

# CARPE SCIENTIAM:

## Integrating Environmental Science and Classical Studies



Interdisciplinary Curriculum Units Exploring:

climate

water

population

land use

agriculture and food production

ecosystem disruption

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# **CARPE SCIENTIAM**

## **Climate**

## CLIMATE: CURRENT SITUATION

### Causes of Global Warming: Article

*Please read the following article and respond to the questions below.*

(CNN) -- If you want to learn about climate change, ask oceanographer Sylvia Earle. Twenty miles off the coast of Georgia, she has seen the fossilized evidence that mastodons and humans lived here 10,000 years ago. "Clearly, sea level goes up and sea level goes down," she says. "There are natural cycles."

Think of those cycles this way: Consider the Earth to be wrapped in a blanket -- in this case, a blanket of gases. Among the ingredients are water vapor, carbon dioxide and methane. This blanket insulates the Earth by trapping heat, a lot like panes of glass in a greenhouse

"It is part of what makes the planet work," Earle says. "Plants and human beings and animals generally produce carbon dioxide as part of the living process. Methane is a natural gas, and it is produced by the natural system." Indeed, gaseous emissions from livestock are a major source of methane.

Without greenhouse gases, the Earth would be much too cold for comfort, unable to sustain life as we know it. But the problem now is that humans are thickening the blanket by producing a lot of greenhouse gases by burning fossil fuels. As a result, more heat is trapped -- and, scientists say, nature's thermostat is nudged up. "It is like pushing the fast forward button -- speeding up the process, accelerating what may be part of the natural process," Earle says.

#### Top Greenhouse Gas Emitters (in percentages)

- US: 19.1
- China: 9.9
- Japan: 5.1
- Brazil: 4.3
- Germany: 3.8
- India: 3.7
- United Kingdom: 2.4
- Indonesia: 1.9
- Italy: 1.7

#### FACTOIDS

**The 10 warmest years on record (since the 1880s) have taken place in the last 15 years.**

**The family of greenhouse gases includes carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons, hydrofluorocarbons and perfluorinated carbons.**

**Carbon dioxide is believed to be responsible for 70% of global warming.**

The planet is littered with proof that pushing the fast forward button on the climate machine can mean big trouble. Sixty-five million years ago, scientists believe, an asteroid augered into what is now Mexico, kicking up the mother of all dust storms. The sun's rays were blocked. Plants and trees died en masse. And it was soon curtains for the dinosaurs.

Ironically, though, that laid the groundwork for the climate troubles we're having today. When the dust settled, mammals -- and ultimately humans -- had a clear path to dominate the planet. We invented the sport utility vehicle, while the dinosaurs quietly decomposed into fossil fuels, eventually becoming unleaded gasoline. While doomsayers aren't predicting that we are headed the way of the dinosaurs, they do have some sobering forecasts.

It's a bleak outlook, and Earle believes we must do something to avoid it.

"This is a pivotal time in history, and I think as such we should take the responsibility pretty seriously and look at what we can do," she says.

### **Causes of Global Warming: Questions for Comprehension & Discussion**

1. How do animals contribute to global warming?
2. How do humans contribute to global warming?
3. Why are greenhouse gases important?
4. How did the dinosaurs die, according to this article? What does that have to do with global warming?
5. Which country emits the most greenhouse gases? Why is this so?
6. What do many of the greenhouse gases have in common? Why is this? What are their sources?

### **Causes of Global Warming: Activity**

Imagine that you are the head of a large pro-environment group. Global warming and climate change is again in the news, and you wish to inform the public about the causes of global warming. Craft a press release for distribution to the media that explains the causes of global warming in language that is easy to understand.

## CLIMATE: CURRENT SITUATION

### **Signs of a Warming World: Article**

*Please read the following article and respond to the questions below.*

(CNN) -- Anyone who thinks the most notable effect of rising global temperatures would be the advent of soft spring breezes from Siberia to the Tierra del Fuego is sorely mistaken, if scientists' models are to be believed.

The preponderance of scientific thought today sees the next 100 years as a time of traumatic environmental change. The United Nations Intergovernmental Panel on Climate Change (IPCC) projects a rise in average global temperature of about 1-3.5 degrees Celsius by the year 2100. Warming in this range is cause for concern, if not alarm.

Scientific modeling produced by some of the world's most advanced supercomputers has depicted a series of scenarios that might result from global warming. Here's a look at what some scientists say might happen:

#### ➤ **Impact on land**

The current boundaries of year-round farming are pushed farther to the north and south as temperatures moderate. But the lands today considered the bread baskets of the world are left with reduced crop yields.

That's because moisture in the soil evaporates at higher rates as the overall temperature rises, and soil moisture is a key to plant growth. So more rain should be falling somewhere, but it's unlikely to make up for the lost moisture in what had been the planet's most fertile fields.

The deserts found in the mid-latitudes are also expected to expand, even as regions of arable land move north and south. The growth of desert areas can already be observed in North Africa's voracious Sahara.

FACT: The U.N. World Health Organization reported in 1996 that malaria and dengue fever could reach epidemic levels and spread farther from the equator as a result of a warmer climate.

- ✓ Range of arable land expands south and north
- ✓ Soil drier due to higher evaporation rates
- ✓ Increased CO<sub>2</sub> aids some plant growth
- ✓ Habitats for some animals shrink
- ✓ Range of insects likely to expand

### ➤ **Impact on water**

Rising waters, the result of melting polar ice caps and water expansion from increasing warmth, are the most widely anticipated consequence of a warming world. The U.N.'s IPCC projects that the world's oceans will rise anywhere from 15 to 95 centimeters by the year 2100.

This may not sound like much, but figures at the high end of that scale would rob a low-lying nation like Bangladesh of over 20 percent of its arable land. And it could put the city of New Orleans underwater. At the low end of the scale, rising waters would increase coastal erosion and heighten the damaging effects of hurricanes and other coastal storms.

Encroaching salt water has the potential to contaminate the water supplies that coastal cities and farms depend on. The rising ocean finds it easier to make its way inland as the level of coastal rivers and streams drop with the drying of the soil. Aside from the outright loss of land to the ocean, the threat of contaminated water supplies is perhaps the most serious problem posed by rising sea levels.

FACT: The Reinsurance Association of America, the trade group for the companies which insure insurance companies, have urged strong action on global warming. The five costliest years for U.S. insurance payouts for floods and storms have happened in the 1990s.

- ✓ Sea level rises due to melting ice caps, warming water
- ✓ High water eats away at, or submerges, coastal land
- ✓ Sea water contaminates some drinking water supplies
- ✓ Water levels drop in some rivers, streams

### ➤ **Impact on air**

What will happen to the atmosphere itself during global warming is unclear. Cloud cover should increase with the higher rates of evaporation, but scientists are unsure where the moisture will go.

Clouds closer to the earth's surface reflect sunlight, producing an overall cooling effect. Clouds higher up in the atmosphere, however, have the effect of trapping heat and warming the planet. Where the extra moisture in the atmosphere ends up -- high or low -- could determine how much of an impact of global warming has on the environment.

- ✓ Cloud cover increases
- ✓ Levels of the greenhouse gas methane may increase
- ✓ Hurricanes range farther north, south on warmer water

## **Signs of a Warming World: Questions for Comprehension & Discussion**

How might global warming affect land, water, and air?

## **Signs of a Warming World: Activities**

1. Imagine that you have just watched an episode of CNN's "Crossfire" program that included heated (ha!) debate among Mr. Terra Firma (representing the land), Mr. Aqua Drop (representing the water), and Ms. Swift Wind (representing the air). The topic of this episode was: "Global Warming: Whom Does it Affect More?" Write a script for this episode.
2. You are a famous photographer and graphic designer. A major environmental group has hired you to put together a photoessay documenting the causes of global warming, including the sources and results of pollution. You may wish to use the World Wide Web to help you locate images for your photoessay.

## CLIMATE: CURRENT SITUATION

### **The Global Warming Debate: Article**

*Please read the following article and respond to the questions below.*

(CNN) -- Solving the global warming problem will take money so it's no surprise that the most vocal opponents of drastic action are the very industries that would bear the biggest financial burden -- factories, utilities and other businesses that release large amounts of so-called "greenhouse" gases into the atmosphere.

Those gases, combined with solar radiation, act like a greenhouse to trap the planet's heat. Carbon dioxide, from burning fossil fuels such as gasoline, is the primary greenhouse gas. Other culprits are methane and hydroflourocarbons, or HFCs.

As a result, notes Gail McDonald of the Global Climate Coalition, any solution will have an economic impact felt by individuals as well as businesses. Estimates of the impact of shifting away from oil and coal energy sources vary widely. Some computer models predict severe dislocations in industries that use a lot of energy, the loss of 1.5 million jobs and a 2 percent economic decline because of increased energy costs.

Other studies, including one by the Energy Department, say economic costs could be contained by heavy investment in new technologies for energy efficiency and a pollution permit trading system. Some costs, these studies suggest, would be offset by environmental benefits.

#### ➤ **Global warming skeptics**

In addition to economic opposition, there are also skeptics -- including some climate scientists -- who doubt global warming exists at all. They contend computer models forecasting the scope of the problem are unreliable and other factors could mitigate warming, such as clouds and oceans.

Still, most scientists acknowledge the Earth is heating up and that people are partly to blame. The more common disagreements are how much hotter it is likely to get. And how fast. That, says McDonald, leaves industry groups urging a limited approach to the problem until science understands it better.

But environmentalists and others -- including many in the Clinton administration -- say industry's call for more research sounds like a familiar delaying tactic.

"They did it to (delay) getting lead out of gasoline. They were against controlling freon -- the chemicals destroying the ozone layer. Now, they're moving out again in opposition to sensible steps to do something about global warming," says Interior Secretary Bruce Babbitt. Babbitt and others pushing for prompt action on global warming say waiting is a luxury the Earth doesn't have.

## **The Global Warming Debate: Questions for Comprehension & Discussion**

1. Which groups will pay the most to solve the global warming problem, and why?
2. What effects will the shifting of the economy away from oil and coal have? How might these economic costs be counteracted?
3. Why are some skeptical about global warming?
4. How do some interpret industry's desire for more research into the global warming problem?

## **The Global Warming Debate: Activities**

1. You have just been selected as the CEO of a major oil company. With global warming all over the news and the oil and coal industry under fire, one of your first initiatives will be to develop a new lobbying strategy. Come up with a plan for how your lobbying staff will attempt to convince lawmakers not to act on global warming. What arguments, scientific, economic, and environmental, will your lobbyists use?
2. Imagine that you are running for President of the United States and the environment, specifically global warming, has become a major issue in the campaign. Craft a speech directed at the American public in which you outline the causes of global warming, its consequences, and the state of current debate using language that is easy to understand. Remember, this is a campaign speech, so you will want to outline general steps that you would take to solve this problem. That is, assuming you feel that it is a problem.

## CLIMATE: CLASSICAL CONNECTIONS

### The Ancients Speak

- Ancient Greeks and Romans too were aware of a warming in the climate. Plato asked,  
“Can we suppose there have not been, all over the world, multifarious climatic revolutions which presumably lead to many modifications of living organisms?”
- Aristotle was perceptive enough to realize that these changes often escaped human notice because they took place in very small increments over very long periods of time.
- Read the selection from Columella on the next page.

### Questions for Comprehension & Discussion

Consider these questions:

1. What sort of modifications might Plato be referring to? That is, how would climatic change affect living organisms?
2. If climatic changes are so difficult to detect, how might Aristotle have known about them?
3. If you were an ancient Greek or Roman, to what would you attribute the changes in climate? What does *caeli situm* (see Columella) have to do with it? What exactly does this mean?

# DE QUALITATE STATOQUE CAELI

(Columella, De Re Rustica, I.I.3-5)

In this selection, Columella encourages his students to consult the old records, because climate has been known to change, allowing crops to grow where they previously could not.

Et consulat commentarios antiquorum sedulo  
scrutetur, atque aestimet  
quid eorum quisque senserit, quid praeceperit;  
an universa, quae maiores prodiderunt, 5  
huius temporis culturae respondeant,  
an aliqua dissonent.  
Multos enim iam memorabiles auctores  
comperi persuasum habere  
longo aevi situ 10  
qualitatem caeli statumque mutari.  
Saserna ... mutatum caeli situm sic colligit,  
quod quae regiones antea  
propter hiemis assiduam violentiam  
nullam stirpem vitis aut oleae depositam  
custodire potuerint, 15  
nunc mitigato et intepescente pristino frigore  
largissimis olivitatibus  
Liberique vindemiis exuberent.

## • AUXILIA DE FABULA

- 1 **sedulo** – “diligently”  
2 **scrutetur** – “he should scrutinize”  
3 **eorum quisque** – “each of them”  
4 **praeceptio, praecepere, praecepi** – “to teach”  
an – “whether it be”  
5 **prodo, ere, prodidi** – “to hand down”  
6 **cultura, ae, f.** – “agricultural practice”  
8 **comperio, ire, comperi** – “to find”  
9 **aevum, i, n.** – “age”; **situs, us, m.** – “neglect”  
10 **qualitatem caeli statumque** – “the nature and state of the heavens” – i.e. weather and climate  
11 **Saserna** – an ancient authority on agriculture  
12 **situs, us, m.** – “position”; **colligo, ere** – “to conclude”  
13 **hiems, hiemis, f.** – “winter”  
14 **assiduus, a, um** – “persistent”  
15 **stirpem vitis** – “stalk of the vine”  
16 **oleae depositam** – “planting of an olive tree”  
17 **custodio, ire** – “to support”  
18 **mitigatus, a, um** – “abated”  
19 **intepescente** – “warming”; **pristinus, a, um** – “earlier”  
20 **frigus, frigoris, m.** – “coldness”  
21 **Liberique vindemiis** – “vineyards of Bacchus”  
22 **exuberent** – “abound”

• **QUAESTIONES:** Respond to the following questions using Latin \*from the passage\* .

