



# **Texas Environmental Science Middle School Textbook Review**

by

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**Please note, the following review no longer accurately portrays the textbooks. Publishers made significant changes in the textbooks since the review was released at the September meeting of the State Board of Education.**

**The September report will be updated with a listing of changes that publishers introduced in response to our review.**

**A final report about the science textbooks will be posted on our website in early December.**

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# Section I

## *Introduction*

Improving public education is the most important task facing Texas. Today, all too few students acquire the knowledge and skills required to make informed civic, economic, social, and political decisions. In no other area of education is illiteracy more acute than in science, especially environmental science. Mounting challenges to land, water, air, and the quality of life require Texans to become better informed about the environment, emerging technology, and ecosystems.

Environmental science is a relatively new addition to science curriculum, stimulated approximately three decades ago by a report by the National Science Board for a national research agenda (*Environmental Science: The Challenge for the Seventies*). Environmental education is a complex, multi-disciplinary subject; it combines physical science, technology, biology and chemistry, technology, sociology, and economics. It is also a complicated subject; research in environmental science is rapidly advancing and there are many areas of scientific uncertainty.

Environmental education has been an important part of science education in public schools of Texas for almost half a century. Texans have long appreciated the importance of careful environmental stewardship and required students to learn about natural resources and resource management. The new state curriculum standards, the Texas Essential Knowledge and Skills (TEKS) adopted by the State Board of Education in 1997, identify specific expectations for environmental science education. To introduce these new expectations for science education, the State Board of Education will adopt new science textbooks in November 2001 that will determine what youth will learn about environmental science over the next decade in Texas public schools.

Because textbooks serve as the foundation of classroom instruction, the selection of accurate, factual, and up-to-date science textbooks is essential. Over the past five years, the Texas Public Policy Foundation (TPPF) has published annual textbook reviews to help the State Board of Education and public schools to make informed decisions about textbook selection. This year, TPPF commissioned a review of middle school science textbooks to evaluate environmental science education. The Foundation limited the review to environmental science for two reasons. First, Texas A & M was commissioned by the Texas Education Agency to review general science content of the textbooks submitted for state adoption; second, there is growing public concern in Texas, as well as throughout the nation, about what students are taught about the environment.

Public concern is justified, according to numerous studies conducted to evaluate science textbooks, and concern is particularly justified about environmental education. Reports published by professional scientific associations (such as the American Association for the Advancement of Science), national commissions (such as the Commission on Environmental Education convened by the Washington-based George C. Marshall Institute), national policy institutes (such as the Washington-based Heritage Foundation and the Thomas B. Fordham Foundation), state policy foundations (such as the Wisconsin Policy Research Institute and the Alabama Policy Institute), higher education (such as North Carolina State University), educators (such as the Textbook League), and popular news media (such as *Forbes Magazine*) identify glaring errors and omissions in science textbooks used today in Texas and throughout the nation.

These reports reveal that textbook materials about the environment generally focus on social and political issues, contain insufficient scientific facts or factual inaccuracies, fail to distinguish between fact and theory, omit citations, ignore uncertainties associated with scientific findings, lack objectivity, and mix science with advocacy.

The poor quality and inaccuracy of environmental science textbooks led the North American Association for Environmental Education (NAAEE), the nation's largest association of professional environmental educators), to publish *Environmental Education Materials: Guidelines for Excellence* in 1996. These guidelines were closely replicated by textbook criteria later established later by the Environmental Literacy Council (a national association of scientists, educators, and economists).

To ensure that textbooks proposed for use in Texas public schools meet standards established by national environmental organizations and meet state requirements for classroom instruction, TPPF commissioned Duggan Flanakin to conduct a review of environmental science in middle school textbooks. Mr. Flanakin has expert knowledge of environmental science, as well as an intimate knowledge of state regulation and private sector activities related to the environment in Texas. He served on the Environmental Science Textbook Committee for the Texas State Board of Education in 1995, authored a report on environmental science education in 1996, and publishes a semi-monthly report on environmental news in Texas.

The review of middle school science textbooks, contained in this report, justifies public concern about environmental science education. Not one of the textbooks for grades 6, 7, and 8 meet standards set by NAAEE or the Environmental Literacy Council for sound environmental education. Not one of the textbooks provides completely accurate, factual, comprehensive and objective information about the environment.

While failing to meet national standards for environmental education, the reviewed textbooks – more importantly - appear to violate state requirements for accuracy and for content specified by state curriculum standards, the Texas Essential Knowledge and Skills. The detailed review of textbook content provided in the following pages furnishes a compelling argument for the State Board of Education to request textbook revisions and to recommend the development of supplemental instructional materials.

Weaknesses of science textbooks now considered for use in Texas public schools should provoke acute concern about educating today's youth to understand, and to resolve complex environmental questions. Our state's health and prosperity depend on sound environmental science education and careful selection of science textbooks.

While the adoption of science textbooks is critically important to Texas, the selection of specific textbooks has equal importance for the nation. Approximately 80 percent of textbook content developed for Texas is adapted and repackaged by major publishers for sales in other states.

Science literacy depends on sound science education materials. Texans have set high standards for environmental education; now Texans must ensure that textbooks meet high standards, equipping students with the knowledge needed to care for Earth and life.

## Section II

### *Textbook Review Criteria & Methodology*

Our textbook review examines the environmental science content in four middle school science textbook series that were submitted for the November 2001 adoption of Conforming Textbooks by the Texas State Board of Education:

- Holt Science & Technology: Texas Edition
- Glencoe Texas Science
- Prentice Hall Science Explorer
- RonJon Select Science

This review does not examine electronic textbooks because paper textbooks remain the principal form of instructional materials purchased by schools. The teacher's edition was used for the review because the teacher's version includes content of the student text.

