



Identifying the 3Es and Writing Criteria

Language Arts/Social Studies

Goal: Students will identify and classify the 3Es of sustainability as they relate to the possible climate change affects on a country and then develop criteria that will be used to evaluate potential solutions.

Objectives: Students will ...

- Identify and classify the 3Es of sustainability
- Determine criteria for each E identified

Materials (for a class of 30):

- 10 sets of highlighters (3 different colors per set)
- 1 set of Identifying the 3Es and Writing Criteria-Country Descriptions
- 30 copies of Identifying the 3Es and Writing Criteria-Student Sheet

Time Required: 45-60 minutes

Standards Met: LA1, LA7, G1, G2, G3, G4, G5, G6,

Procedure:

PREP

- Before class begins, cut out each of the Identifying the 3Es and Writing Criteria-Country Descriptions for distribution to the assigned groups.

IN CLASS

- Have the class divide into 10 groups of three.
- Pass out a set of highlighters to each of the groups.
- Distribute a copy of Identifying the 3Es and Writing Criteria-Student Sheet to each student.
- Allow time for the class to read the description of Underalia.
- Explain to the students that the country of Underalia is encountering many affects potentially related to climate change. These affects can be broken down into their relationship to the 3Es of sustainability.
- Tell the students that within the description one example of each of the Es has already been highlighted using the following color scheme **Environment**, **Economics** and **Equity**.
- Explain to the students it is their job to identify at least one more affect/relationship to each of the 3Es of sustainability using the same color scheme.
- Using the affects that have been classified, have the class list in Table 1 of their student sheet one criteria that they will use to rate their potential solution they will develop later in the course of the unit.
- Explain that criteria are usually no more than taking a potential affect of climate change and changing it to a "positive outcome." This is usually accomplished through the use of a quantifier – example: maximizes, increases, improves, reduces, assures, etc. One example has been supplied for each of the affects that were originally highlighted as examples in Table 1.

- After the students have completed this exercise, spend some time discussing their criteria to make sure they understand the concept.
- Pass out one country's description to each of the groups.
- Explain to the groups that they must repeat the above process using the description of the country that was assigned to them. They are to list 2 criteria for each of the 3Es (6 total criteria) in Table 2.

Assessment:

- Successful identification of the 3Es
- Completion of criteria



Identifying the 3Es and Writing Criteria - Teacher Answer Key

Name _____ Date _____

Read the description of Underalia below. Using your highlighters and the color key below, identify the affects of climate change as they relate to the 3Es of sustainability. One example for each of the Es has been done for you already.

Key:

3Es of Sustainability

Environment

Economics

Equity

Some answers are open for discussion and may be classified by the students in different ways. These are only examples.

Underalia Land has warmed by 0.7°C between 1910 and 1999, with most of the increase occurring since the 1950s. And although Underalia Land is historically prone to droughts and flash floods, the recent ones have been particularly severe. These changes are contributing to alterations in migratory patterns, geographical ranges, breeding and feeding of many forms of animal life. In 2002, abnormally high sea-surface temperatures on the reefs that are offshore of Underalia Land have caused coral bleaching which has disrupted the food chains for a variety of animals. Death of the reefs has also had an adverse affect on tourism in the area. Increases in cyclones and storm surges have caused coastal erosion forcing many inhabitants to lose property and move inland.

Summer temperatures, and droughts in Underalia Land, have increased in severity during the last 10 years. During recent summers, there has been an increase in heat related deaths in the elderly population. Vector borne disease, such as malaria has also been on the rise. These increases in health related issues are beginning to influence the cost of health care. The indigenous population of Underalia Land is more subject to climate change because their health status in general is worse than the average inhabitant of Underalia Land.

With the increase in summer temperatures, the demands for and costs of energy production for such things as air conditioning have rose dramatically. Agricultural lands and the supply of freshwater for irrigation and drinking are also declining in many areas of the country, especially for the indigenous populations. Existing social disadvantage of indigenous people reduces their coping ability and may restrict adaptive capacity to these temperature extremes. Also, extreme changes to mangroves and increases in bush fires will cause problems to many indigenous groups.