1. What should the farmer consult?
2. What do many memorable authors believe?
3. What did Saserna conclude?
4. Why did Saserna make this determination?

# **CARPE SCIENTIAM**

## **Water**

## WATER POLLUTION: CURRENT SITUATION

### Scale of the Problem: Chart

Please examine the following chart (from the EPA's 1998 National Water Quality Inventory) and respond to the questions below.

Summary of Quality of Assessed Rivers, Lakes, and Estuaries

Waterbody Type	Total Size	Amount Assessed* (% of Total)	Good (% of Assessed)	Good but Threatened (% of Assessed)	Polluted (% of Assessed)
 Rivers (miles)	3,662,255	842,426 (23%)	463,441 (55%)	85,544 (10%)	291,264 (35%)
 Lakes (acres)	41,593,748	17,390,370 (42%)	7,927,486 (46%)	1,565,175 (9%)	7,897,110 (45%)
 Estuaries (sq. miles)	90,465	28,687 (32%)	13,439 (47%)	2,766 (10%)	12,482 (44%)

\*Includes waterbodies assessed as not attainable for one or more uses.

Note: percentages may not add up to 100% due to rounding.

### Scale of the Problem: Questions for Comprehension & Discussion

1. What substances do you think might be the leading pollutants of rivers, lakes, and estuaries? What might be the major sources of pollution?
2. What effects does pollution have on a body of water? Think broadly – do not consider just the effects on wildlife.
3. Examine the two photographs below. How do you react when you see them? What do they make you think about?



## WATER POLLUTION: CURRENT SITUATION

### **Leading Pollutants: Chart**

Please examine the following chart (from the EPA's 1998 National Water Quality Inventory) and respond to the questions below.

Leading Pollutants and Sources\* Causing Impairment in Assessed Rivers, Lakes, and Estuaries

	Rivers and Streams	Lakes, Ponds, and Reservoirs	Estuaries
<b>Pollutants</b>	Siltation	Nutrients	Pathogens (Bacteria)
	Pathogens (Bacteria)	Metals	Organic Enrichment/ Low Dissolved Oxygen
	Nutrients	Siltation	Metals
<b>Sources</b>	Agriculture	Agriculture	Municipal Point Sources
	Hydromodification	Hydromodification	Urban Runoff/Storm Sewers
	Urban Runoff/Storm Sewers	Urban Runoff/Storm Sewers	Atmospheric Deposition

\*Excluding unknown, natural, and "other" sources.

### **Leading Pollutants: Questions for Comprehension & Discussion**

1. Was your answer to question one on the previous page correct? Were you surprised at what the leading water pollutants and sources of pollution are?
  
2. In terms of pollution, how are nutrients and agriculture related? What effect do these have on water?
  
3. What types of pollutants might be found in urban runoff? How does urban runoff reach bodies of water?

### **Leading Pollutants: Activity**

Imagine that you are on the staff of the EPA and have been given the task of creating a video that will be distributed to farmers and municipal (city) planners. The goal of the video is to show municipal planners and farmers the dangers of pollution, and to introduce them to techniques for limiting water pollution from their respective sources. Write a screenplay for this video – what text will you use? What facts and figures will you present? What images will you use?

## WATER POLLUTION: CURRENT SITUATION

### Case Study: The Cuyahoga River

*In the 1950's and 1960's, Cleveland's Cuyahoga River was so polluted with oil that it actually burst into flames on several occasions. Please examine the following photographs (from Case Western Reserve University) and describe your reactions to them.*



1. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



2. \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

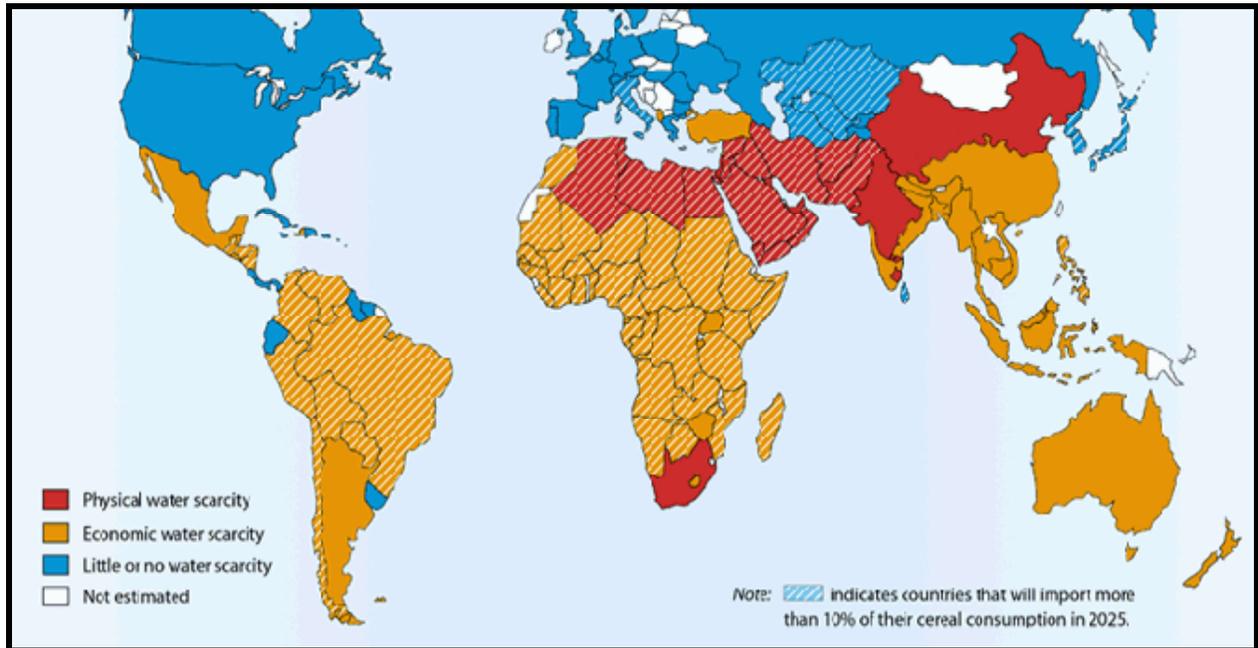
\_\_\_\_\_

\_\_\_\_\_

## WATER SCARCITY: CURRENT SITUATION

### Scale of the Problem: Projected Water Scarcity in 2025 Chart

*Please examine the following chart (from the International Water Management Institute) and respond to the questions below.*



According to the IWMI, “By 2025, 1.8 billion people will live in countries or regions with absolute water scarcity. Most countries in the Middle East and North Africa can be classified as having absolute water scarcity today. By 2025, these countries will be joined by Pakistan, South Africa, and large parts of India and China. This means that they will not have sufficient water resources to maintain their current level of per capita food production from irrigated agriculture—even at high levels of irrigation efficiency—and also to meet reasonable water needs for domestic, industrial, and environmental purposes. To sustain their needs, water will have to be transferred out of agriculture into other sectors, making these countries or regions increasingly dependent on imported food.

The remainder of the 118 countries included in the study theoretically have sufficient water resources to meet their needs. But many of them will have to develop their water supplies by 25 percent or more. This will mean embarking on large and expensive water-development projects. For many countries, specifically in sub-Saharan Africa, it will be difficult to mobilize the necessary financial and other resources to achieve this goal.”

## WATER SCARCITY: CURRENT SITUATION

### **Questions for Comprehension & Discussion**

1. What does the term “water scarcity” mean?
2. What is the difference between physical water scarcity and economic water scarcity?
3. What areas of the world have “little or no water scarcity,” and why might this be? What areas of the world have “physical water scarcity,” and why might this be? What areas of the world have “economic water scarcity,” and why might this be?
4. What are the effects of water scarcity on people? On agriculture? On the economy?

## WATER POLLUTION: CLASSICAL CONNECTIONS

### The Ancients Speak

- In his book Pan's Travail, J. Donald Hughes writes of ancient Greek and Roman water bodies,

“Ground and surface waters were polluted. Poisons such as lead, mercury, and arsenic got into the water used in hydraulic mining, or leached out of mines through drainage. Even long after a mine was abandoned, pollution continued, and metallic salts were carried down from higher elevations to places where the contaminated water was used for drinking or irrigation.”

- Indeed, the ancients were aware of these problems. For example, Vitruvius (VIII.4.1-2) discusses ways of testing water for purity. The translation is William Thayer's:

“The trial and proof of water are made as follows. If it be of an open and running stream, before we lay it on, the shape of the limbs of the inhabitants of the neighbourhood should be looked to and considered. If they are strongly formed, of fresh colour, with sound legs, and without blear eyes, the supply is of good quality.

Also, if digging to a fresh spring, a drop of it be thrown into a Corinthian vessel made of good brass, and leave no stain thereon, it will be found excellent. Equally good that water will be, which, after boiling in a cauldron, leaves no sediment of sand or clay on the bottom.

So if vegetables are quickly cooked over the fire in a vessel full of this water, it shows that the water is good and wholesome. Moreover, if the water itself, when in the spring is limpid and transparent, and the places over which it runs do not generate moss, nor reeds, nor other filth be near it, every thing about it having a clean appearance, it will be manifest by these signs, that such water is light and exceedingly wholesome.”

- Vitruvius also seems to understand that certain areas are major sources of water pollution, as you will discover in the Latin reading.

### Questions for Comprehension & Discussion

1. In the first paragraph above, how does Vitruvius suggest we should assess the purity of water from an open and running stream? What does this test indicate about the ancient Romans and their knowledge of polluted water's effects on humans?
2. Why would water that does not stain bronze be excellent? If the water did stain the bronze, what would this indicate about the water?
3. For what purpose does Vitruvius suggest boiling water? Of what other use of boiling does he appear to be unaware?
4. Why might Vitruvius believe that water leading to the growth of moss or reeds was bad?

## Activities

1. Read the article below, which details modern mining practices and water pollution resulting from chemical leakage from the mine. Then, write a letter to the CEO of a major mining corporation in which you describe the dangers facing water bodies nearby to mines. Emphasize in your letter the information that Hughes presents on the previous page. Have we learned from the mistakes of the ancient Greeks and Romans?

(DENVER POST – 20 January 2002 – by Steve Raabe)

There's nothing quiet about the 24-hour-a-day, 365-day-a-year organized commotion rumbling from Colorado's only remaining major gold mine, the Cresson. Cripple Creek & Victor's majority owner is AngloGold North America, a Denver-based operating unit of AngloGold Ltd., the world's largest gold producer.

'The Cresson mine is a significant producer of gold,' said Stuart Sanderson, president of the Colorado Mining Association. 'It has set (post-World War II) records because of its modern mining methods.' Single-handedly, the mine's \$70 million annual production has elevated gold to the No. 3 position in Colorado mining, behind coal and construction materials such as sand, gravel and cement.

The Cresson uses high-volume, low-cost mining techniques that enable it to extract gold ore from vast open pits, despite gold prices that have plunged 70 percent since hitting an all-time high of \$850 an ounce in 1980. At last year's average gold price of \$270 per ounce, Cripple Creek & Victor grossed an estimated \$70 million by producing about 260,000 ounces of gold.

But at the site of the Cresson mine, there's not a gold nugget to be found. Virtually all of the gold is in the form of microscopic particles locked within volcanic rock formations. To unlock the hidden treasure, the ore must first be dug out in large chunks, crushed and then sprinkled with a cyanide solution to separate gold from ore.

The Cripple Creek & Victor Gold Mining Co. must blast, shovel and process as much as 100 tons of ore to obtain an ounce of gold. Even at the most potent concentrations, the mine's gold yields itself grudgingly at the rate of 1 ounce per 12 tons of ore.

The mining process starts with 9,000 pounds of explosives each day to blast large rock formations. Shovels and loaders then scoop the gray ore into trucks, which unload their cargo at nearby crushing plants. The 3-foot boulders are ground down to 1 1/2-inch pieces of rock.

Another set of trucks carries the rock to a huge pile, or leach pad, where rubber hoses pour a cyanide solution - 100 parts cyanide per 1 million parts water - at a rate of 10,000 gallons per minute over the rocks.

The cyanide trickles down through the rocks, reacting with the minute gold particles and carrying them to the bottom of the pad where the 'pregnant solution' is pumped to a plant that filters out the gold.

The gold particles, along with smaller amounts of silver, are partly refined into conical, 80-pound 'buttons' that resemble huge 7-inch-high Hershey's Kisses. The buttons then are sent to smelters in Massachusetts and Switzerland for complete refining and eventual sale to jewelry makers and industrial users.

Cripple Creek & Victor officials say they pay very close attention to environmental matters, especially in the areas of land reclamation, prevention of cyanide leaks and monitoring of water discharges. Environmentalists say the mine is not careful enough.