The review was designed to determine if the textbooks meet requirements for content that are established by the Texas Essential Knowledge and Skills (TEKS) in eight key environmental topics:

- Energy and Natural Resources
- Climate Change (Global Warming) and the Greenhouse Effect
- Acid Rain
- Human Population Dynamics
- Endangered Species and Tropical Rainforests
- Waste Management
- Water Quality
- Air Quality

Using TEKS as the criteria for reviewing instructional content, guidelines established by the North American Association for Environmental Education (NAAEE-the nation's largest professional association of environmental educators) were used as a framework for reviewing the facts and theories introduced by the texts.

NAAEE's guidelines for evaluating educational materials state that environmental science instruction materials "should be fair and accurate in describing environmental problems, issues, and conditions, and in reflecting the diversity of perspectives on them. Where there are

differences on opinion or competing scientific explanations, the range of perspectives should be presented in a balanced way.”

The Science TEKS standards directly relate to this educational objective. The Appendix lists the TEKS for grades 6, 7, and 8 that relate to environmental science. The first TEKS standards considered in this review [6.1 (B), 7.1 (B), 8.1 (B)] require textbooks to “provide appropriate information so that students can make wise choices in the use and conservation of resources and the disposal and recycling of materials.” This TEKS standard touches on waste management and on ways to lessen the generation of waste; it also requires that students learn some economics, including the current and projected costs (including environmental costs) for first use, reuse, and recycling of specific materials and comparative costs of substituting alternative materials for those whose costs (including environmental costs) are judged to be too high.

The Science TEKS [6.3, 7.3, 8.3] further state that students must be able to use “critical thinking and scientific problem solving to make informed decisions.” To accomplish this, students are “expected to analyze, review, and critique scientific explanations, including hypotheses and theories, as to strengths and weaknesses, using scientific evidence and information.” [6.3 (A), 7.3 (A), 8.3 (A)]. TEKS also requires textbooks to provide appropriate information so that students can properly evaluate the impact of research on scientific thought, society, and the environment [6.3 (D), 7.3 (D), 8.3 (D)].

These TEKS standards require instructional materials to present alternative hypotheses and explanations of controversial phenomena in a balanced manner. Otherwise, students are unable to engage in “critical thinking” or test the strengths and weaknesses of scientific explanations. Moreover, textbooks should incorporate the latest possible information on rapidly advancing technologies and scientific research and how these changes may affect the relative economics (hence, marketability) and even environmental friendliness of various energy sources. At all three middle school grades, the TEKS require students to learn about topics of critical importance to Texans.

TEKS requires grade 6 textbooks to include thorough coverage of all energy sources so that students may know “that obtaining, transforming, and distributing energy affects the environment” [6.9]. Students are expected to be able to “identify energy transformations occurring during the production of energy for human use such as electrical energy to heat energy or heat energy to electrical energy” [6.9 (A)], “compare methods used for transforming energy in devices such as water heaters, cooling systems, or hydroelectric and wind power plants” [6.9 (B)], and “research and describe energy types from their source to their use and determine if the type is renewable, non-renewable, or inexhaustible” [6.9 (C)].

TEKS requires grade 7 textbooks to thoroughly discuss the Earth’s renewable, non-renewable, and inexhaustible resources - including the latest technological and scientific developments - in order for students to know “that natural events and human activities can alter Earth systems” [7.14] and be able to “make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources” [7.14 (C)].

And, TEKS requires grade 8 textbooks to provide thorough coverage of air quality, water quality, and waste management issues so that students can know “that natural events and human activities can alter Earth systems” [8.14] and can “describe how human activities have modified soil, water, and air quality.” [8.14 (C)]

This section includes our overall evaluation and line-by-line reviews of 12 textbooks submitted by the four publishers for adoption on the state textbook conforming list. After each comment, we have indicated whether that comment indicates an error of **OMISSION**, a factual **INACCURACY**, a direct or apparent **BIAS** in the reporting, or merely a recommendation of additional information that would add to the text’s coverage of the topic.

We have rated each publisher as to whether the coverage of each environmental topic has been thorough, accurate, balanced, and free of bias - all necessary components if the textbooks are to meet state requirements established by TEKS. The ratings are provided by publisher, not by textbook. A publisher rating was developed because most school districts will purchase grades 6, 7, and 8 textbooks by the same publisher. In current form, not one of the four middle school science textbook series covered all of the topics according to review criteria that was based on TEKS.

This review determines if middle school science textbooks, submitted for adoption by the Texas State Board of Education, covers statutory requirements for environmental science. Eight key topics were selected for review, and the following TEKS requirements and criteria are defined for each topic.



## Section III

### *Environmental Science Textbook Topics & Review Criteria*

#### **1. Energy and Natural Resources**

**Applicable TEKS - 6.1 (B); 6.3; 6.9, 7.14 (C); 8.14 (B) (C) [See Appendix 1]**

Energy and natural resources are elements of a dynamic model of use and availability - a model that considers economic and environmental (and other) costs over time, with projections as appropriate. The grade 6 texts in particular should provide a framework that describes all current and potential energy sources as to past, present, and possible future availability at market prices. They should also explain how society's use of these resources affects the environment in general [6.1 (B), 6.9]. For example, textbooks should describe how societies shift from one resource to another based on multiple considerations, such as economic and environmental factors. The grade 7 texts should follow a similar path to ensure that students can "make inferences and draw conclusions" about the positive and negative effects of human activity on Earth's energy and other resources [7.14]. The grade 8 texts must address air and water quality and waste management with enough thoroughness to enable students to describe how human activities have modified soil, water, and air quality in both positive and negative ways [8.14].

