dump. The dump was a source of significant air and water pollution. The CNMI was also required to identify effective measures to deal with the island's solid waste problems.

Because of our failure to follow the timeline and to take the required actions, a $125,000 fine was levied in August of 1997. Three weeks later, the EPA's fine was rescinded with statements that it was a premature action.

At the time of this book's writing, the political and economic formula for how best to deal with and pay for solid waste management in the CNMI has not been developed. Instead, a blame-laying public relations battle has ensued.

In the meantime, our shoreline trash piles grew, then they burned; the waters got increasingly polluted; and the funds for solving this problem sat in Federal and Commonwealth treasury accounts waiting to be spent.

At the time of this book's writing, some forty million dollars was identified to open a new landfill and to buy waste-reducing incinerators. Another twenty million dollars, a bare minimum, is projected to be needed to clean up and manage the current waste-filled dumpsite. [Ed. update note: On the island of Saipan, an integrated solid waste program is now being implemented. Unfortunately, many solid waste problems still remain.]

The Puerto Rico dump was a source of significant air and water pollution.

1. 8. 5. Regulatory Rollback Actions

In 1994, our own environmental rollback of sorts took place when the Saipan Legislative delegation suspended a controversial **zoning** program for a minimum of a three year period.

Just a year earlier, the Legislature had adopted the Saipan Zoning Law. At the time, an economic downturn was in effect. Some leaders blamed this zoning law for a slowdown in new construction. Other, non-regulatory factors were also blamed. Likewise, a land use plan for Tinian was shelved after being only half-completed.

Another regulatory rollback attempt occurred in 1995. There was an effort by some legislators to strip the Coastal Resources Management Program of its regulatory authorities. Commonwealth citizens then launched a petition campaign to support the CRM program.

In one week, the campaign gathered more than a thousand signatures from each of the CNMI's legislative districts. The Commonwealth Legislature then overwhelmingly defeated the rollback effort. The petition was considered to be instrumental in forcing its defeat.

1. 8. 6. Wiser Land Use Planning and a New Zoning Effort

At the time of this book's writing, leaders on Luta have opted to seek wiser land use planning. These leaders are presently seeking the designation of a major natural resource conservation area.

The idea of promoting **ecotourism** has caught hold here. More scenic overlooks, more trails, more tree planting occurring on Luta than anywhere else testifies to the pro-ecology perspective of Luta's leadership.

Designation of a protected habitat for endangered species is seen as an economic plus instead of a drawback. At the time of this book's writing, a comprehensive natural resources conservation plan is in its final stages of development.

Also at the time of this book's writing, many people on Saipan are again calling for the re-implementation of an island zoning program. A pro-zoning Governor, Pedro P. Tenorio, was elected and plans were made to develop a more acceptable and simplified zoning program.

Business leaders and banking institutions have criticized the helter-skelter, unplanned, small-scale development patterns. Foreign-owned and often poorly designed, commercial sites are popping up all over. Such community degrading 'developments' were not planned for and proper zoning laws would stop them.

(Ed. update note: Despite originally fostering zoning, the downturn of the CNMI economy at the turn of the millennium caused the Tenorio administration to put all plans for re-implementing zoning on hold.

More recently, pro-zoning Governors Juan N. Babauta and Benigno R. Fitial have both worked to implement a modified zoning program for Saipan using a step-by-step approach. Community standards are being incrementally applied to certain land areas on a priority basis.

The first phase of the zoning plan is to control adult-oriented businesses, primarily in the Paseo De Marianas in Garapan. Future plans include zoning for Saipan's main residential communities, with an eye towards the regulation of poker parlors, auto repair shops, and other 'nonconforming' land uses.)

1. 8. 7. Fish and Wildlife Program Enhancements

The CNMI is more actively addressing fishing and wildlife issues, too. At the time of this book's writing, the first class for deputizing conservation officers (C.O.'s) is currently underway. The C.O. candidates are presently attending public safety classes. Public leaders are calling for the designations of more permanent conservation lands. The Brown Treesnake threat is being more aggressively fought with the new *sniffer dog* program. New marine conservation areas were established for the waters off Saipan, Tinian, and Luta.

1. 9. TRYING TO FIGURE OUT THE RIGHT THING TO DO

Trying to figure out the *right thing to do*, is often more than just a scientific question. The three E's of economics, education, and engineering also play key roles.

1. 9. 1. Economics

As our islands' population grows, it makes good economic sense to insure a good balance of:

1) fostering new economic development;
2) building infrastructure capacity;
3) fostering public health, education and other necessary social programs; and,
4) protecting the unique legacy of our natural and cultural resources.

Economically, most private businesses and non-Commonwealth government activities that occur here bring in wealth and provide us with revenue. This revenue helps to support our local tax base. Some activities, however, actually cost our economy more than they give back to it.

Each time our government makes a permit decision, it decides whether or not to allow a proposed project to be carried out. As a democratic society we help to participate in our government's decision. We can better determine what we should and should not allow by employing good economic tools, especially a tool called a **cost/benefit analysis**.