The Sierra Club and another advocacy group, the Mineral Policy Center, have filed two lawsuits in federal court alleging that the mine has sent water laden with dangerous metals and toxic chemicals into surrounding creeks. The groups also contend that the mine has not obtained permits for some of its water discharges.

'It's sort of a witches' brew of heavy metals and high acid levels,' said Roger Flynn, an attorney for the plaintiffs. 'We're saying that the discharges should be permitted, monitored, and maintained at safe levels.'

Mine officials say discharge violations have occurred on only a handful of occasions when heavy rains and fast snowmelt sent unusually high volumes of water off the mine property. They say some of the toxic discharge stems from mine operations conducted decades ago on properties not owned by Cripple Creek & Victor.

Talks to settle the suits have been called off for lack of progress.

AngloGold officials said they are strong backers of the International Cyanide Management Code for Gold Mining, which seeks to implement voluntary guidelines for the safe use of cyanide leaching.

Jim Komadina, president and chief executive of AngloGold North America, said the Cresson mines regulation is some of the tightest in history because the permitting process was done shortly after the Summitville mine disaster in southwestern Colorado.

'All you can say is that is an aberration,' Komadina said of Summitville. 'Mining is a temporary use of the land, and if done properly, we can complete the life cycle of the land.'

2. Read the two passages below and then answer the questions.

➤ **From Pan's Travail by J. Donald Hughes:**

“Because of its huge size, Rome generated more waste, and had the potential to do more damage to the environment than other ancient cities. But Rome also took more measures to protect public health. The Cloaca Maxima (a giant sewer) was Rome’s main drain. About 15 by 11 feet in cross section in some places, it could be maintained by workmen from within. Under ordinary conditions, much of Rome’s waste matter was flushed out through sewers and into the Tiber which, it was hoped, would carry it past Ostia into the sea. There was no way to treat sewage. Often during floods, the Tiber backed up through the sewers and inundated lower sections of the city.

People dumped every imaginable form of refuse into the river including stale grain and bodies that had been denied burial. The level of odor pollution can scarcely be imagined. It is no wonder that there is only one mention of drinking from the Tiber in all Roman history.”



*Inside the Cloaca Maxima*

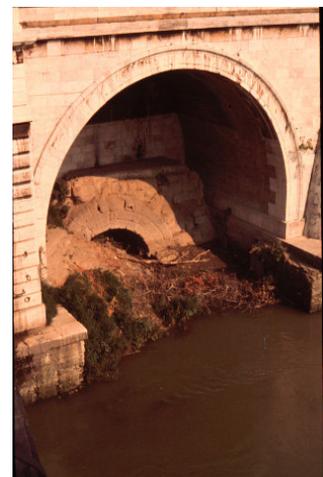
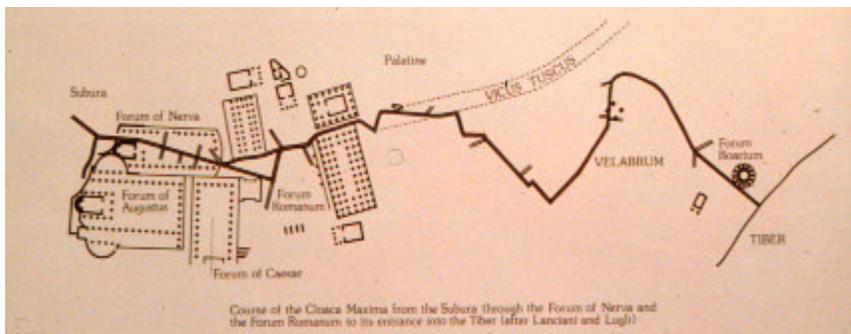
➤ **From The World's Water 1998-1999 by Peter H. Gleick:**

“As Akhtar Hameed Khan, director of the Orangi Pilot Project in Pakistan said: ‘Access to safe water and adequate sanitation is the foundation of development. For when you have a medieval level of sanitation, you have a medieval level of disease, and no country can advance without a healthy population.’ For nearly three billion people, access to a sanitation system comparable to that of ancient Rome would be a significant improvement in their quality of life.”

1. Despite the fact that ancient Romans had a public sewer system, the potential for water pollution still remained. Assess the validity of this statement. Explain your answer.

2. A great debate amongst ancient philosophers was whether or not history was equivalent to progress. In light of both of the above passages, describe whether you support or reject the theory that history is progress, and why.

*Plan of the Cloaca Maxima (below) and an Entranca to the Cloaca Maxima (right)*



## WATER SCARCITY: CLASSICAL CONNECTIONS

### The Ancients Speak

- Ancient Greece and Rome did not receive enough rainfall to properly water agricultural crops. Therefore, it was a time honored tradition to irrigate crops. Homer, the earliest of Greek poets, describes how water from other sources was used to supplement rainfall. Allen Mandelbaum is the translator:

And past the vineyard's final aisle, in rows well ordered, varied vegetables grow. There are two springs. The first spring feeds the garden with fresh water; the other issues near the courtyard door, in toward the palace: from this second spring, the townsfolk draw their water.

- Urban areas often exhausted their local water supply as well. As a result, tremendous aqueducts were built in order to transport water from distant lands to the city.



### **Frontinus expresses his amazement at Rome's aqueducts**

(Frontinus, De Aquis, I.16)

Tot aquarum tam multis necessariis (indispensible) molibus (structures)  
pyramidas videlicet (if you will) otiosas (idle) compares  
aut cetera inertia (useless) sed fama celebrata opera (works) Graecorum.

## Activities

1. Research how an aqueduct works. Imagine that you are Frontinus, Rome's Water Commissioner, and prepare a report for your boss detailing the workings of aqueducts. You may wish to use illustrations in your report. The following websites may assist you in your task:

- <http://www.pbs.org/wgbh/nova/lostempires/roman/aqueduct.html>
- <http://www.dl.ket.org/latin2/mores/aqua/index.htm>

2. A major travel agency wants to develop a special Aqueducts-'N-History themed travel package. The agency has hired you to produce a brochure advertising its tour package. In the brochure, describe aqueducts from various provinces of the Roman Empire, and include photographs. You will also want to describe each of the provinces you include – what is the climate, what other Roman ruins are there, what would the ancient people who lived there have been like, et cetera.

Use the website and map (from Greenhill School) below to help you find information about the provinces of the Roman Empire:



[http://www.greenhill.org/facultyfolders/US/languagedept/worcester/projects/Empire%20project/roman\\_empire.htm](http://www.greenhill.org/facultyfolders/US/languagedept/worcester/projects/Empire%20project/roman_empire.htm)

3. Construct a model aqueduct!

## DE

# AQUAE GENERI MORTIFERO

(Vitruvius, De Architectura, VIII.3.15)

In this selection, Vitruvius relates how certain bodies of water are poisonous, an indication of his understanding of water pollution.

Etiamque inveniuntur aquae genera mortifera,  
quae per maleficum sucum terrae percurentia  
recipiunt in se vim venenatam,  
uti fuisse dicitur Terracinae fons  
qui vocabatur Neptunis, 5  
ex quo qui biberant imprudentes  
vita privabantur.  
quapropter antiqui eum obstruxisse dicuntur.  
et Chrobsi Thracia lacus,  
ex quo non solum qui biberint moriuntur 10  
sed etiam qui laverint.  
item in Thessalia fons est profluens,  
ex quo fonte nec pecus ullum gustat  
nec bestiarum genus ullum propius accedit,  
ad quem fontem proxime 15  
est arbor florens purpureo colore.

## • AUXILIA DE FABULA

- 1 **genus, generis, n.** – “kind”
- 2 **mortiferus, a, um** – “fatal”
- 3 **maleficus, a, um** – “vicious”
- 4 **sucus, i, m.** – “juice”; **percurentia** – “flowing”
- 5 **vis, vis, f.** – strength
- 6 **uti** – “as”; **fuisse** – “to be”; **dicitur** – “is said”
- 7 **Terracinae** – name of a place
- 8 **vocabatur** – “is called”
- 9 **privabantur** (+abl) – “are deprived of”
- 10 **quapropter** – “hence”
- 11 **obstruxisse** – “to have blocked”
- 12 **Chrobsi** – a race of people living in Thrace
- 13 **laverint** – future perfect – “will have washed”
- 14 **item** – “likewise”; **profluens** – “flowing”
- 15 **pecus, pecoris, n.** – “cattle”
- 16 **ullus, a, um** – “any”; **gusto, gustare** – “to drink”
- 17 **propius** – “nearer”
- 18 **proxime** – “nearby”
- 19 **florens** – “blooming”

- **QUAESTIONES:** Respond to the following questions using Latin \*from the passage\*.

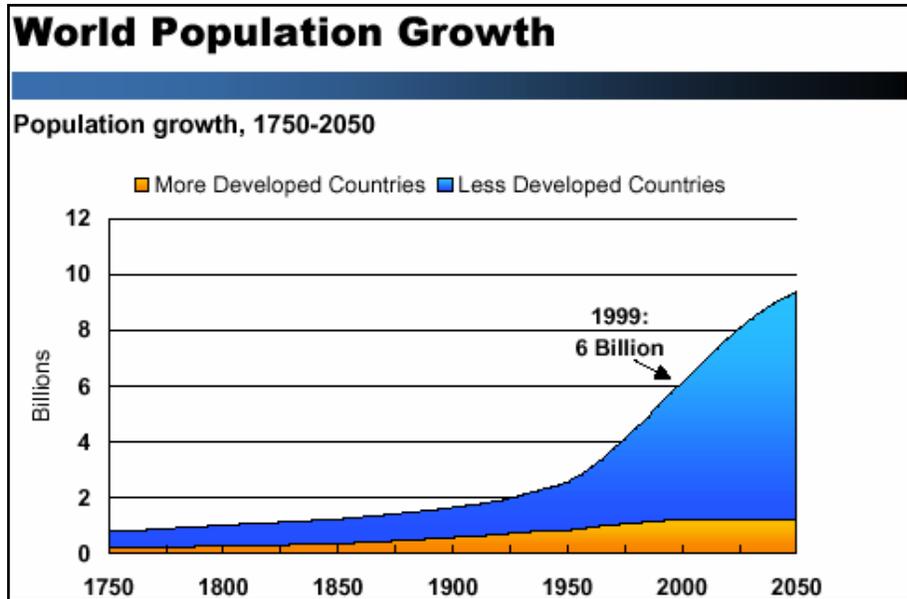
1. Quid inveniuntur?
2. Quomodo recipiunt in se vim venenatam?
3. Qui moriuntur ob Chrobsi lacum?
4. Quid crescit prope fontem in Thessalia?

# **CARPE SCIENTIAM**

## **Population**

## POPULATION: CURRENT SITUATION

Please examine the following graphs (from the Population Reference Bureau) and respond to the questions below.

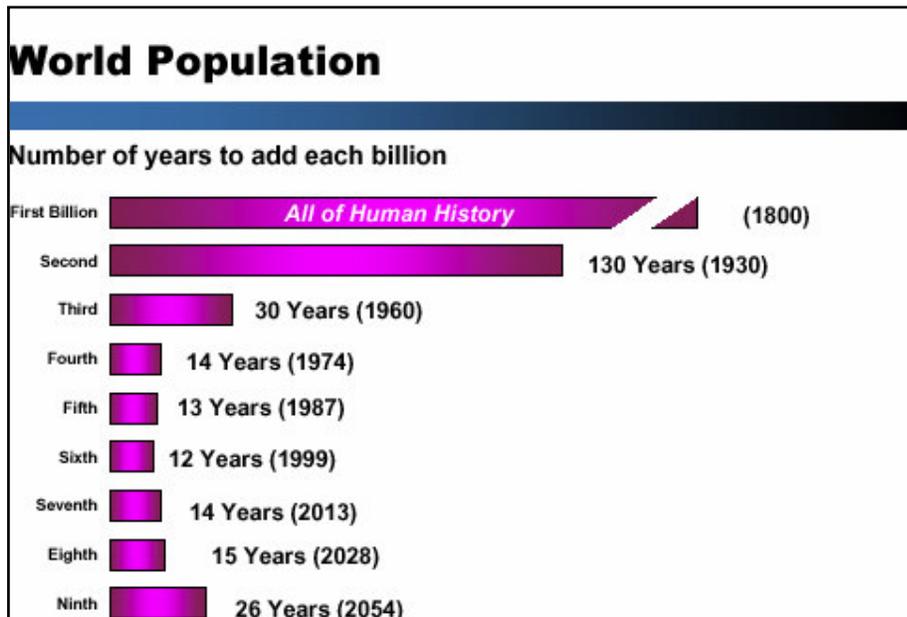


I.

A. What has been the trend in world population since 1750? What comments can you make about the trend since 1950?

B. What is the difference in population trends for less developed and more developed countries? Why might this difference exist?