#### **2. Climate Change (Global Warming) & the Greenhouse Effect**

**Applicable TEKS – 5.1 (B); 6.3; 7.1 (B); 7.3 (A) (B) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (B) (C) (D); 8.11 (A); 8.14 (B) (C) [See Appendix I]**

Textbooks, especially grade 8, should explain the greenhouse effect or climatic change accurately, both as to how it operates and what benefits (and possible detriments) this effect provides for Earth's inhabitants. To enable students to have a proper perspective on the short-term climate changes that are the focus of current controversy, textbook coverage - which would appropriately be found mainly in the grade 8 texts - should describe the variations in Earth's climate over centuries or even aeons, as well as provide alternative hypotheses as to what may be causing climate changes on Earth today. Such discussion should include explanation of the "heat island" effect, the effects of sunspots, and the possibility that Earth's climate is being affected by increases in the concentrations of various greenhouse gases in the troposphere.

### **3. Human Population Dynamics**

**Applicable TEKS – 6.3 (A) (C) (D); 7.3 (A) (C) (D); 7.14 (C); 8.3 (A) (C) (D); 8.11 (A); 8.14 (B) [See Appendix I]**

Discussions about human population dynamics should include information on the distribution of population growth over time, the reasons that populations have grown (mainly declining death rates that are not matched immediately by declining birth rates), and the likelihood that birth rate declines will eventually result in stabilization - or even future declines - in world population. Arguments supporting the benefits of population growth should also be offered in a balanced presentation. Presentations should also explain the differences, as well as the similarities, between human and non-human (plant and animal) population dynamics.

### **4. Acid Rain**

**Applicable TEKS – 6.1 (B); 6.3 (A) (C) (D); 7.1 (B); 7.3 (A) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (C) (D); 8.11 (A); 8.14 (B) (C) [See Appendix I]**

Textbooks should identify the different scientific hypotheses about the impact of acid rain - from chemical weathering to depopulation of lakes and streams. The starting point for these discussions should be the 10-year, \$500 million study conducted by the National Acid Precipitation Assessment Program; other research, including recent U.S. Environmental Protection Agency reports, should also be included. Textbooks should also include information about the natural acidity of rain water and of some water bodies and soils, so that students will have sufficient information to be able to make informed decisions about how to address the ongoing effects of acidity added by human activity. Textbooks should also discuss the impact of the sulfur dioxide emissions trading program, which was created as part of the 1990 Clean Air Act, and ask students to consider the potential application of emissions trading programs for addressing other environmental concerns. They should also note that acid rain has impacts on both air and water quality, and that fly ash generated by the “scrubbers” used to capture sulfur dioxide emissions poses waste management problems.

### **5. Endangered Species & Tropical Rainforests**

**Applicable TEKS – 6.1 (B); 6.3 (A) (B) (C) (D); 7.1 (B); 7.3 (A) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (C) (D); 8.11 (A); 8.14 (B) (C) [See Appendix I]**

Instructional materials should provide sufficient scientific evidence and information, as well as scientifically founded hypotheses, to enable students to “analyze, review, and critique” the evidence and hypotheses about species and habitats. Textbooks should identify the full range of estimates regarding species extinction and rainforest destruction, so that students can recognize that these data are controversial and look at the evidence supporting each data set in order to draw their own conclusions. Discussions of endangered species should also include information on the nature and effectiveness of U.S. and worldwide efforts to protect species and habitat. Rainforest destruction should also be presented as a problem with a range of possible solutions.

## **6. Waste Management**

**Applicable TEKS – 6.1 (B); 6.3 (A) (B) (C) (D); 7.1 (B); 7.3 (A) (B) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (B) (C) (D); 8.14 (C) [See Appendix I]**

While waste management is included in many discussions of energy and natural resources, coverage of this topic should be sufficient for students to be able to “make inferences and draw conclusions” about the effects, positive and negative, of human efforts to manage the generation, storage, and disposal of all sorts of waste materials. This discussion should include coverage of the full range of pollution prevention activities, as well as the ways societies manage wastes already generated.

## **7. Water Quality**

**Applicable TEKS – 6.1 (B); 6.3 (A) (C) (D); 6.9 (C); 7.1 (B); 7.3 (A) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (C) (D); 8.11 (A); 8.14 (C) [See Appendix I]**

Textbooks should cover point and nonpoint sources of water pollution, the full range of water treatment technologies, health effects and other problems caused by various pollutants, and the broader question of water availability. Limited discussions of the impact of acid precipitation on water quality are insufficient.

## **8. Air Quality**

**Applicable TEKS – 6.1 (B); 6.3 (A) (C) (D); 6.9 (C); 7.1 (B); 7.3 (A) (C) (D); 7.14 (C); 8.1 (B); 8.3 (A) (C) (D); 8.11 (A); 8.14 (C) [See Appendix I]**

The grade 8 texts in particular should provide in depth coverage of air quality issues. Air quality as a topic independent of discussion of climate change, the greenhouse effect, acid rain, and energy and natural resources should be thoroughly covered in middle school science, but most particularly by grade 8 textbooks. Information regarding air quality in major metropolitan areas and some national parks, for example, should be provided so that students develop a comprehensive understanding of critical challenges to quality of life.