****Criteria for Tables 1 and 2 will vary depending upon the Es that have been identified and the country that has been assigned.****



Identifying the 3Es and Writing Criteria - Student Sheet

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Criteria: A standard on which a judgment or decision is made. In this case, determining which action is the most sustainable.

Take into consideration that criteria are:

√ Tied to the 3Es of Sustainability

√ Factors to weigh or measure your action ideas to help you decide which is the most sustainable

Table 1 -- Underalia

| |
|--|
| Criteria for Evaluating the most Sustainable Action Plan |
| Environmental: |
| 1. Reduces erosion |
| 2. |
| Equity: |
| 1. Provides adequate healthcare to all inhabitants |
| 2. |
| Economic: |
| 1. Improves tourism |
| 2. |

Table 2 – Your Country's Name is _____

| |
|--|
| Criteria for Evaluating the most Sustainable Action Plan |
| Environmental: |
| 1. |
| 2. |
| Equity: |
| 1. |
| 2. |
| Economic: |
| 1. |
| 2. |



Identifying the 3Es and Writing Criteria - Student Sheet

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Table 2 – Your Country’s Name is _____

| |
|--|
| Criteria for Evaluating the most Sustainable Action Plan |
| Environmental: |
| 1. |
| 2. |
| Equity: |
| 1. |
| 2. |
| Economic: |
| 1. |
| 2. |



Identifying the 3Es and Writing Criteria-Country Descriptions

Napinsany

This year in Napinsany it hasn't rained all spring and summer and because of the lack of water farmers have lost close to 100% of their leguminous and cereal harvest. This has seriously impacted the potential income in the rural areas of the country. Farmers all across the country have been hit by the drought. Small sustenance farms are incurring more of a financial impact than larger commercial farms.

But it's not the first time Napinsany has suffered from climate change. They have been noticing climate impacts for many years now. Unfortunately, the problems have increased massively over the past few years and nowadays it's not only affecting the agriculture but also tourism due to the excessively hot and dry summers.

Over the last few years, the seasonal cycle has changed: it goes directly from summer to winter and from winter to summer. Spring and autumn seem to have disappeared completely. These changes have occurred so suddenly that they are affecting Napinsany's farming cycles. It is difficult to adjust the farming cycle to all these unexpected frosts that occur at the most unusual dates or to unexpected heat waves that arrive much earlier than they used to. It seems that the weather has gone crazy: summer and winter get mixed up when you have snow in May and extreme heat in February like this year. That's just not normal.

In 2005, Napinsany underwent the worst drought since the beginning of data registration 120 years ago. Water rationing has been implemented in large parts of the country. Many small villages have to travel long distances to obtain drinking water. Napinsany has asked for aid in needed cereals because Napinsany farmers haven't been able to cover the country's demand this year. Climate modeling suggests that if global greenhouse gas emissions continue at the current rate, by 2020 one in two summers in Napinsany is likely to be as hot as the record-breaking summer of 2003.

Napinsany is warming faster than other parts of the world. If global average temperatures rise by 2°C above pre-industrial levels, Napinsany summer inland temperatures are likely to rise by an average of 4 to 5°C. The center of Napinsany will potentially experience an extra six weeks of days with temperatures over 35°C. Napinsany coastal areas could experience an average of two extra weeks above 35°C. In June 2005, the Napinsany government suggested that a third of the country could become desert-like as climate change exacerbates the loss of topsoil caused by overgrazing.

Westmoasa

Westmoasa has begun to notice that the fish and shellfish that used to be gathered so easily are getting harder to find. There also used to be colorful, live coral from the edge of the beach out to the reef, but now everything has gone white. The destruction of the reefs has led to a decrease in tourism.

The sea is slowly eroding the coastline affecting small native habitats as well as beachfront resort areas. Local fishermen used to catch enough fish in the shallows but now they have to go further out, and the women are spending longer and longer helping the men fish in the seawater. Fish used to bite quickly – now fisherman can spend more than an hour in the seawater before they get a single bite.

The fish are often tiny, barely enough for a meal for the local fishermen's families much less enough to sell commercially. One of Westmoasa's great delicacies, the gera shellfish, is now very difficult to find.

The sea is slowly eroding Westmoasa's coastline and spreading the sand over fishing grounds. The seagrass beds have also spread quickly which is clogging up the natural flow of water within the fishing grounds and burying the coral.