C. What affects do you think this trend will have on the earth's environment, resources, and population?

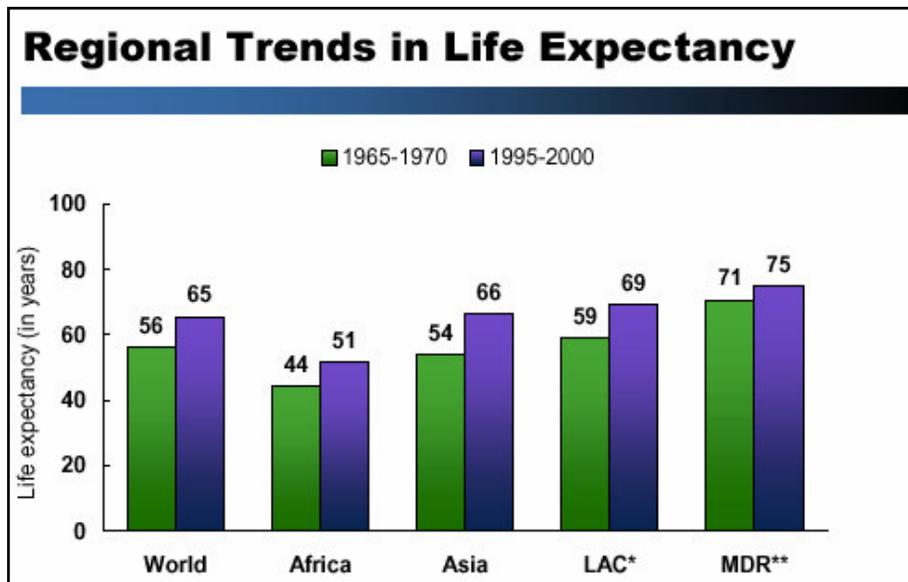


II.

A. How long did it take to add the first billion people to the planet? The second billion? The third billion? The fourth billion? What conclusions can you draw from this?

B. Why has it taken progressively shorter to add more people?

C. What trend might develop when the seventh, eighth, and ninth billions are added? What might this indicate about world population growth?

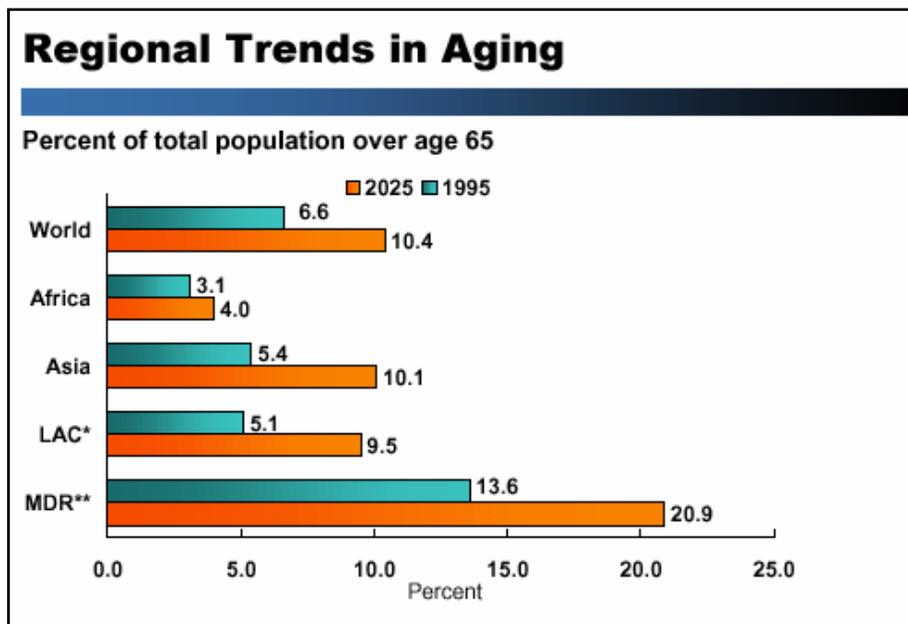


**III.**

A. Describe the trends in life expectancy across the world that are illustrated by this graph.

B. What might account for this trend?

C. What region had the lowest life expectancy in 1995-2000? The highest? What might account for this difference?



**IV.**

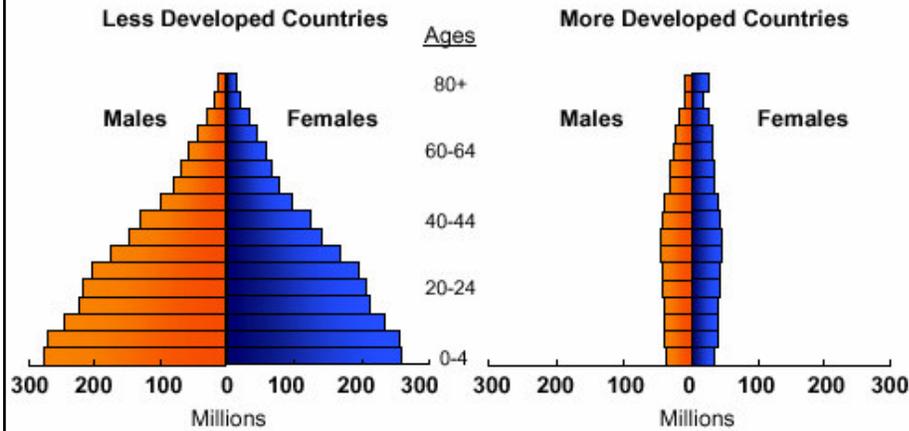
A. Describe the trends in aging across the world that are illustrated by this graph.

B. What might account for this trend?

C. What region had the lowest percentage of total population over 65 in 1995? The highest? What might account for this difference?

## Age Distribution in More and Less Developed Countries

Population structures by age and sex, 1995



V.

A. How do the graphs for less developed countries and more developed countries differ?

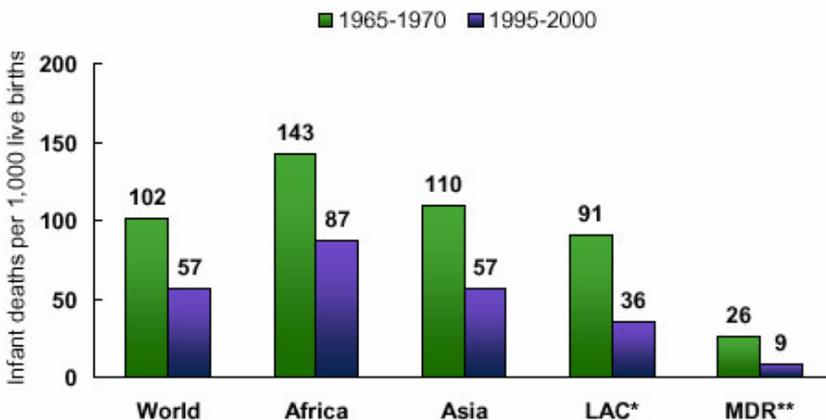
B. Describe what these two graphs mean.

C. Based on these graphs, fifty years from now, what will the population structure of an LDC be like? Of an MDC?

D. Why do the differences in these two graphs exist?

## Regional Trends in Infant Mortality

Annual number of deaths to infants under age 1 per 1,000 live births



VI.

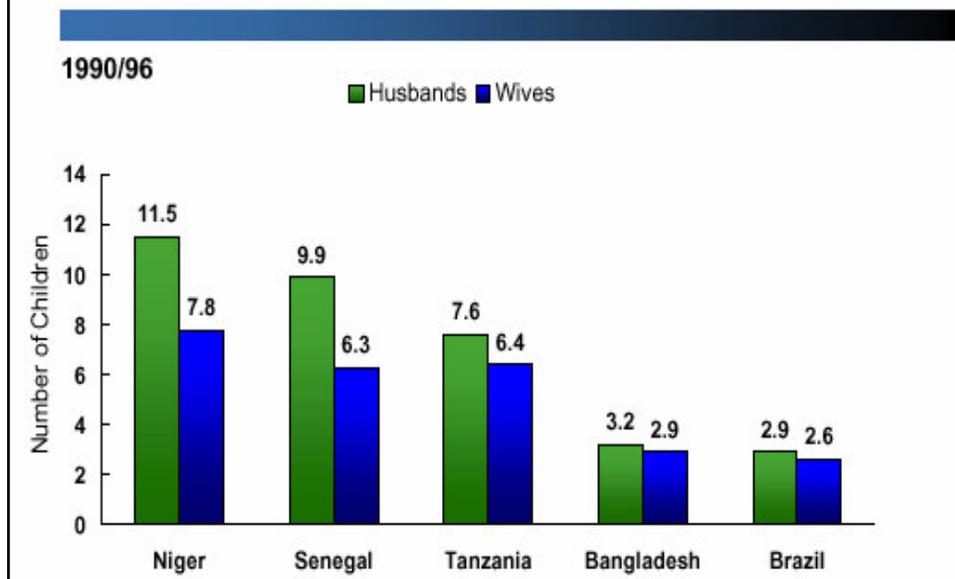
A. What has been the worldwide trend concerning infant mortality?

B. Why might this trend have come about?

C. What effect will this trend have on world population?

D. Why is there a difference between infant mortality rates of Africa and the MDRs?

## Number of Children Desired



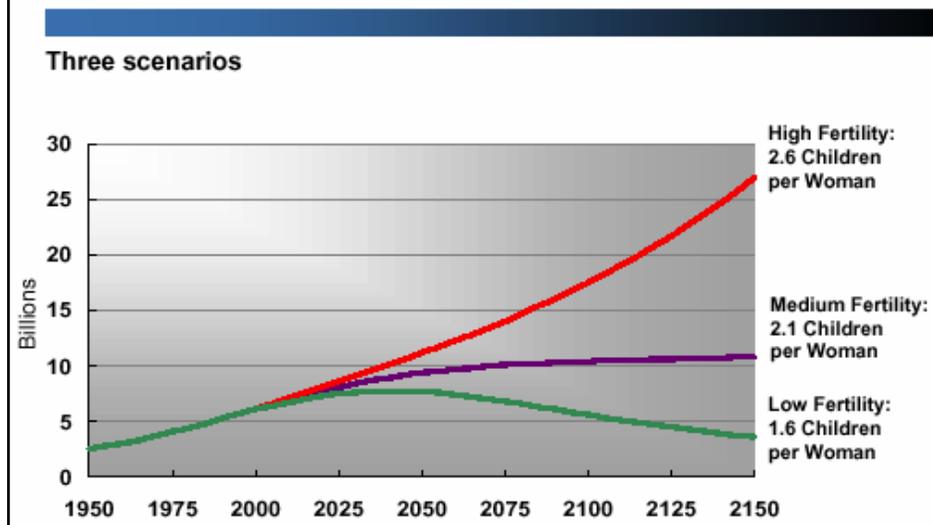
### VII.

A. How does the number of children desired differ from husbands to wives? What might account for this difference?

B. Why might the number of children desired be so much higher in Niger than in Brazil?

C. What effects do these figures have on world population? Do they affect different regions of the world differently? How?

## Projected World Population to 2150



### VIII.

A. Describe what this graph shows.

B. In 2150, what will be the world's population if a path of high fertility is followed? Medium fertility? Low fertility?

C. What do high, medium, and low fertility mean? How might people or governments monitor and regular fertility? Would it be right to do so?

## Activities

1. You are a science teacher and you want to create a brochure that will summarize major world population trends for your students, in a way that is simple and easy for them to understand. Using the information you learned in graphs I – VII, create such a brochure.

2. The President of the United States has created a World Population Task Force, and you have been selected to serve on it. Each member of the task force has been asked to submit a plan for what they would like to see done regarding world population, and a statement describing what the world of the future will be like as a result of these steps. Approach this activity by stepping into the shoes of one of the following people. Think of what their interests and concerns regarding population might be.

- ✓ an activist in a neo-Malthusian group (find out who Thomas Malthus was!)
- ✓ a farmer in Africa whose twelve children help with the harvest every year
- ✓ a conservative Republican U.S. congressman who abhors regulations and limits on personal freedoms

## POPULATION: CLASSICAL CONNECTIONS

### **Comparison: Ancient Rome vs. Mexico City**

- In his book Pan's Travail, J. Donald Hughes writes of the packed metropolis that was ancient Rome,

“The main population of the city lived in cramped, noisy, airless, foul-smelling, infected quarters, paying extortionate rents to merciless landlords, undergoing daily indignities and terrors that coarsened and brutalized them. Cicero and Martial complained of poor streets that were narrow, muddy, dusty, slippery, and unlighted. In Rome, only major streets were paved, and all were filled with crowds. Subura, the most densely inhabited quarter, seethed with people.

Traffic crawled slowly but nonetheless dangerously. Getting through the streets was a struggle. Pedestrians, wagons, and the well-to-do in sedan chairs, disputed the right-of-way with overloaded marble carts.

Noise came not only from traffic but also from other sources such as industry, trade, building and demolition, and the numerous baths. Writers complained of the “din” to which they were subjected.”

- Examine the following text and images, from a National Geographic article about Mexico City,

Mexico City, capital and center of Mexico, and one of the world's largest metropolises. “Even from the air Mexico City looks exuberant,” Parfit said. “You read about it being an incredible disaster area, but it looks like an *exuberant* disaster area.

“The place is just packed with people, and all of a sudden you see from the air what looks like a bloom of poinsettias blocking the street . . . and later you find out it's a market; everybody has a bright red-pink awning for his market stall. People are selling things at every street corner.

“The sense I had on the ground was that you could probably drive the rest of your life and never get out of town.

“And the smog is really different here. It billows. It's like the place is smoking, vigorously. In Los Angeles the smog just sits there; in Mexico City they're cooking it up.

Volcanoes erupt, earthquakes destroy towns, politics go crazy, people are gunned down. This is all normal life for Mexico. And at the same time people are having fiestas in the street and putting up their poinsettia markets. There is a willingness to work and an urgency here that's a part of the drive that Mexico City represented to me.”