## Section IV

### *Environmental Science Textbook Review Summary Findings*

This review examined middle school science textbooks to determine if the instructional materials covered the content required by state curriculum standards, the Texas Essential Knowledge and Skills (TEKS) in eight key environmental subject areas. This examination was guided by standards established by the North American Association for Environmental Education.

Standards for classroom instruction, established by both TEKS and the Association, require textbooks to provide up-to-date, scientific facts in sufficient detail to thoroughly inform students about environmental topics. Content should be factually correct without omission of significant fact, distinguish fact from theory, and identify uncertainties associated with scientific findings.

None of the textbooks examined in this review fully meet these standards. Our findings are summarized in data tables on the following pages. A detailed report on each textbook is provided in Sections V – VIII.

Data tables are included in this report to give the State Board of Education a snapshot of errors that should be corrected in order for textbooks to be adopted for the State's Conforming List. Tables are also included for individuals who cannot take the time to read the detailed report in subsequent pages but seek to identify which texts require revision or use with supplementary materials.

The data tables list the number of factual errors, factual omissions and biases (or lack of objective text) found in each topic in each textbook. The tallies do not reflect, and cannot be used to determine, the overall quality of textbooks. Although our detailed report does note areas where content coverage is excellent, our review was not designed to, nor does it furnish the information required to, rate the textbooks on environmental science. While the tallies cannot be used to determine overall textbook quality, the tallies are equally insufficient for the purpose of comparative analysis. In fact, a textbook with a large number of inaccuracies may have more and better academic content than a textbook with few inaccuracies.

The current state adoption of science textbooks will determine what is taught to students in public schools throughout the next decade. Our review indicates that the middle school textbooks submitted for adoption do not provide the factual and comprehensive environmental education required to equip youth with the information needed to address the complex scientific, social, economic, and political challenges now facing Texas.

**Holt Science & Technology:  
Texas Edition\***

Holt Rinehart & Winston <i>Holt Science &amp; Technology: Texas Edition: 2002</i> Grade 6			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	2	6	2
Climate Change	0	3	2
Human Population Growth	2	0	1
Acid Rain	N/A	N/A	N/A
Species & Rain Forests	1	0	0
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>5</b>	<b>9</b>	<b>5</b>

Holt Rinehart & Winston <i>Holt Science &amp; Technology: Texas Edition: 2002</i> Grade 7			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	2	14	9
Climate Change	5	2	1
Human Population Growth	N/A	N/A	N/A
Acid Rain	2	1	3
Species & Rain Forests	0	1	1
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>9</b>	<b>18</b>	<b>14</b>

Holt Rinehart & Winston <i>Holt Science &amp; Technology: Texas Edition: 2002</i> Grade 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	0	1	2
Climate Change	N/A	N/A	N/A
Human Population Growth	3	0	0
Acid Rain	4	2	0
Species & Rain Forests	5	6	3
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>12</b>	<b>9</b>	<b>5</b>

Holt Rinehart & Winston <i>Holt Science &amp; Technology: Texas Edition: 2002</i> Grades 6, 7 & 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	4	21	13
Climate Change	5	5	3
Human Population Growth	5	0	1
Acid Rain	6	3	3
Species & Rain Forests	6	7	4
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>26</b>	<b>36</b>	<b>24</b>

**\*Legend:**

*N/A = Publisher did not include topic in text.*

*0 = No errors or omissions or selections with bias*

**Glencoe Texas  
Science\***

Glencoe-McGraw Hill <i>Glencoe Texas Science Teacher Wrap Around Editions: 2002</i> Grade 6			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	6	5	3
Climate Change	N/A	N/A	N/A
Human Population Growth	1	1	0
Acid Rain	2	1	0
Species & Rain Forests	N/A	N/A	N/A
Waste Management	1	1	0
Water Quality	0	2	0
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>10</b>	<b>10</b>	<b>3</b>

Glencoe-McGraw Hill <i>Glencoe Texas Science Teacher Wrap Around Editions: 2002</i> Grade 7			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	5	6	1
Climate Change	3	4	0
Human Population Growth	2	0	1
Acid Rain	2	0	0
Species & Rain Forests	1	0	0
Waste Management	1	2	1
Water Quality	0	1	0
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>14</b>	<b>13</b>	<b>3</b>

Glencoe-McGraw Hill <i>Glencoe Texas Science Teacher Wrap Around Editions: 2002</i> Grade 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	2	7	1
Climate Change	6	6	7
Human Population Growth	5	0	6
Acid Rain	0	2	0
Species & Rain Forests	3	3	1
Waste Management	1	0	0
Water Quality	1	0	0
Air Quality	2	2	0
<b>Total</b>	<b>20</b>	<b>20</b>	<b>15</b>

Glencoe-McGraw Hill <i>Glencoe Texas Science Teacher Wrap Around Editions: 2002</i> Grades 6, 7 & 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	13	18	5
Climate Change	9	10	7
Human Population Growth	8	1	7
Acid Rain	4	3	0
Species & Rain Forests	4	3	1
Waste Management	3	3	1
Water Quality	1	3	0
Air Quality	2	2	0
<b>Total</b>	<b>44</b>	<b>43</b>	<b>21</b>