Westmoasa is also experiencing severe sea flooding. As the sea levels continue to rise, several king tides have hit the island. Saltwater intrusion affects the quality of water in wells, floods agricultural lands, gardens, and puts stress on plants/trees, which are very important to the life and culture of Westmoasa. Increased sea levels and saltwater intrusion have reduced mangrove tree populations. Mangrove roots protect coastlines from erosion, but as sea levels rise over time mangroves migrate toward the land. If they eventually reach a sea wall or other barrier, they may be reduced to a narrow strip of trees or may disappear altogether. Westmoasa depends on rainfall and natural filters such as mangroves to maintain a clean supply of freshwater. Rising sea levels cause salt water to move farther inland often contaminating drinking water sources.

Mangroves act as natural filters preventing sediment and toxins from reaching Westmoasa's water sources. Reduction of the mangrove habitat from rising sea levels would allow more sediments and pollutants to move inland polluting fresh water sources. Loss of mangrove and coral reef habitats means reduced food resources for the inhabitants of Westmoasa. Mangroves provide habitats for many types of seafood, including crabs, clams, and fish. Coral reefs likewise provide habitat for many fish.

The potential socio-economic impacts of climate change on Westmoasa have been estimated in a series of vulnerability studies. Depending on the worst-case scenario (one meter sea level rise), the studies suggest that sea level rise will have negative impacts on tourism, freshwater availability and quality, aquaculture, agriculture, human settlements, financial services and human health. Storm surges are likely to have a harmful impact on low-lying structures.

Ebaliza

Weather patterns in Ebaliza have changed. It's very unpredictable now. The cold weather comes in spurts - it used to come in early December and stay for weeks. Now, cold, rainy weather stays only a day or two. April weather appears in June, for example. June is the beginning of the rainy season in Ebaliza, and there is usually significant rainfall within this month up until the ending of the season in November. It's all mixed up now. Ebaliza used to know what to expect at certain times of year but since the past three years or so, it has become very unpredictable.

Storms in general, such as big "southwesters," have changed a lot. These used to occur mainly during the rainy season (June-November) but now they are unpredictable occurring at different times within the year. Heavy rainfalls associated with these storms have caused flash floods and mudslides in the northern part of the country. Sediment runoffs from the north affect fishing and diving for lobster, an important economic base for the area. Floodwater flushes down from the rivers carrying heavy sediment making it hard to fish.

The northern coast is undergoing coastal erosion, as are the islands off the coast. Some of these off shore islands are almost under water resulting in the migration of the local natives of these islands to the coast. The water level seems to be rising over the past five years or so.

The impact of hurricanes, which seem to be increasing in intensity and frequency and human development is destroying mangrove habitats along Ebaliza's mainland and outer cayes (small, low islands consisting mostly of coral). Rising sea levels are also affecting mangrove populations. Mangroves act as natural filters, preventing sediment and toxins from reaching Ebaliza's water sources. Reduction of mangrove habitats from rising sea levels would allow more sediments and pollutants to move inland polluting fresh water sources. Loss of mangrove and coral reef habitats means reduced food resources for the inhabitants of Ebaliza. Mangroves provide habitat for many types of seafood, including crabs, clams, and fish. Coral reefs likewise provide habitat for many fish.

During April and May, Ebaliza used to have a lot of birds migrating throughout the country. The increase in annual temperatures is having a detrimental effect on their natural nesting grounds. It is getting much warmer now. Both the air and waters are getting warmer. The warming of the sea is believed to be causing the bleaching of the corals. The corals, for example, were greatly affected in late 1998 by bleaching due to warming sea temperatures. This has a very adverse affect on local fishing and tourism.

Whenever there is heavy rain downfall, there are agricultural chemicals run-offs to sea. Besides warmer sea temperature, corals are also dying from pesticides washing down the coast. An important economic crop for locals of the area, Lobsters and conchs are become very scarce. Some species of amphibians have disappeared in the cloud forest regions of Ebaliza, and climate change may have been a factor in their extinction.

Infirdiddy

In Infirdiddy the sea level is rising - partly as a response to climate change. Low lying coastal areas are vanishing from the map. This is the home of millions of inhabitants. Many of these people are living in poverty and will find it very difficult to move inland to find new land for their families. The problem is compounded by rapid population growth in this area.