The rewards of a fractured economy remain uneven, but many live very well. The serious business of survival brings young members of the Hernández family out in funny faces. Almost the entire family—father, mother, six of seven children, and three young relatives—pitches in to earn pesos by performing at a busy intersection in Mexico City. “We’re not teaching our kids to do anything bad,” says the mother, Gabriela. “You see other moms who let their kids run loose on the streets—those are the ones who pick up vices.”

A caustic brew of pollution simmers over Mexico City, home to some 16 million people. Generated by car exhaust, factory emissions, and leaking residential gas tanks, the contaminants prove more than a little irritating to residents, who suffer a myriad of respiratory and eye problems.”



### **Ancient Rome vs. Mexico City: Activities**

1. Pretend that you are a resident of Mexico City who has jumped into a time machine and traveled back in time to visit the city of ancient Rome. When you return, you grant the local newspaper an interview. They are interested in how the cities of ancient Rome and Mexico City are similar and different. Write the article that the newspaper produced.
2. Create a Venn-Diagram in which you chart the similarities and differences between ancient Rome and Mexico City. Use the Venn-Diagram on page 32 to help you.

## Comparison: Ancient Rome vs. New York City

- Examine the following images of ancient Rome (from the Universite' de Caen):



- Now, examine the following images of Manhattan in New York City (from Esto Photographics, Inc.):



## **Ancient Rome vs. New York City: Questions for Comprehension & Discussion**

1. Describe the images of ancient Rome. What can you tell about the population of the city? What can you say about the level of urbanization of the city?
2. Based on the images, what might life be like for an ancient Roman?
3. Compare and contrast the city of ancient Rome with Manhattan in New York City. Comment on similarities and differences between the populations and levels of urbanization of the two cities, based on what you can see in the images.
4. How might life be similar or different for people living in New York City? What urban problems might an ancient Roman face that a modern New Yorker would also face?

## **The Ancients Speak**

*As it turns out, ancient Roman authors often complained of the great din and other urban problems caused by Rome's enormous population.*

- Horace writes,

“Cease wondering at the smoke, the riches, and the din of Rome!”

- Martial writes,

“In my profound sleep, the quiet is offended by many tongues... the day does not come without this! The laughter of the crowd tramples across us. Such is a bed at Rome. If anyone wants to sleep, let's go to the country house!”

- Juvenal writes,

“Where have we ever seen a place so dismal and lonely? We'd not be better off there than afraid, as we are here, of fires, roofs caving in, and the thousand risks of this terrible city?”

## **The Ancients Speak: Questions for Comprehension & Discussion**

1. What is the main concern that Martial has about Rome? How does this differ from Juvenal's concerns?
2. What might be some benefits of living in a city such as ancient Rome?

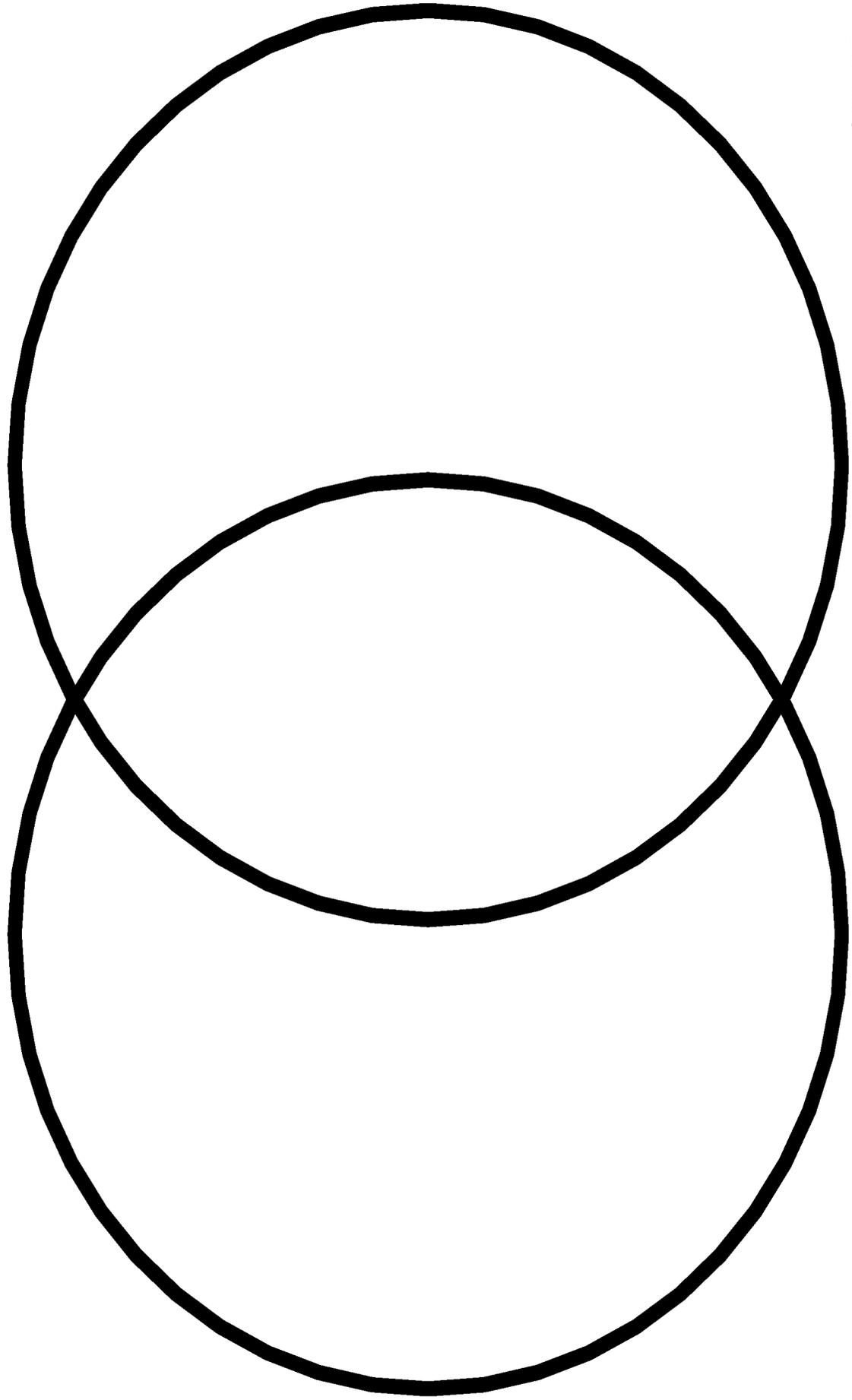
## **The Ancients Speak: Activity**

Write a poem in which you describe the wonders or problems (or both) of living in a large city.

# Comparison of Ancient Rome and Mexico City

Ancient Rome

Mexico City



# DE MULTITUDINE CIVIUM ROMANORUM

(Augustus, Res Gestae, VIII)

In this selection, Augustus describes the three censuses (*lustra*) that he oversaw as Emperor. In each *lustrum*, the number of Roman citizens across the Empire was counted. Note the sharp increases in population, and note also that these *lustra* do not include non-citizens such as slaves and women.

It is commonly held that slaves outnumbered citizens in the Empire. The first *lustrum* was held in 28 BC, the second in 8 BC, and the third in 14 AD.

Lustrum post annum alterum et quadragensimum feci,  
quo lustrum civium Romanorum censa sunt capita  
quadragiens centum millia 5  
et sexaginta tria millia.  
Tum iterum consulari cum imperio  
lustrum solus feci  
C. Censonno et C. Asinio cos.,  
quo lustrum censa sunt civium Romanorum capita  
quadragiens centum millia 10  
et ducenta triginta tria millia.  
Et tertium consulari cum imperio lustrum  
conlega Tib. Caesare filio meo feci  
Sex. Pompeio et Sex. Appuleio cos.,  
quo lustrum censa sunt civium Romanorum capitum  
quadragiens centum millia 15  
et nongenta triginta et septem millia.

## • AUXILIA DE FABULA

- 1 **lustrum, i, n.** – “census”  
**alterum et quadragensimum** – “forty-two”  
3 **quadragiens centum millia** – “four million”  
7 **C. – Cato; cos.** – *consulibus*  
10 **ducenta** – “two hundred”  
12 **Tib.** – *Tiberio*  
13 **Sex.** – *Sexto*  
16 **nongenta** – “nine hundred”

## • QUAESTIONES: Respond to the following questions in English.

1. How many Roman citizens were present at the first *lustrum*? At the second? At the third? Make a line graph in which you chart the increase in Rome’s population from 28 BC – 14 AD, over the course of these three *lustra*.
2. What might the result of such population growth have been on the Roman world? Consider its effects on environment, people, and government services.
3. Why might the Romans not have included slaves and women in their *lustra*?



Augustus of Prima Porta Statue

# **CARPE SCIENTIAM**

## **Land Use**

## LAND USE: CURRENT SITUATION

### Case Study - Roads: The Inter-County Connector Controversy

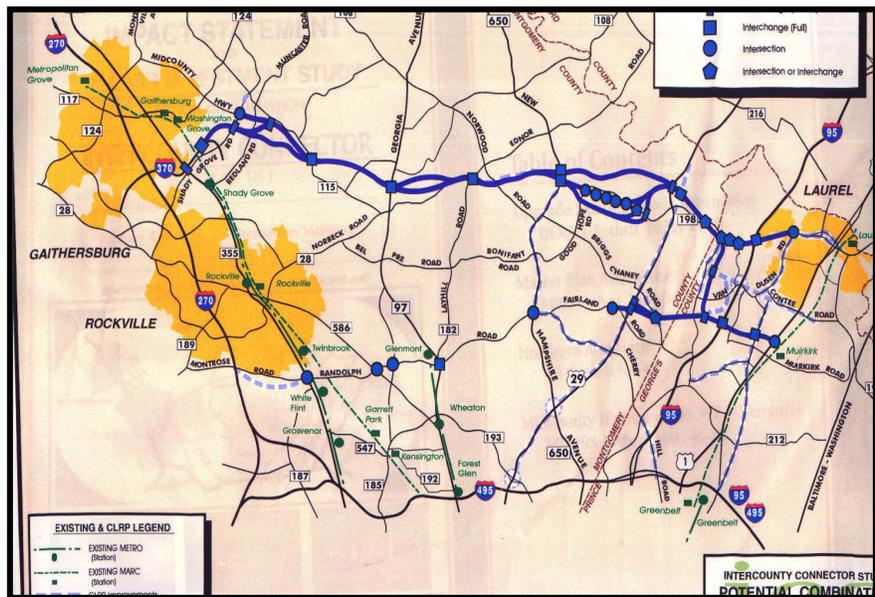
The Metropolitan Washington, DC region has some of the worst traffic problems in the United States. One proposed way to alleviate some of these problems is to construct an Inter-County Connector between Montgomery and Prince George's Counties in Maryland, north of Washington, DC.

The map below shows the two proposed routes of the Connector. At the very bottom of the map is Interstate 495, the beltway that circles Washington, DC.

- Arguments against the Connector (from the Sierra Club),

#### **The ICC would promote sprawl development.**

It could financially destabilize counties and drain resources away from existing communities. It would destroy dozens of homes and devalue thousands of others.



#### **The ICC would harm the environment.**

The ICC would destroy some of the region's last and best wetlands and forests with clearcuts across three of the county's major watersheds, and would cross streams 77 times. It would destroy 144 acres of parklands. In its path are threatened and endangered plant species, champion hardwood trees, and fast-disappearing wildlife habitat.

#### **The ICC would undermine efforts to restore the Anacostia River, Potomac River, and Chesapeake Bay.**

The ICC would further pollute the Chesapeake Bay and the Anacostia by increasing toxic runoff, currently the #1 source of water contamination in the Bay's watershed.

The ICC would also jeopardize efforts to improve regional air quality, the nation's sixth worst for ground-level smog.

➤ Arguments for the Connector (from Marylanders for a Second Crossing, Inc.)

Despite Annual Growth Policy (AGP) reviews since 1986, plus billions spent to build two Metro lines and a Ride-On bus system, along with 145 miles of arterial roads from 1991-1997, Montgomery County keeps growing in population, jobs and households, but limited-access roads are NOT being built – a prime reason for current congestion problems. Prince George’s also has built the Green Line north to Greenbelt and south to Branch Avenue, the Orange Line to New Carrollton and the Blue Line to Addison Road (with a Blue Line extension to Largo Town Center in the final stages of planning).

Montgomery County, alone, canceled or deferred construction of about 117 miles of limited access freeways, express parkways and major highways. This represents more than half of the 244 miles of roads never built in the entire D.C. area, which leads the nation in killed or delayed road projects.

In some cases, roads were not built due to monetary constraints, but environmental issues were NOT leading factors because environmental review laws were NOT in effect at the time. Most of these roads were canceled or delayed due to the opposition of residents who lived near them. In most cases, residents opposed these highways despite knowing full well their homes were near the rights of way for master-planned highways, and politicians – particularly the Montgomery and Prince George’s County Councils and state legislators – did their bidding.

These people – often derided as “NIMBYs” (not in my backyard) – were the only beneficiaries of highway-construction delays. The losers were (1) residents living on cut-through streets and arterials with signalized intersections, which bore the brunt of the traffic that would have passed on express roads; (2) commuters and freight traffic; (3) pedestrians, who have been killed in record numbers in recent years.