*\*Legend:*

*N/A = Publisher did not include topic in text.*

*0 = No errors or omissions or selections with bias*

**Prentice Hall Science Explorer\***

Prentice Hall <i>Prentice Hall Texas Science Explorer Teacher's Editions: 2002</i> Grade 6			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	1	8	0
Climate Change	1	1	0
Human Population Growth	N/A	N/A	N/A
Acid Rain	3	1	0
Species & Rain Forests	N/A	N/A	N/A
Waste Management	N/A	N/A	N/A
Water Quality	0	3	0
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>5</b>	<b>13</b>	<b>0</b>

Prentice Hall <i>Prentice Hall Texas Science Explorer Teacher's Editions: 2002</i> Grade 7			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	N/A	N/A	N/A
Climate Change	1	1	1
Human Population Growth	1	1	1
Acid Rain	2	2	2
Species & Rain Forests	10	5	5
Waste Management	0	2	0
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>14</b>	<b>11</b>	<b>9</b>

Prentice Hall <i>Prentice Hall Texas Science Explorer Teacher's Editions: 2002</i> Grade 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	N/A	N/A	N/A
Climate Change	6	4	2
Human Population Growth	N/A	N/A	N/A
Acid Rain	2	3	1
Species & Rain Forests	1	2	1
Waste Management	0	5	0
Water Quality	0	7	0
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>9</b>	<b>21</b>	<b>4</b>

Prentice Hall <i>Prentice Hall Texas Science Explorer Teacher's Editions: 2002</i> Grades 6, 7 & 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	1	8	0
Climate Change	8	6	3
Human Population Growth	1	1	1
Acid Rain	7	6	3
Species & Rain Forests	11	7	6
Waste Management	0	7	0
Water Quality	0	10	0
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>28</b>	<b>45</b>	<b>13</b>

**\*Legend:**

*N/A = Publisher did not include topic in text.*

*0 = No errors or omissions or selections with bias*

**RonJon Select Science®\***

RonJon Publishing <i>RonJon Select Science Teacher's Edition: 2002</i> Grade 6			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	3	4	2
Climate Change	4	0	0
Human Population Growth	N/A	N/A	N/A
Acid Rain	N/A	N/A	N/A
Species & Rain Forests	N/A	N/A	N/A
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>7</b>	<b>4</b>	<b>2</b>

RonJon Publishing <i>RonJon Select Science Teacher's Edition: 2002</i> Grade 7			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	0	1	0
Climate Change	1	0	1
Human Population Growth	N/A	N/A	N/A
Acid Rain	0	1	0
Species & Rain Forests	0	6	2
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>1</b>	<b>8</b>	<b>3</b>

RonJon Publishing <i>RonJon Select Science Teacher's Edition: 2002</i> Grade 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	3	2	5
Climate Change	2	1	5
Human Population Growth	1	2	1
Acid Rain	4	2	1
Species & Rain Forests	2	5	6
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>12</b>	<b>12</b>	<b>18</b>

RonJon Publishing <i>RonJon Select Science Teacher's Edition: 2002</i> Grades 6, 7 & 8			
Topics	Errors		Bias
	Fact	Omission	
Energy & Natural Resources	6	2	7
Climate Change	7	1	6
Human Population Growth	1	2	1
Acid Rain	4	3	1
Species & Rain Forests	2	11	8
Waste Management	N/A	N/A	N/A
Water Quality	N/A	N/A	N/A
Air Quality	N/A	N/A	N/A
<b>Total</b>	<b>20</b>	<b>19</b>	<b>23</b>

**\*Legend:**

*N/A = Publisher did not include topic in text.*

*0 = No errors or omissions or selections with bias*



## Section V

### *Holt, Rinehart & Winston – Review of Grades 6, 7 & 8*

#### ***Holt Science & Technology: Texas Edition Annotated Teacher's Editions: 2002 Grades 6, 7, and 8***

The Holt middle school texts are notable for their focus on Texas-specific information, and in particular for the “Science Across Texas” segments at the beginning of each chapter. It is clear that much thought has gone into the preparation of these textbooks, and that there has been a general effort to conform to Texas state requirements and the standards of professional organizations.

Despite the many good things in these textbooks, there are several major problems. There is a disturbing lack of agreement among textbook publishers with official information on hard science numbers on several topics - most notably, world population projections, the pH of acid rain and other acids, and the amount of acreage of rainforest that is annually being destroyed.

The treatment of energy issues is particularly troubling. There is little, if any, economic information supplied that compares the costs and benefits of various energy sources. The coverage of both fossil fuels and alternative energy sources is inadequate as well. In many cases, the text presents inaccurate or misleading information. Just as frequently, important information about a resource is not provided. The end result is that students are not provided with the tools to properly evaluate the pros and cons of using various energy sources in today’s market, or with the tools to understand how today’s energy situation is likely to evolve over time.

#### **Section V. Holt Science & Technology: Texas Edition** **A. Energy and Natural Resources** *Summary of Grades 6 - 8*

The coverage of energy and natural resources in all three Holt middle school science textbooks contains significant errors of fact and errors of omission. In all three texts, definitions of non-renewable, renewable, and inexhaustible resources are incomplete and misleading. There is

inconsistent coverage of individual energy sources, and the texts introduce a bias against the past, present, and future use of fossil fuels. The texts begin with a presumption that students must be taught that the only hope for the future is for an immediate, wholesale switch to renewable or inexhaustible energy resources, even though the practical reality is that such a switch will much more likely be phased in over quite a lengthy period of time, if ever.

It is principally the failure to introduce economic principles and facts into the discussion that could mislead students and their teachers alike. One critical economic principle is that societies have historically replaced scarce, and thus costly, resources with cheaper, more plentiful resources that perform the same function. An example involves the current shift in the telecommunications industry from copper wire to fiber optics made of ordinary sand. A second principle is that over-reliance on any single source of materials - for example, crude oil from OPEC nations - can lead to price instability brought on by political pressures.