These coastal areas, as well as the small islands offshore of Infirdiddy, are hard to access because of poor infrastructure yet more and more families are flocking into these very vulnerable areas to make a living from the sea. As the waters rise, it is expected that they will submerge the entire coastal region, home to many animal species and destroy the main source of food and income to millions of individuals.

The effects of climate change are being felt in cities too. Heavily populated urban areas are running short on sources of potable freshwater. Increases in average temperatures are contributing to an increase in parasitic diseases. In rural areas, villagers are sucking the ground dry with the tube wells they use to irrigate their crops. Many of these crops are failing due to insufficient irrigation. Farmers are now taking water directly from the river to supplement the wells but if the glaciers in the northern mountainous areas of the country continue to recede, so will the summer flow of the river.

Typically mild in temperature, Infirdiddy is experiencing a decline in rainfall and experiencing more intense weather conditions such as cyclones. Scientists predict that by the end of the century the country will experience a 3 to 5°C temperature increase.

The livelihood of a vast population in Infirdiddy depends on agriculture, forestry, wetlands and fisheries and land use in these areas is strongly influenced by water-based ecosystems that depend on monsoon rains, which are becoming unpredictable. Changes to the water cycle may also cause an increase in water borne diseases such as cholera and hepatitis, as well as diseases carried by insects such as malaria.

Yanikia

Yanikia has witnessed remarkable changes in the climate in the last few decades. The rainy season in Yanikia was known to start in mid-April, but it has shifted to June when it used to end. The rainfall pattern has become unpredictable and unreliable. This has made it more challenging to plan any agricultural activities.

Changes in temperature are also occurring. Although daytime temperatures seem to have gone up, the number of cold nights appears to have increased as well occurring in different months. The type of cold has changed as well. The month of July used to be cold and misty. However, nowadays the cold is much drier. This has caused an increase in the number of children suffering from pneumonia.

Malaria has long been endemic to Yanikia's humid coast and swampy lowland regions, but it is now spreading to normally cooler, higher elevations. Many medical and environmental experts attribute the spike in malaria to climate change, in the form of warmer temperatures and variations in rainfall patterns.

Since 1996, agricultural production has been declining in Yanikia. Warmer and drier weather has affected agriculture in the region. Some of the edible insects that people used to depend on when food was scarce are now extinct. People are now even more dependent on the food crops they grow, which are vulnerable to changes in rainfall.

The ice on the tallest mountain in Yanikia is drying up. Increases in temperature are melting the ice and snow that has crowned Yanikia's highest peak for more than 11,000 years, dramatically altering the surrounding ecosystem. Scientists have already started seeing a decrease in the amount of water supply to the remote lowland areas around the mountain, which will likely generate a whole range of impacts on rural and economically stressed communities. Yanikia's economy is overwhelmingly agriculture-based and highly susceptible even to minute variations in temperature and rainfall.

Yanikia farmers often labor without the most basic of irrigation systems. Burdened by decades of underdevelopment and impoverishment, the agricultural industry is now increasingly crippled by periodic droughts.

Unstattica

Climate change is beginning to affect Unstattica throughout the country. In the northern areas, permafrost thawing has caused the ground to subside 16-33 ft. since the 1960's, which limits the range for animal's movement, increases insect populations and has caused havoc to manmade structures. It is becoming more dangerous for local natives of the northern regions of Unstattica to travel across the land by snowmobile or dog team and more difficult for them to hunt for food in the wintertime. Lakes are draining into the thawed ground and many have dried up completely. The beavers have had to move from the lakes to the rivers, and there has been a drop in the population of muskrats. While there used to be hundreds of geese flocking in the springtime, hunters now see only five or six geese at a time. Some fish populations are also disappearing causing problems for both bears and people who rely on them as a food staple.

Shorelines have been retreating in much of Unstattica for well over a century. In areas with gradually sloping coasts, shore lines are likely to recede as much as 200 times the amount of the sea level rise. A one-foot rise in sea level might well translate to a 200-foot retreat of shoreline with loss of several rows of homes.