Contrary to arguments that “road killing” would thwart “sprawl,” sprawl-type development still came to Montgomery and Prince George’s Counties.

Metro’s extension into Montgomery County with 12 stations boosted development and transit ridership, but only 13.2 percent of Montgomery residents use transit (including buses) to get to work. The County leads the state in auto ownership and vehicle miles traveled, but along with Prince George’s, ranks nearly last in road mileage investment.

### **Roads: Questions for Comprehension & Discussion**

1. What are the arguments for and against the Inter-County Connector, from a land use perspective?
2. Which argument do you feel is more convincing, and why?
3. If the Inter-County Connector were built, what do you think its effect would be on the environment, and on development of the region?

### **Roads: Activity**

The Prince George's County Council is holding a hearing shortly concerning the Inter-County Connector. You have called the Council and been given a short time slot in which to speak and air your views. Compose a speech in which you state your opinion on whether or not the Inter-County Connector should be built. Note especially its effects on the environment and development. Is it a good use of land? OR – substitute any road that is about to be built in your own neighborhood!

## LAND USE: CURRENT SITUATION

### **Case Study - Sprawl: Smart Growth in Maryland**

*Sprawl is a major problem facing many large metropolitan areas. The governor of Maryland, Parris N. Glendening, has pioneered an influential program called Smart Growth. According to the State of Maryland:*

“Smart Growth has three straightforward goals:

- ✓ to save our most valuable remaining natural resources before they are forever lost,
- ✓ to support existing communities and neighborhoods by targeting state resources to support development in areas where the infrastructure is already in place or planned to support it, and
- ✓ to save taxpayers millions of dollars in the unnecessary cost of building the infrastructure required to support sprawl.

The 1997 General Assembly adopted several specific programs, which together form the Smart Growth initiatives. Collectively, these initiatives aim to direct State resources to revitalize older developed areas, preserve some of Maryland's valuable resource and open space lands, and discourage the continuation of sprawling development into our rural areas.

The Smart Growth legislation allows the State to direct its programs and funding to support locally-designated growth areas and protect rural areas. This landmark legislation's passage is a significant accomplishment which will play a major role in Maryland's efforts to better manage land use and growth.

The centerpiece of this new legislative package is the ‘Priority Funding Areas’ legislation, which limits most State infrastructure funding and economic development, housing and other program monies to Smart Growth Areas which local governments designate for growth. The other bills in the 1997 legislative package also support locally-identified development areas. They facilitate the reuse of brownfields and provide tax credits to businesses creating jobs in a Priority Funding Area. A new Live Near Your Work pilot program supports this effort by providing cash contributions to workers buying homes in certain older neighborhoods. And, to spur more preservation of undeveloped land, the new Rural Legacy Program provides financial resources for the protection of farm and forest lands and the conservation of these essential rural resources from development.”

### **Sprawl: Activities**

1. Create maps of two imaginary metropolitan areas – one that has been heavily affected by sprawl, and one that has employed smart growth techniques from the very beginning.
2. As a citizen, write a letter to Governor Glendening in which you outline the pros and cons, in your opinion, of the Smart Growth plan.

## LAND USE: CLASSICAL CONNECTIONS

### Roads & Sprawl

- In his book Pan's Travail, J. Donald Hughes writes,

“In road building, as in much else, the Roman attitude to the natural world was that of the conquest of nature and confidence in human power. Roads secured the extent of Roman domination and made land transportation more rapid, economical, and competitive with sea transport. They encouraged the development of agriculture, mining, and industry farther from metropolitan centers by providing access to distant areas. Because of the network of roads, more forests were felled and more plants and animals were transported, with the result that they were introduced to new lands or extirpated in their original ranges. Roads increased human mobility and reduced the inaccessibility of marginal territories, amplifying the impact of the Romans on the natural environment.”

- Examine the following images (from Kentucky Educational Television):



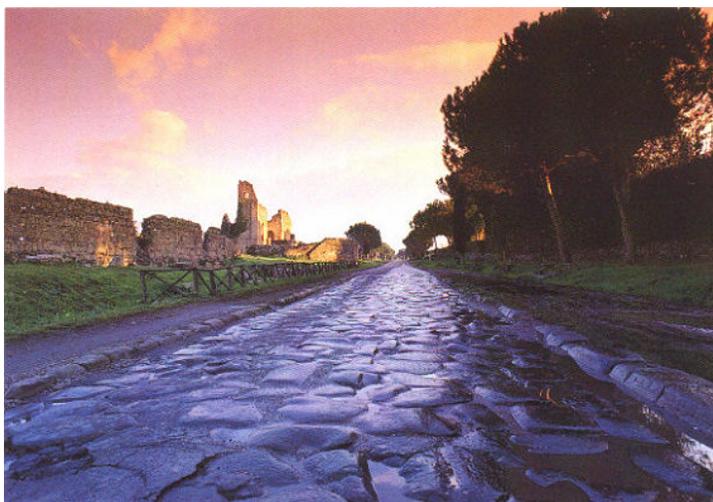
### Roads & Sprawl: Questions for Comprehension & Discussion

1. How does the passage above relate to the Inter-County Connector controversy?

2. How does the passage above relate to sprawl? How might techniques of Smart Growth have helped the ancient Romans?

3. Consider the image (top left) depicting the Roman Empire's network of over 50,000 miles of roads. What is your reaction to this picture? What might the effect of these roads have been on the environment and development?

4. Consider the image (bottom left) showing an ancient Roman road as it looks today. In what condition is this road? What does this indicate about ancient Roman roads and their construction?



# DE PAUCIS IUGERIS PRO ARATRO

(Horace, Carmina II.15)

In this selection, Horace decries suburban sprawl – that is, he is angry because the massive estates of wealthy Romans have taken over field after field. He also mourns for the loss of community, and devotion to the gods.

Iam pauca aratro iugera regiae  
moles relinquent, undique latius  
extenta visentur Lucrino  
stagna lacu platanusque caelebs

evincet ulmos; tum violaria et  
myrtus et omnis copia narium  
spargent olivetis odorem  
fertilibus domino priori;

tum spissa ramis laurea fervidos  
excludet ictus. Non ita Romuli  
praescriptum et intonsi Catonis  
auspiciis veterumque norma.

Privatus illis census erat brevis,  
commune magnum; nulla decempedis  
metata privatis opacam  
porticus excipiebat Arcton,

nec fortuitum spernere caespitem  
leges sinebant, oppida publico  
sumptu iubentes et deorum  
templa novo decorare saxo.

5

10

15

20

## • AUXILIA DE FABULA

- 1 **aratum, i, n.** – “plow”; **iugerum, i, n.** – “acre”  
**regiae moles** – “grand masses of people”
- 2 **undique** – “everywhere”; **latius** – “wider than”
- 3 **extentus, a, um** – “extensive”; **visentur** – “are seen”  
**Lucrino** – a place
- 4 **stagnum, i, n.** – “swamp”; **lacus, us, m.** – “lake”  
**platanus, i, f.** – “plane tree”; **caelebs, caelibis** – “single”
- 5 **ulmus, i, f.** – “elms”; **violarium, i, n.** – “violet”
- 6 **copia, ae, f.** – “supply”; **narium** (gen. pl.) – “smells”;  
7 **spargo, ere** – “to sprinkle”
- 8 **domino priori** – “for their prior owner”
- 9 **spissus, a, um** – “thick”; **fervidus, a, um** – “boiling”
- 10 **ictus, us, m.** – “attacks (rays of the sun)”
- 11 **intonsus, a, um** – “unshorn”
- 12 **auspiciis** – “under the auspices”
- 13 **vetus, veteris, m.** – “ancestors”; **norma, ae, f.** – “standard”  
**illis** – “with them”; **census, us, m.** – “property”  
**brevis** – “small”
- 14 **decempeda, ae, f.** – “tens of feet”
- 15 **metatus, a, um** – “measured”; **opacus, a, um** – “shady”
- 16 **excipio, ere** – “to extend”; **Arcton** – “north”
- 17 **fortuitum** – “chance”; **caespes, caespitis, m.** – “turf”
- 18 **sino, ere** – “to allow”
- 19 **sumptus, us, m.** – “cost”

- **QUAESTIONES/ACTIVITATES:** Respond to the following questions in English.

1. Horace believes there are fewer lands available for plowing. What does he think the causes of this are?
2. Describe his nostalgia. For what does he long?
3. What is the function of the nature imagery in lines 2-10? Draw a picture (in several scenes) illustrating those lines. Use Latin phrases from the poem as captions for each scene.

1. ----- 2. ----- 3. -----

4. ----- 5. ----- 6. -----

7. ----- 8. ----- 9. -----

Nomen: \_\_\_\_\_

Fabula: \_\_\_\_\_

Dies: \_\_\_\_\_

# **CARPE SCIENTIAM**

## **Agriculture & Food Production**

## AGRICULTURE AND FOOD PRODUCTION: CURRENT SITUATION

### **Agricultural Degradation – Article**

*The world is currently plagued by agricultural degradation. Read the following article to learn more, and then answer the questions below.*

(Jakarta Post – by R. Kristiawan - 27 October 2001)

Economic and environmental concerns are sometimes really hard to mix. In reality, they should support each other but in too many cases, the environment is sacrificed for the sake of economic interests. Degradation of the soil quality in many areas in Temanggung is one example among many of poor environmental management.

A 1999 study conducted by Djajadi, a researcher from Fiber Plant and Tobacco Research Center in Malang, East Java, discovered a decrease in both the productivity and quality of Temanggung tobacco. Degradation of soil quality, in this case soil erosion, was the reason behind the decrease. Continuous and intensive tobacco planting, from generation to generation, has been blamed for the soil erosion. The research discovered that such a planting system damaged the organic composition of the soil, causing a decrease in the capacity of the soil to absorb rainwater. As a result, rainwater washed over the soil, carrying with it the fertile topsoil.

Tobacco farmers here usually till the land in January and February, the time when rain falls heavily. Since the land has just been plowed, the soil cannot absorb the rainwater well. A high concentration of rainwater is left on the surface, causing erosion. The magnitude of the problem of erosion in the region needs urgent attention. A recent research conducted by Yogyakarta-based Gadjah Mada University's school of geography cited the average erosion rate here at 53.72 tons per hectare per year on land with a declivity of 63 degrees.

The level of erosion in areas known as main tobacco producers like Lamsi, Paksi and Toalo on the slopes of Mt. Sindoro that have a declivity of 30 degrees, was recorded as "heavy" to "very heavy". From a distance, one can see the dry, critical condition of the area, which in fact, contributes 30 percent of the total tobacco production in Temanggung.

Some farmers, in an effort to increase the organic content of the soil, add manure to the soil. This results in an increase in the price of manure. For the farmers, this is an added burden considering that a hectare of land needs some 20 tons to 30 tons of buffalo manure -- costing them between Rp 3 million to Rp 4 million.

The local government had tried to do something about the matter by introducing policies that will gradually limit the tobacco plantation area and by introducing new varieties of agricultural plants. Temanggung Regent Sardjono, for example, decided in 1998 that the total area of tobacco plantation in the region should not exceed 10,000 hectares. The policy was aimed mainly at encouraging farmers not to plant tobacco only.

So far, the policy seems to be working. The tobacco plantation area has decreased from 17,727

hectares in 1998 to 11,645 hectares in 1999. "Since we know that we cannot rely solely on tobacco due to environmental problems, we have started to introduce new plant varieties including Arabic coffee. We chose plants that are harvested annually in order to protect the soil from further erosion," said Untung Prabowo of the local plantation office.

However, he realized it was difficult to change the habit of local farmers to plant tobacco, something they have done for centuries, within a short period. "But there has been a good progress," Untung added. In Joho, for example, farmers have started to plant watermelon, while in Pringsurat farmers chose to plant Zalacca or salak as the fruit is locally known. Economically high-value crop Arabic coffee has also started to grow in Tlilir village.

"Those plants are good, both economically and ecologically. They do not damage the soil," said Untung, adding that the farmers might also plant vanilla for its high returns, Rp 110,000 per kilogram. "But we're still waiting for a genetic engineering study conducted by Gadjah Mada University to create disease-resistant vanilla plants," Untung said.

Previously, Temanggung farmers had produced vanilla but they stopped it after finding it was susceptible to disease. Until now, tobacco is still Temanggung's number one agricultural product.

### **Agricultural Degradation – Questions for Comprehension & Discussion**

1. What problems are Indonesian farmers facing?
2. What are the possible solutions to these problems?

## **Government Farm Subsidies – Article**

*Read the following article and then answer the questions below.*

(Business Times Singapore – by Leon Hadar – 10 May 2002)

President George W Bush is expected to sign a new farm Bill that will provide huge subsidies to America's agricultural sector, a move that is expected to rile some of its trade partners, including Australia and the European Union.

The Bill that could result in the doubling of government spending in support of agriculture, costing close to US\$170 billion over the next 10 years, has been approved by the Senate by a 64-35 vote. Most of the money is expected to go to subsidies for farmers and agribusiness, which represent 13 per cent of the US gross domestic product. And although the White House and many Republicans warned that the increasing government spending could result in overproduction in the agricultural sector, President Bush, aware of the political power of the farmers in Congress, is expected to sign the Bill in the coming days.