Through well-applied economic studies, we can better understand the **direct**, as well as the indirect **secondary** and **cumulative costs**, that might accrue from each proposed development. We should properly study these costs and carefully weigh them against each project's estimated benefits. With this information we can make good decisions on behalf of our generation and those of our islands' future.

Clean, well-designed, well-located, and locally-supportive developments enhance our islands' overall economy. Poorly-designed, improperly-located, job-exportive, or polluting 'developments' only present us with excessive, publicly-borne social costs.

Non-consumptive developments providing new employment opportunities for our existing workforce can enhance our economy. This is because such income would likely be re-invested in our society. Developments which would only export our resources, or would only provide jobs to those who would export their income, merely degrade our resources for the profit of others living elsewhere.

Such developments commonly use our public land, our public utilities, and our public services. Do the tax revenues we gain from them outweigh these social costs?

Many aspects of island pollution and resource loss result from not requiring a particular development to pay for all the environmental and social costs associated with it. If agencies do not set strict conditions, then only the project owner gets the economic rewards. The public gets stuck with the wastes. Public financial resources then become depleted when we are forced to pay for the cleanup.

Several of our regulatory agencies issue permits only when project proposals clearly demonstrate that they will comply with our environmental standards. Such permits should always be written with strict conditions to insure that environmental and social costs are not passed on to the general public.

1. 9. 2. Education

Psychologists and educators tell us that human behavioral learning begins at very young ages. Clean living and good habits include such things as turning off the lights when not in a room, cleaning up after a picnic, closing water faucets tightly so they do not leak, and not over-running the water when brushing one's teeth.

Teenagers learn a great deal from observing other teenagers. Adopting good behavior modes early can benefit a person for a lifetime. If more young people would tell others who they see drawing on walls that their graffiti is ugly and not wanted, this would have a stronger influence than the best crafted laws. All of this involves public education.

The fight to protect the environment has a catch phrase: *Think Globally, Act Locally*. A popular recent environmental education campaign fostered the slogan; *Reduce, Reuse, and Recycle*. These are key messages that we who live on small islands need to heed, even more than others elsewhere. A similar key message campaign is fostered by those working to combat the serious Brown Treesnake threat. *Kill It and Call* is the slogan. Kill the snake and call the Division of Fish and Wildlife or the Emergency Management Office.

Improving our infrastructure is one solution towards addressing today's social, economic and environmental problems.

Likewise, this book is our collective attempt to put our own words into effective action. Most of us cannot, or do not wish to move away. So in essence we must live in our own self-made environments. Supporting better public education can help to achieve our goal of clean, healthy and resource-abundant islands.

1. 9. 3. Engineering

Civil engineers build our roads and ports. They construct our water and sewer lines. They also erect our public buildings. Civil engineers help us find solutions to our solid waste problems. They help us to solve our water and energy shortage problems, too. The word *civil* refers to citizenry. Civil engineers work to help meet a society's construction challenges.

These problem-solving experts do this by carefully applying federal and local capital improvement funds. They guide the use of identified funds to carry out public works, school, and utility projects. Finding the wisest and most proper way to use limited public works funds is one of the greatest challenges resource managers face.

Many of the construction projects civil engineers provide us make up our **infrastructure**. Examples include our roads, power, water, sewage systems, storm water run-off channels, bridges, etc... Improving our infrastructure is one solution towards addressing today's environmental problems.

Civil engineers often work with biologists and planners to formulate **environmental impact assessments (EIA's)**. These are required by regulatory agencies under our Commonwealth's Coastal

Resources Management Program. The EIA's explore various alternatives to proposed actions. Civil engineers work to identify engineering solutions to **mitigate** any adverse impact resulting from a development project.

1. 10. INTRODUCTORY CHAPTER CONCLUSION

At this point, it might be useful to define what is meant by **resource management**. Defining *management* is easy. It is how we control the use of something. What are these *somethings*? What are **resources**? That's a good question. To answer it we did *research*—remember what we mean by that term?

Here is our research result: The word *resources* is a loan-word taken from France (try to say it with a French accent)—*resources*. It comes from medieval times. In Europe, these were the days of the knights and lords and peasants and castles. Resources are defined as the things one holds (like in storage) and which are available for use when needed. One nearly equivalent word for the word 'resources' is *supplies*.

One can easily imagine where the word came from. Storages of food from the castle were given out to the peasants during hard times, such as droughts and plagues. The castle's *resources* also included weapons that could be used when the castle was attacked by neighboring kingdoms.

The term *island resources* then includes aspects of our islands' natural and human-made environment that we use, or which we hold in storage and care for so they will remain available for our use later. Included is our air, water, soil, forests, and fisheries, along with our schools, libraries, museums, roads, and other public facilities.

Again we extend our invitation to you to learn well and to help us care for our island's resources wisely. Just imagine what probably happened to castle owners of the early days who did not heed such a call and let their resources go to rust and ruin.