If sea level rise accelerates as climate change scenarios project, the losses of property will be even greater than anticipated. Extensive losses of coastal wetlands and beaches seem likely. In past eras of sea level rise, wetlands and beaches could retreat naturally inland but roads and coastal structures have closed off this option of natural retreat in much of Unstattica's coastline. The result is that the total area of beaches and wetlands may diminish greatly over this century. This could have a dramatic affect on the coastal tourism industry.

Climate change may also increase the risk of some infectious diseases, particularly those diseases that appear only in warm areas. Deadly diseases often associated with hot weather, like the West Nile virus, Cholera and Lyme disease, may increase throughout Unstattica because increased temperatures in these areas allow disease carriers like mosquitoes, ticks, and mice to thrive. For instance, the number of cases of West Nile in Unstattica has ballooned exponentially since 1999.

Some scientists believe that algal blooms could occur more frequently as temperatures warm--particularly in areas with polluted waters. Diseases such as cholera that tend to accompany algal blooms could become more frequent. Malaria is rare in Unstattica, even in warmer regions where the mosquito that transmits the disease is found, because this country has the ability to rapidly identify and contain outbreaks when they appear. However if temperatures continue to increase, containment and control may become very difficult especially in lower income areas that do not have ready access to medical facilities.

Gamtulala

Gamtulala is being plagued by mudslides that are brought on by excessive rain. Other parts of the country are becoming almost desert-like. Severe storms are not uncommon and are becoming stronger every year. It is expected that climate change will exacerbate the vulnerability of people and pose new threats such as availability of fresh water supplies and efficiency of local sewerage systems; availability of food; distribution and seasonal transmission of vector-borne infectious diseases.

Climate change in Gamtulala has exposed inhabitants to new or intensified health threats, particularly from infectious diseases. Dengue fever and malaria are likely to spread as mosquitoes and other vectors move into areas that were previously too cold or dry. In 2001, the Intergovernmental Panel on Climate Change report on impacts, vulnerability and adaptation to climate change found that the incidence of water-borne diseases, such as cholera and diarrhea, would increase in geographical areas similar to Gamtulala.

Gamtulala is particularly affected when extreme weather events such as hurricanes, which appear to be on the increase, damage health and sanitary infrastructure. Vulnerable groups such as the elderly and the very young are experiencing higher heat related morbidity and mortality, and are disproportionately affected by increased ozone and smog formation in higher temperatures. Allergies are also increasing. Rising ambient temperatures increase risks associated with aquatic pathogens in important fisheries and accelerate the spoiling of food and meat.

Security of food supply is a fundamental determinant of human wellbeing. Food production is a major source of employment and export earnings. The adverse effects of climate change on agriculture are disproportionately burdening poor inhabitants. Much of the population of Gamtulala experiences inadequate food security, from malnutrition to the extreme of intermittent famine. This is multiplied by climate change related extreme weather events.

Climate change has also reduced commercial farming and fisheries yields upon which Gamtulala relies on for export earnings. Grain cropping production and forestry are starting to show a decline. On the coast, sea level rising is affecting natural barriers such as mangroves, which are then threatening coastal farmlands. Valuable estuarine fisheries may be lost.

Many rural populations in Gamtulala are already very poor and have few resources with which to adapt their farm practices or endure more frequent bad seasons. The World Bank notes that at least 70% of the rural population in Gamtulala lives in poverty.

As farmlands fail, people in Gamtulala will migrate to urban areas. The major long-term impact is likely to be severe housing shortages and overcrowding as rural populations are displaced by drought and flooding. The lack of safe water and sanitary infrastructure in emergency camps or slum areas could seriously increase the incidence of mortality and morbidity from transmissible diseases.

Ziralia

Ziralia has already started to show the effects of climate change. Tropical cyclones have increased and rises in sea levels are covering some coastal areas, causing coastal inhabitants to migrate inland. Coastal resort areas are also being forced to make adaptation to assure the sustainability of a strong tourism industry. A disastrous 2005 drought in Ziralia's main river basin killed crops, kindled forest fires, dried up transportation routes, caused disease and wreaked economic havoc. An estimated 40% of the biodiversity of the area was put at risk.

The freshwater fishing industry of the river basin, an economic factor for local natives, is beginning to show signs of stress. Recently, the first hurricane reported in history caused heavy damage on Ziralia's southeast coast. Tornadoes have also shown a dramatic increase in recent years having devastating effects on poorly constructed rural housing that offer little or no shelter in the event of severe storms.