The failure to explain resource substitution as a function of scarcity and price is one of the major shortcomings in these textbooks' coverage of energy and natural resources. Students are not given comparative costs per energy unit for various fossil fuels, nuclear energy, wind power, hydro, solar, geothermal, or other energy sources. Nor are they made fully aware that the costs of each of these energy sources can vary considerably depending on location, embargoes (including withdrawal of public or even private lands from production), tax policies, subsidies, and other factors. The story of resource substitution over the course of history would provide students with valuable precepts for understanding how we may resolve concerns about future energy and natural resource needs.

The texts also fail to inform students about today's energy grids, which enable homes and businesses to obtain electric power from coal one day, natural gas the next, and nuclear, wind, solar or other sources on other days. The fuel switching that is commonplace in today's energy grids is nowhere mentioned in any of these texts, nor are the reasons (which include shutdowns for maintenance and repairs, peak load conditions, etc.) that this is done. Having diverse energy sources enables us to utilize the most efficient fuels as they are available, while providing additional, backup energy sources - which may be more expensive or more polluting - to meet high demand or in the event that the primary energy source is temporarily unavailable. These factors - price, diversity, and emergency - mitigate against the likelihood that we will wholly "run out" of any energy source in the near term.

## **Section V. Holt Science & Technology: Texas Edition**

### **A. Energy & Natural Resources - Grade 6**

The first part of Chapter 5, Energy and Energy Resources, covers basic energy science. Section 4 of the chapter focuses on "Energy Resources."

P. 136      Students are told that 454 kg of lead-acid batteries are needed to store the same energy of about 4 liters of gasoline. What does this say about electric cars? What does it say about disposal of batteries as hazardous waste? [OMISSION]

- P. 137      Figure 24, which shows predicted drop in oil production over the next 50 years, has no listed source; why not use M. King Hubbert’s classic 1956 prediction instead? The fact is that despite predictions of the impending demise of petroleum, oil prices, adjusted for inflation, have remained nearly constant for the past half century, and are likely to continue that pattern for many years to come. The only exceptions have been when politicians and governments imposed bans or restrictions on exploration and production. When the price does rise, other fuels will become more competitive, and the switch to cheaper fuels will both prevent the exhaustion of petroleum reserves and allow greater development of alternative uses for petroleum. [INACCURACY, OMISSION]
- The third chart in figure 24 shows that natural gas is the cleanest burning fossil fuel, but does not show units, nor does it show emissions from coal-fired power plants with new technological controls that limit emissions. These emissions data appear to represent the burning of coal as it used to be done - in open furnaces and fireplaces. [OMISSION]
- P. 139      What is the benefit to be gained by asking students to debate [Debate, Annotated Teacher’s Edition (ATE)] whether to develop shale oil and tar sands or renewable energy resources, given the fact that students have been given absolutely no information about these two resources in the text? Tar sands are already being mined in Canada, and new technology is lowering the cost and environmental damage caused by this mining. The oil in Canadian tar sands alone dwarfs all other North American petroleum resources - some have estimated there is a 300-year supply. Had students been given this information, they might be inclined to make a more knowledgeable choice than the (all too obvious) one the authors want students to reach - that the renewable resource should take precedence over fossil fuel. As for oil shale, the technology for recovery of oil from deposits high in the Rocky Mountains is nowhere near economic viability, and the environmental damage from the processes that have been tested by the former U.S. Bureau of Mines was excessive even for politicians in the 1960's and 1970's. [INACCURACY, OMISSION]
- P. 140      The ATE “Debate” section on page 140 has the same weaknesses, as does the “Alternative Assessment” in the ATE information on page 141. This entire section, as noted in the Introduction, is an unwarranted criticism of fossil fuels. [BIAS]
- The sections on page 140 on wind energy, geothermal energy, and biomass are inadequate, but these shortcomings will be discussed in our review of the more extensive coverage of these topics in the 7th grade text. [OMISSION]
- P. 141      The ATE’s “Connect to Environmental Science” states that reclamation of strip-mined land is “very expensive,” but fails to note that this cost has yet to price strip mining out of the market. Apparently, this label is used to convince students that strip mining is too expensive to be continued. An honest text would explain the

benefits society has received from strip-mined minerals, and note that the price of most strip-mined minerals has not changed much even with these “very expensive” restoration costs. [BIAS, OMISSION]

## **Section V. Holt Science & Technology: Texas Edition**

### **A. Energy & Natural Resources - Grade 7**

This text contains the most complete discussion of various energy sources, but the coverage is spotty and uneven. Chapter 6, Energy Resources, is not the only source of problems in this text, but it alone is filled with major errors and other problems. Once again, the definitions of nonrenewable and renewable resources are inadequate and misleading (see general comments). The section on “Conserving Natural Resources” on page 142 discusses recycling but fails to discuss the economics of recycling that make some recycling efforts better bets than others. This entire section is in need of economic context.