But the increase in government subsidies for grain and cotton growers has angered America's trade partners, including the EU, Australia, and Canada. The move comes at a time when the Bush Administration is facing criticism abroad of its protectionist policies, including the decision to raise tariffs on steel imports, and as the White House is struggling to get lawmakers to approve legislation that will grant it the authority to negotiate trade accords without Congressional interference.

That the Bush Administration and Congress are assisting American farmers with massive subsidies, will also erode Washington's ability to press developing countries as well as the EU to end their own governments' support for their agricultural sectors. In fact, Washington has been very critical for years of the efforts by the Japanese and French governments to protect their politically powerful farmers through huge subsidies.

## **Government Farm Subsidies – Questions for Comprehension & Discussion**

1. What is a farm subsidy?
2. Why might President Bush (and indeed other world leaders) feel that it is necessary to subsidize farms?
3. Why might government subsidies result in overproduction? What effects, environmental and economic, would overproduction have?

## AGRICULTURE AND FOOD PRODUCTION: CLASSICAL CONNECTIONS

*“And she, the greatest of gods, Earth, ageless she is, and unwearied. He wears her away as the ploughs go up and down from year to year, and his mules turn up the soil.”*

*- Sophocles*

As the above quotation indicates, the ancient Greeks and Romans also struggled with agricultural decline. In the first Latin reading accompanying this section, Lucretius expresses the feelings of Roman farmers well. But why did the Romans face such decline? As Columella discusses in the second Latin reading, they were certainly aware of proper and modern methods of soil rejuvenation.

➤ Historian Mikhail Rostovtzeff expounds on this issue as well,

If ... there was exhaustion of the soil in Italy and in the provinces in the centuries after the great crisis of the third century, this must be ascribed to man, not to nature. Men failed to support nature, though they knew as well as we do, or as the Japanese and the Chinese, how it should be done. It is very probable that, in the late Roman Empire, exhaustion of the soil in some parts was a real calamity.

➤ In his book Pan's Travail, J. Donald Hughes puts forward several possible explanations for why agricultural decline so affected the Romans:

**Development of *latifundia*** – “It may well be that on smaller subsistence farms where traditional peasant wisdom was applied, productivity held up better than it did on the huge Roman ranches (*latifundia*) under the stresses of monoculture and overgrazing.”

**Taxation of farmers** – “From the early third century AD onward, the Roman government collected in kind an annual tax, the *annona militaris*, which did not vary with the yield of the harvest. Such a tax encouraged the depletion of the land while depriving farmers of the means to restore it; much marginal land must have gone out of production as a result.”

**Obligations to the military** – “Greek and Roman governments expected agriculture to provide resources for the military. This meant that unsupportable pressure was placed on the agrarian segment of society with the result that agriculture failed even where, with proper care, soil could have produced adequate harvests.”

### Questions for Comprehension & Discussion

1. Explain the quotation from Sophocles.
2. What is the difference between a small subsistence farm and a Roman *latifundium*? What effects might monoculture and overgrazing have on land?
3. Based on the Latin readings in this section, what might Columella have to say about the practices of *latifundia*?

4. What sort of “resources” might the agrarian sector of the economy provide for the the Greek or Roman military? Does this still happen today?

5. Assess the validity of each of Hughes’ three suggestions for why Romans encountered agricultural decline. Which is most convincing? Why?

6. Compare and contrast the problems faced by Indonesian farmers in Temanggung with those faced by the ancient Greeks and Romans. Compare and contrast the possible solutions to these problems. Discuss Columella in your answer.

7. How does government interaction with farmers today differ from government interaction with farmers in ancient Rome? What might be the reasons for this difference?

### **Activities**

1. Imagine that you are an ancient Roman subsistence farmer who is familiar with the works of Columella. Your farm is succeeding. However, a rich friend of yours runs a *latifundium* several miles away, and he is having great difficulty maintaining the productivity of the land. What suggestions would you give your friend about how to properly care for his land? Write him a letter with these suggestions.

2. Now imagine that you are that *latifundium* owner. You have just received the letter from your subsistence-farming friend down the road. His suggestions are excellent, but what with the *annona militaris* and your obligations to the army, you simply can’t incorporate them. You feel that you must produce as much as possible as quickly as possible. Luckily, you have a meeting with one of the Emperor’s advisors later this week. Outline your concerns (and the environmental, agricultural, and economic results of those problems) in either a letter to be delivered to the Emperor, or a PowerPoint presentation for the Emperor’s advisor.

## The Mediterranean Triad

The Romans valued three foods the most: grapes, olives, and grain. These three foods were so important to the ancient Romans (and Greeks, too) that they have been called the “Mediterranean Triad.” Grain, for example, was so crucial that wars were fought over it and colonies were founded to find more of it.

**Grapes** - Grapes were important because they were used to make wine, the main drink of the ancient Romans and Greeks. Grapes were picked in places called vineyards.



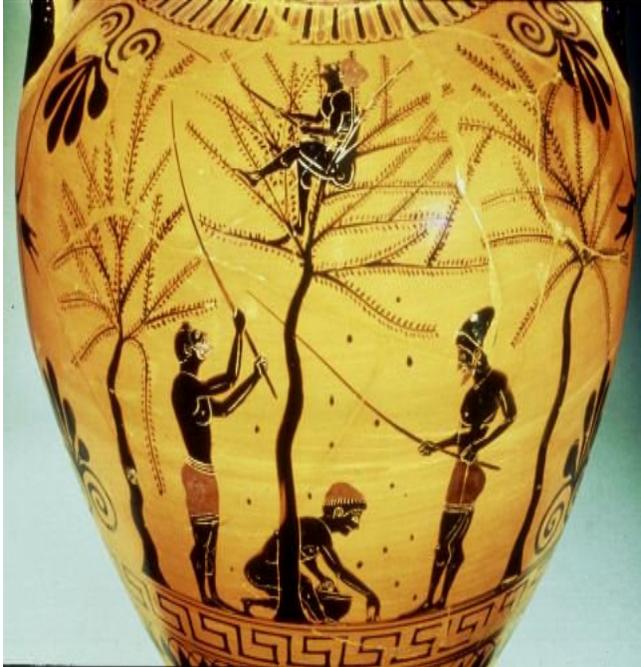
They were then placed in huge tubs and people would stomp on them with their feet to squeeze the juice out of them. The juice would flow out of the tubs into a cup called a kylix. The juice would sit for many months until it fermented. Once the juice had fermented, it had become wine.

1. What sorts of things do we have on our own modern coins? Why do we put these things on our coins? What is the significance of a bunch of grapes on the ancient coin above?

2. The vase above shows a scene of several mythical beasts called satyrs making wine. It shows the process from start to finish, and has been described as an early version of a motion picture! Why might it have earned this name? What are each of the satyrs doing, from right to left?



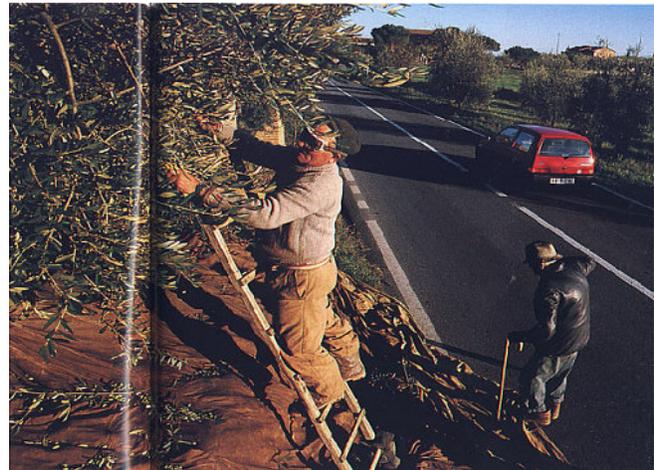
Grapes are still important to Greece and Rome today



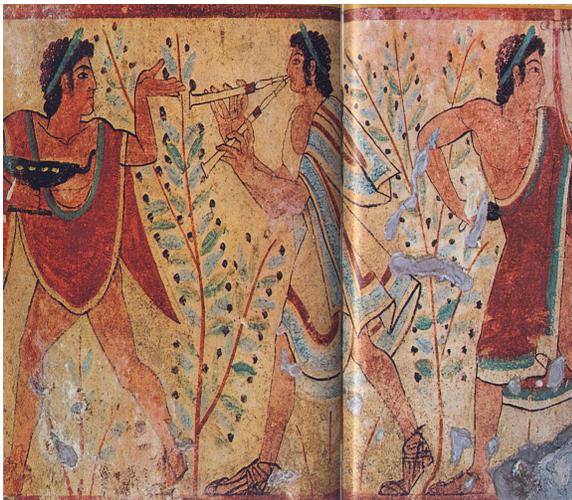
**Olives** - Olive oil was made from olives. The ancient Romans and Greeks valued olive oil so highly because it was used not only for cooking, but also as soap and as oil for lamps. To get olive oil, the olives are first ground up to form a paste (which could be spread on bread for eating). The paste is then spread onto woven mats. Finally, the mats are pressed very hard with stones. This causes the oil to be squeezed out from the paste.



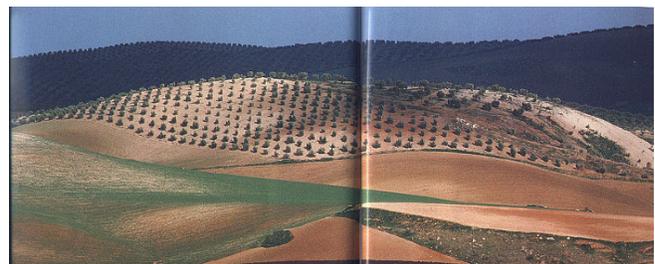
1. Based on the vase (above left), what must have been the process of harvesting olives? Compare to the photo of a man harvesting olives at right. What are the similarities and differences? What does the photograph at right indicate about the importance of olives in modern Greek culture?



2. Can you think of any products that have the same importance to our own culture as olives had (and still have) to Greek and Roman culture?



3. In the Etruscan (a pre-Roman people) fresco at left, several youths are marching and making music amidst olive trees. What does this fresco indicate about the relationship between the Etruscans and their environment?



4. Examine the photo of a grove of olives (previous page, bottom right) and note the quality of the soil and land. How does this compare to the soil with which ancient Romans like Lucretius and Columella might be familiar? To what extent have we learned from the problems of the ancient Greeks and Romans?

**Grain** - Grain was certainly the most important crop of all, because with grain the ancient Romans and Greeks could make bread. One of the highest priorities for an ancient Roman leader was to provide enough grain for his people so that they would not go hungry. At certain times during Rome's history, a great majority of its people would wait in long lines each day to collect grain which was distributed by the government.



1. Why was grain so important to the ancient Greeks and Romans?

2. Why might those cultures have had difficulty growing enough grain? Think also of the natural topography of both regions. Study the map at right for assistance.



3. Do we have problems in our modern world with producing enough grain to feed the world's populace, and distributing this grain to people? Why or why not? If so, are the problems due to the same factors that complicated grain production and distribution for the ancient Greeks and Romans?

## Meat Production and Overgrazing

*The hunting of game for meat posed a serious danger to wildlife populations in ancient Greece and Rome.*



1. Describe what both images above depict.
2. What effect does hunting have on nature and the environment? How might hunting, if carried to excess as it was in ancient Greece and Rome, negate its economic benefits?
3. How might the bas relief (above right) look different if geese and pigs were hunted excessively?

*Additionally, overgrazing by herds of domesticated livestock animals caused problems.*



1. Describe what both images above depict.
2. What might the effects of overgrazing be?
3. In your opinion, which is more important: having an adequate supply of meat (even if it means that certain species of wildlife will lose population, and certain lands will be overgrazed) or maintaining the environment (even if it means not have enough food).

## DE

# TEMPORIBUS PRATERITIS

(Lucretius, De Rerum Natura, II.1156-1167)

In this selection, Lucretius longs for the earlier times when the Earth's bounty was more plentiful. He describes how the fields have become less productive, and how the farmer must work harder for very little.

Sed genuit tellus eadem  
quae nunc alit ex se.  
Praeterea nitidas fruges vinetaque laeta  
sponte sua primum mortalibus ipsa creavit,  
ipsa dedit dulcis fetus et pabula laeta; 5  
quae nunc vix  
nostro grandescunt aucta labore,  
conterimusque boves et viris agricolarum,  
conficimus ferrum vix arvis: 10  
usque adeo parcunt fetus  
augentque laborem.  
iamque caput quassans  
grandis suspirat arator crebrius,  
in cassum magnos cecidisse labores,  
et cum tempora temporibus praesentia  
confert praeteritis, 15  
laudat fortunas saepe parentis.