Minimum temperatures are elevating in many regions of Ziralia. This elevation varies from 1°C to 3°C, depending on the proximity to the coast. The maximum temperatures have also risen but in much smaller variations.

If temperatures continue to increase, grain production could become unfeasible in the south of Ziralia, stimulating more rural exodus. The migration of crops northward could cause greater deforestation of the rainforest of Ziralia, which would reduce the transportation of humidity and rains to the Southern Ziralia.

Increasingly intense rains are beginning to affect the cities, with great social impact in the poorer districts, especially on hillside habitats prone to flash floods and mudslides. Higher temperatures are increasing the incidence of sicknesses and infant and senior mortality.

Coolandria

In past centuries, climate variability has had dramatic effects on the lives of Coolandrians. Recently, yearly changes in temperature have led to substantial variation in agricultural yields, including hay for livestock. For example, a 1°C change in annual temperature can alter hay production by 20% in the most fertile regions. Small farms are being forced out of production.

Deteriorating climate is beginning to reduce the capacity of the vegetation to support livestock grazing, resulting in widespread erosion. Given the harsh environment, small temperature changes in the future could affect the balance between re-growth and erosion in many parts of the country. Lack of vegetation could affect the population of Coolandria's few native species.

One of the greatest concerns for Coolandria is the potential effect of climate change on ocean circulation, because of the importance of the fishing industries. Even small changes could substantially affect fish stocks in the seas around Coolandria, though predicting future change is difficult. It is clear, however, that primary productivity (by photosynthetic algae), distribution of fish stocks and the location of spawning grounds all depend on currents and ocean temperature.

In the mid-1960s, large-scale physical changes took place in the seas north of Coolandria. These physical changes had ecological consequences that led to the loss of the herring's main food supply. Severe environmental stress, combined with heavy fishing pressure, drove the herring stocks toward collapse. Over fishing alone was sometimes the culprit, but over fishing during times of adverse climatic conditions has been particularly lethal.

Glaciers cover about 10% of Coolandria. Warmer temperatures have increased melt-water from these glaciers, increasing the flow in glacial rivers. Sea level rise is also a concern, as the population of Coolandria is primarily located in settlements along the coast. Coolandria is assessing the potential increase in flooding and land erosion, along with available measures to minimize consequent damages to roads, harbors and property. Potential sea level rise will also necessitate rebuilding harbor infrastructure.

Nichicia

Early in 2005, a comprehensive assessment of environmental and climate change in Nichicia showed that the effects of climate change in Nichicia are similar to those in the rest of the world. During the past century, the average temperature in Nichicia increased by 0.6-0.8 degrees Celsius. In the past 50 years, sea levels rose by between 1-2.5 millimeters each year.

Climate change is making Nichicia more vulnerable to damage caused by rising sea levels, drought, flooding, tropical cyclones, sand storms, and heat waves. Although a warmer climate will increase the amount of land available for farming, extreme weather could reduce agricultural yield by 10%. This will have a dramatic effect on the small sustenance farmers in many rural areas. In 2004 alone, drought and floods damaged more than 37 million hectares of arable crops, leaving more than four million of them barren. Agricultural economies in certain parts of the country are declining causing many inhabitants to migrate into large urban areas looking for jobs to support their families.

Nichicia has several climatic zones and a varied physical environment. Northwest Nichicia is a largely arid and semi-arid, fragile environment that is highly vulnerable to climate change. In northeast Nichicia, a warmer climate might increase agricultural production, but extreme weather events, such as storms and flooding, would cause serious damage to rice crops.

In central and eastern Nichicia, winters are cold and summers are hot. The building industry in these regions is using more and more energy. Coastal areas in the south and east are densely populated and a rise in sea levels could greatly damage the economically dynamic and prosperous delta areas of Nichicia.

The far northern mountainous areas of Nichicia, which has one of the most diverse temperate ecosystems on Earth, is threatened by rising temperatures that are double the average global trend. One of the biggest indicators of this warming trend in has been the receding glaciers of the high plateau areas. Several large rivers in Nichicia are showing a decline in flow, threatening major shipping lanes.