- P. 143            The “Motivate” exercise (ATE) is also a criticism of the use of fossil fuels. The text encourages teachers to (a) lead students in a discussion about why fossil fuels are so widely used, then “challenge” them to think about what a “good” fuel would be like - meaning, of course, that fossil fuels are not “good.” This is made evident by the next instruction - to give students 10 minutes to write an essay about “how the disadvantages of fossil fuels affect them.” [BIAS]
- P. 144            The discussion on natural gas is accompanied by a photo with a caption stating that automobiles powered by liquefied natural gas are becoming more common [should be commonplace, as we are not speaking of their behavior]. A better statement would be that LNG use by fleet vehicles has been increasing, though largely through government-sponsored efforts. The “automobile” here appears to be a fleet van, not a personal car. Moreover, the text fails to note that the lack of fueling stations (like the one shown) for LNG vehicles restricts widespread use of this fuel to fleet vehicles. [INACCURACY]
- P. 144            The discussion of coal is likewise a criticism of this resource. The text, for example, states that other energy sources are “better” than coal without explanation as to why. For many uses, coal has long been and continues to be the best available fuel. [BIAS]
- P. 146            The chart showing the relative carbon content of peat, lignite, bituminous coal, and anthracite does not link carbon content to energy efficiency, only to its pollution production without scrubbers. [OMISSION]
- P. 147            The map fails to show Alaska and its vast energy resources (or Hawaii, for that matter). It also fails to show East Texas lignite reserves, offshore oil anywhere, or the vast coal reserves in southeastern Utah taken out of production by the creation of the Escalante-Grand Staircase National Monument. Moreover, the text also fails to refer to the use of lignite for power generation in Texas. These

failures demonstrate a bias - for example, against drilling for oil in the Arctic National Wildlife Reserve. [OMISSION, BIAS]

- P. 148 The section on “Problems with Fossil Fuels” starts with a visual exhibition of and brief comment on the destruction caused by acid precipitation (acid rain) [see acid rain discussion], but fails to explain what has been done to curtail sulfur dioxide emissions. This could leave children with the impression that every time we burn coal we do major damage to wildlife, plants, buildings and statues - and that we have done nothing to stop or slow down this damage. The next paragraph outlines in brief the environmental and human health dangers involved in coal mining, but again says nothing about the improvements in mining techniques that have reduced these problems. [OMISSION, BIAS]

The *Exxon Valdez* is then cited as an example of problems with “collecting” petroleum, and burning petroleum is credited with creating smog. Oddly, the authors note that mountains around Los Angeles keep the wind from blowing pollutants away there, then state that LA’s smog levels have decreased in recent years. By contrast, there is no corresponding explanation that a major reason for Houston’s high smog levels is the long, hot, humid summer weather and the nearby heavily forested areas - or that Houston, too, has had decreasing smog levels. Nor is it stated that Texas has just taken major steps to further reduce smog in Houston within the next few years - information that ought to be added, even at this late date, and even though the new laws were just enacted this spring. As the text is now written, students get the impression that California is doing something to clean its air, while Texas is not. [OMISSION]

- P. 148 Students are told (ATE) that oil industry executives promise to drill only on 8 percent of the Arctic National Wildlife Refuge - the 1.5 million acre coastal plain - yet the current legislation would confine drilling to a maximum 2,000 acres within the coastal plain. Students are also not told that there is other oil drilling nearby, or even shown a map identifying the location of the ANWR and Prudhoe Bay, or a photograph showing the terrain in the ANWR coastal plain. [OMISSION]
- P. 149 Photos depict the use of mass transit, walking, and riding a bicycle, but none show technological improvements that have lowered air pollution from burning fossil fuels. The text here makes a misleading statement that the only way we can solve our pollution problems is to stop using fossil fuels and switch to alternative fuels. [BIAS, OMISSION]
- P. 150 In a section on nuclear energy, students are told that “a safe place” needs to be found to store “dangerous radioactive” nuclear wastes so that radiation cannot escape into the environment. There is, however, no discussion on efforts to find - and get approval for - such storage sites. Nor does the text mention that the cost of building and operating nuclear plants in the U.S. has been exacerbated by emotional reactions that have led to much litigation and even cancellation of

projects, as well as to very high margins of safety. The text also fails to note that Texas has two nuclear power plants and ample uranium resources (in south Texas) that have been mined in the past. [OMISSION]

The text also refers to Chernobyl to warn students that nuclear plants are killers - without noting that (a) Chernobyl had antiquated technology not used anywhere else, (b) Three Mile Island, this nation's worst "disaster," was in reality a minor event, causing less damage than typical train derailments, (c) that other nations, like France, rely heavily on nuclear energy, or (d) that Vermont relies even more heavily than France on nuclear energy, and several U.S. states obtain much or most of their energy from nuclear plants. [OMISSION, BIAS]

A recent PBS Frontline segment reported that, "In France, unlike in America, nuclear energy is accepted, even popular.... France's decision to launch a large nuclear program dates back to 1973 [the year of the Arab oil embargo]. Over the next 15 years France installed 56 nuclear reactors. A major reason was that the nation has no fossil fuel resources of its own and was wholly dependent upon imports. Another reason, says PBS, was that, "Scientists and engineers have a much higher status in France than in America." This difference in public acceptance levels in part is "that cultural, economic, and political forces in France act to counteract" fears of radiation and disaster that have crippled the development of nuclear energy here. Yet, while France recycles most of its nuclear waste for reuse, disposal has recently become a significant issue. The year 2006 may determine whether France accepts a nuclear waste management proposal that is now in the works. [USEFUL INFORMATION]

- P. 151      The text tackles solar energy, informing students that "many homes and businesses" use solar panels mounted on their roofs even though these panels are expensive to produce. Oddly, there is no explanation of how a solar panel is made, or of the ways outdoor solar cells can be impaired by dust, hail, and other natural or man-made materials - or of what has been done to try to minimize these negative impacts on solar cells. [OMISSION]