## • AUXILIA DE FABULA

- 1 gigno, gignere, genui – “to bear”  
tellus, telluris, f. – “earth”; eadem – “the same”  
2 alo, alere – “to nourish”; ex se – “from itself”  
3 praeterea – moreover; nitidus, a, um – “shining”  
frux, frugis, f. – “harvests”  
vinetum, i, n. – “vineyards”  
4 sponte sua – “by its own will”; ipsa – “these things”  
5 dulcis – “sweet”; fetus – “fruit”  
6 pabulum, i, n. – “pasture”  
7 vix – “scarcely”  
8 grandesco, ere – “to grow large”  
auctus, a, um – “increased”  
9 contero, ere – “to wear out”  
viris – acc. pl. – “strength”  
10 conficio, conficere – “to exhaust”  
ferrum, i, n. – “iron”; arva, ae, f. – “fields”  
usque – “continuously”; adeo – “thus”  
11 parco, ere – “to spare”  
12 augeo, ere – “to increase”  
13 quassans – “shaking”  
14 suspiro, are – “to sigh”; arator, is, m. – “farmer”  
15 crebrius – “more often”  
16 cassum, i, n. – “emptiness”; cecidisse – “have fallen”  
confero, conferre – “to compare”  
praeteritum, i, n. – “the past”

- **QUAESTIONES:** Respond to the following questions in English.

1. What did the earth give to mortals?
2. What is happening now to the cows, to the farmers, to the farming tools (*ferrum*)?
3. How does the farmer react to this?

# DE FATIGATIONE HUMI

(Columella, De Re Rustica, II.I.1-7)

In this selection, Columella disagrees with the assertion that agricultural degradation is a result of the earth's old age. Rather, he suggests that lands can be rejuvenated if a few simple practices are followed.

Falsamque sententiam repudiaverim  
longo aevi situ  
longique iam temporis exercitatione  
fatigatam et effētam humum consenuisse ... 5  
Falso credit parentem omnium terram,  
sicut muliebrem aetate anili iam confectam,  
progenerandis esse fētibus inhabilem ...  
At e contrario  
seu sponte seu quolibet casu  
derelecta humus,  
cum est repetita cultu,  
magno faenore cessatorum colono respondet ...  
Non igitur fatigatione,  
quemadmodum plurimi crediderunt,  
nec senio, 15  
sed nostra scilicet inertia  
minus benigne nobis arva respondent.  
Licet enim maiorem fructum percipere,  
si frequenti et tempestiva et modica stercoracione  
terra refoveatur. 20

## • AUXILIA DE FABULA

- 1 repudiaverim – with *humum* and *consenuisse* – “I should repudiate”
- 2 aevum, i, n. – “age”; situs, us, m. – “weariness”
- 4 effetus, a, um – “spent”; humus, i, f. – “soil”
- 5 consenuisse – “growing old”
- 6 falso – “falsely”; credit – with indirect statement
- 6 anilis, is, e – “of an old woman”
- 7 confectus, a, um – “exhausted”
- 7 progenerandis – “bearing”; fetus, us, m. – “offspring”
- 9 inhabilis, is, e – “incapable”
- 9 seu ... seu – “whether ... or”
- 9 sponte – “purposely”; casus, us, m. – “chance”
- 10 derelictus, a, um – “neglected”
- 12 faenus, faenoris, n. – “profit”
- 13 cessatorum – “idleness”
- 14 fatigatio, fatigationis, f. – “fatigue”
- 14 quemadmodum – “as”
- 15 senium, i, n. – “old age”
- 16 scilicet – “actually”; inertia, ae, f. – “laziness”
- 17 arvum, i, n. – “field”
- 18 percipio, ere – “to reap”
- 19 stercoratio, stercoracionis, f. – “manuring”
- 20 refoveatur – “is renewed”

## • QUAESTIONES: Respond to the following questions in English.

1. What belief about the soil does Columella set out to repudiate?
2. What false belief about the earth do many hold, according to Columella?
3. What two methods for rejuvenating the soil does Columella suggest?

# **CARPE SCIENTIAM**

## **Ecosystem Disruption**

## ECOSYSTEM DISRUPTION: CURRENT SITUATION

### **Case Study: The Rainforests - Article**

(Boston Globe – by Matthew Brelis – 7 June 1998)

In the two decades since saving the world's rain forests became an environmental cause celebre, there has been plenty of consciousness raising, some successful corporate boycotting, and a new flavor of ice cream - Rainforest Crunch. There have been modest victories. Children have put coins in parking meters at zoos and aquariums around the country, raising \$ 1.5 million for conservation land. Costa Rica, which witnessed massive deforestation, has preserved about 20 percent of its wilderness and is in the vanguard of new, benign land uses. And there is hope for more: In April, Brazil promised to set aside 62 million acres of Amazon jungle for preservation.

But in the time it takes you to read this sentence, more than two acres of rain forest will be destroyed. From 1980 through 1995, 450 million acres of forest - almost all of it tropical - were lost around the world. In roughly that same time, a comparatively small 18.3 million acres were conserved, according to the World Conservation Monitoring Centre in Cambridge, England.

And despite the high profile of the rain forest issue, the rate of destruction is increasing. A congressional commission this year estimated that 22,393 square miles, or 145 million acres, are being destroyed in the Amazon annually. As a result, the rain forests aren't only being threatened, they are disappearing. If the current rates continue, all that may be left in 20 years are boutique forests and jungle museums - protected areas that give a glimpse of what the past was like but that are so small they cannot support all the life that once thrived there.

"We need to leapfrog destruction or jump start some new conservation processes so that something meaningful is left," says Bruce Cabarle, director of the global forest program for the World Wildlife Fund. "When we whittle forests down to such a small size, we begin to lose the things inside them that make them unique. And one of the things you usually lose are the large vertebrates that require a lot of space. We could end up where we will have boutiques or museums, but they will be empty museums."

And the dry season is about to settle on an Amazon Basin that some scientists say is dangerously parched. That condition could permit fires to burn out of control. The Amazon is the largest of the world's three remaining great tropical rain forests - the others are in Central Africa and Papua New Guinea - and the home to much of the world's flora and fauna, and a fifth of the world's fresh water.

"This is really a very critical situation," says Daniel C. Nepstad, a scientist at the Amazon Institute and the Woods Hole Research Center. "There is an interaction between El Nino events increasing in severity and frequency, selective timber harvesting, which leaves the forest more vulnerable, and the expansion of the agricultural frontier. It means that 1998 could be a severe burning season. The area that is vulnerable is some 400,000 square kilometers, or eight Costa Ricas, or 20 Massachusettses." Recent fires in Brazil, Mexico, and Indonesia indicate how fragile the rain forests are on a global scale. The fires are set, in some cases by poor indigenous people clearing land to farm, in others by multinational companies clearing land for plantations.

In the case of subsistence farming, the resultant ash provides rich fertilizer for only two or three years, then the process is repeated. The Amazon forest is also facing threats from international timber companies that previously clear-cut their way across the Southeast Asian archipelago and are now moving into Latin America with a vengeance, buying up the logging rights to millions of acres.

"It looks like we are tilting at windmills," acknowledges Christopher Hatch, campaign director for Rainforest Action Network, a California-based environmental action group that organizes product boycotts and demonstrations in an effort to raise awareness and protect the remaining forests.

Because of the pace of deforestation, the World Bank and World Wildlife Fund estimate that one of every eight plant species on earth is threatened with extinction. Some have great medicinal and pharmaceutical value - for example, a plant that grows only on Madagascar is used in the treatment of Hodgkin's disease - while the value of others remains undiscovered.

The rain forests also have helped to protect the world's climate by cleansing the air. Carbon dioxide - a gas mostly caused by industrial uses and burning forests - exacerbates the greenhouse effect by permitting the sun's heat to reach the earth, but then blocking the heat from radiating back out to space. As a result, the globe's temperature is rising. Last year was the warmest in the last 600 years, according to researchers at the University of Massachusetts. In 1995, scientists reported direct evidence that the tropical rain forests soak up large amounts of carbon dioxide.

Even selective logging, mining, or oil exploration of the forests, each of which leaves a much smaller area of destruction than slash-and-burn agriculture or clear-cut logging, can also create a threat because the access roads left behind are used by settlers to clear more land, says Ian Bowles, vice president of Conservation International.

While there is a generalized awareness that it is important to preserve the rain forest, that does not seem to be translating into significant consumer action. Imports of the tropical wood mahogany to the United States, for example, rose 14 percent from 1991 to 1995. Despite the daunting odds, conservationists insist there is still some hope for the rain forests.

"I'm optimistic because I have seen significant successes and I have seen corporate leaders from Intel and Ford Motor play an active role in our organization," says Bowles. "Ten years ago, major corporate leaders in the US were not paying as much attention to conservation on a global scale as they are now." And Hatch, of the Rainforest Action Network, predicts that mahogany imports should start to drop as public awareness is increased.

What is doomed, however, is the idea of a wilderness area set aside simply for preservation's sake. Land purchases are good solutions for areas that are highly threatened and might not otherwise be saved, says Nigel Sizer, a senior associate with the World Resources Institute. But buying the land, which can be had for as little as \$ 1 an acre, is the cheap part. Protecting it from poachers and illegal logging is more difficult, and more expensive.

It is estimated that 80 percent of logging in Brazil is illegal. And many of the country's national parks are known as "paper parks" because there is nothing to prevent them from being overrun. Even Brazil's announcement with the World Bank and World Wildlife Fund that 62 million acres will be set aside has been met with some skepticism since preserving the land may be difficult.

"Every effort made today, no matter how small, can make a difference many years from now," Sizer says. "The environmental movement has won huge victories protecting wilderness. . . . That said, each year more forest is lost, less is left, and time is running out."

### **Case Study – The Rainforests – Questions for Comprehension & Discussion**

1. What threats are facing the rainforests? What groups are creating these threats?
2. What is being done to protect the rainforests?
3. Why are the rainforests important to humans?
4. Why are the rainforests important environmentally?
5. What is clearcutting? What damage does it cause?
6. How are rainforest ecosystems being affected by clearcutting?



## ECOSYSTEM DISRUPTION: CLASSICAL CONNECTIONS

### **Forests: The Ancients Speak**

- In the *Georgics* (II.485-486), Vergil writes,

Flumina amem (may I love) silvasque inglorius!

- In *de Amicitia* (68), Cicero writes,

Cum locis ipsis delectemur (we delight), montuosis etiam et silvestribus, in quibus diutius commorati sumus (we have remained).

- In *Critias*, Plato (translated by Harold North Fowler) describes how his native land of Attica in Greece once was covered in forests and had the best soil. He goes on to note subsequent deforestation and erosion. Please read the following selection and then respond to the questions below:

“All other lands were surpassed by ours in goodness of soil, so that it was actually able at that period to support a large host which was exempt from the labors of husbandry. And of its goodness a strong proof is this: what is now left of our soil rivals any other in being all-productive and abundant in crops and rich in pasturage for all kinds of cattle; and at that period, in addition to their fine quality it produced these things in vast quantity.

The soil which has kept breaking away from the high lands during these ages and these disasters, forms no pile of sediment worth mentioning, as in other regions, but keeps sliding away ceaselessly and disappearing in the deep. And, just as happens in small islands, what now remains compared with what then existed is like the skeleton of a sick man, all the fat and soft earth having wasted away, and only the bare framework of the land being left.

But at that epoch the country was unimpaired, and for its mountains it had high arable hills, and in place of the “moorlands,” as they are now called, it contained plains full of rich soil; and it had much forestland in its mountains, of which there are visible signs even to this day; for there are some mountains which now have nothing but food for bees, but they had trees no very long time ago, and the rafters from those felled there to roof the largest buildings are still sound.

And besides, there were many lofty trees of cultivated species; and it produced boundless pasturage for flocks. Moreover, it was enriched by the yearly rains from Zeus which were not lost to it, as now, by flowing from the bare land into the sea; but the soil it had was deep, and therein it received the water, storing it up in the retentive loamy soil and by drawing off into the hollows from the heights the water that was there absorbed, it provided all the various districts with abundant supplies of springwaters and streams, whereof the shrines which still remain even now, at the spots where the fountains formerly existed, are signs which testify that our present description of the land is true.”

### **Forests: Questions for Comprehension & Discussion**

1. What is Vergil's attitude to forests? What is Cicero's? What might this indicate about Romans' views of nature?
2. What was Plato's homeland like in the past? What is it like at the time that he is writing? What is the reason for the change?
3. How did deforestation of Attica result in erosion?
4. According to the Plato, what were the effects of erosion?
5. What effects would deforestation have on the ecosystem? What effects would erosion have?

### **Wildlife: Ancient Art**

1. Examine the two pieces of artwork below. Discuss what each reveals to you about how the ancient Romans viewed and/or treated wildlife. Do the two pieces send the same message, or a different message? Explain.



2. Describe the ecosystem pictured in the fresco (the image on the left).
3. The bas relief (the image on the right) shows a *venatio* – or an event in which beasts and men fought in order to entertain the Roman populace. The Emperor Augustus alone held twenty-six *venationes* in which 3,500 animals were killed. What do you think of such an event? Why do you think the Romans enjoyed it and allowed it to occur?
4. How would *venationes* affect ecosystems?
5. Examine the following passage, from Pan's Travail by J. Donald Hughes,

“In 55 BC, the elephants in Pompey’s show at the dedication of his theater gained the crowd’s sympathy when, wounded by javelins, they defended themselves by snatching the shields of their attackers, attempting to break out of their enclosure, and trumpeted piteously. Cicero protested at this incident, ‘What pleasure can it possibly be to a man of culture, when ... a splendid beast is transfixed with a hunting spear ... the result was a certain compassion and a kind of feeling that the huge beast has a fellowship with the human race.’ When he governed Cilicia, Cicero refused to make his provincials collect leopards for the games.”

Does this passage change your opinion of the ancient Romans in regard to their views and treatment of wildlife? Why or why not?

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