The photo of the "former" solar power facility in California raises more questions than it answers. First, why is this facility no longer in existence? Was it that the cost of generating electricity made the facility uneconomical, or were there other problems? One supposes that students would want to know why this huge project died. [OMISSION]

- P. 153      It is useless to mention a cost per kilowatt-hour for solar without giving some comparable costs for other energy sources. [OMISSION]

- P. 154      Moving to wind energy, this Texas textbook states that most of the wind power generation in the U.S. is in California, but fails to note that Texas is ranked No. 2, and that wind power generation is growing faster in Texas than anywhere else in the nation. The "Brain Food" inset in the ATE further states that North Dakota

alone experiences enough steady wind to supply about a third of the nation's electrical energy needs, but fails to note that the long distances that such power would have to travel keep the price of that power high. This inset also fails to note that Texas ranks No. 2 - and barely behind North Dakota - in wind power generation potential. According to the American Wind Energy Association, Texas has 1,190 billion kWh/y in potential and has 199.54 MW of installed wind power generation capacity and 919.78 MW under development. North Dakota, by contrast, has 1,210 billion kWh/y in potential energy but only 0.5 MW installed. California, which ranks only No. 17 in wind energy potential, has 1,603.95 MW installed and 455.03 MW planned, though some of this is just repowering existing plants. [OMISSION]

P. 155 The omissions continue as the text turns to hydroelectric energy. Again, there is no mention of Texas hydro plants - at least one of which (Canyon Dam) may be threatened because of potential conflicts with drinking water needs. The "Multicultural Connection" in the ATE mentions environmental concerns over hydroelectric dams. The most famous hydro plant in the U.S. - the Tellico Dam in Tennessee - was nearly stopped because its construction was believed harmful to the endangered snail darter, but politicians overrode the Endangered Species Act to save the dam. The text also fails to provide data on how much power can be generated via a typical hydroelectric project. [USEFUL INFORMATION]

P. 156 Moving to biomass, the discussion - including the "Multicultural Connection"(ATE) - is of the burning of dung and wood, both of which create air pollution problems and one of which creates disease vectors, especially in Third World nations that still rely on these primitive heating and cooking methods. While the ATE inset mentions composting pig manure to harness methane, the text makes no mention of the more sophisticated anaerobic digesters used in Europe and being tried out in the United States, or of an even newer technology, thermal depolymerization, for which the EPA just awarded a \$5 million grant to a Missouri firm for a field test. [OMISSION]

As a subset of biomass, the text refers to gasohol - but does not mention the primary ingredient, which is ethanol. [Ethanol is used in other Holt texts in this series, and in one other place in this text.] The text laments that producing biomass alcohol fuel would require land that could otherwise be used for growing food; however, the fact that we have taken huge amounts of arable land out of food production that could quickly be replanted with corn and other crops is absent. [BIAS]

P. 156 The "Section Review" activity (p. 157) asks students to explain why "gasohol" could create "another problem," and introduces a MathBreak (p.156) that asks students to calculate the number of acres of corn needed to fuel a car for a year. The MathBreak fails to account for the volume-percent ethanol in this reformulated gasoline (RFG), making the calculation way off base - because ethanol is an additive that constitutes only a small portion of the fuel. The text

also fails to note that RFG containing ethanol is recommended by the EPA and virtually required by the state of California (over objections) as a fuel to be used during certain times of the year to cut down on carbon monoxide emissions. This type of oxygenated RFG is also required in El Paso part of the time. Moreover, the text fails to note that U.S. farmers who are receiving subsidies to grow corn to manufacture this fuel are strongly in favor of mandates for using this fuel. [INACCURACY, OMISSION, BIAS]

- P.157 The discussion of geothermal energy would be enhanced by a discussion of the use of geothermal heat pump technology, which relies on the differential between surface and underground temperatures to heat and cool homes. President Bush has installed such a system at his ranch in Crawford, Texas, and this technology is used in an estimated 400,000 U.S. homes. [USEFUL INFORMATION]
- P. 162 The graph shows worldwide use of various energy sources, but Texas teachers will have to provide their own charts showing domestic and Texas energy use breakdowns. Again, nothing in the text shows relative prices for different types of energy per unit generated. [USEFUL INFORMATION]
- P. 163 It also seems heavy-handed to use the name “Gigantico Industries” in the TEKS/TAAS practice test. This name gives children the impression that oil companies are “gigantic” and thus out of control and dangerous to ordinary people. [BIAS]

## **Section V. Holt Science & Technology**

### **A. Energy & Natural Resources - Grade 8**

Chapter 11, Maintaining the Environment, provides this text’s major discussion of energy issues. The text starts with the hopeful statement: “People and industry prefer to avoid pollution to begin with.”

- P. 290 The section on “Resource Depletion” fails to mention resource substitution or price and its relationship to scarcity. The photo of a strip mine fails to include corresponding information about resource extraction methods that protect the environment, such as slant-well drilling for oil and natural gas and double-hull oil tankers, or information on various technologies for containing oil spills and other accidents. Moreover, there is nothing that identifies the benefits and value associated with the use of natural resources. [USEFUL INFORMATION, BIAS]

The text in the “Marine Habitats” section provides only partial information about the effects of oil spills and does not identify how natural forces in the environment counteract damage, or note that most damage is temporary. The selection on alternative sources of energy - labeled “Reduce” - provides little information about such things as how societies convert from one energy source to another. [OMISSION, BIAS]



## **Section V. Holt Science & Technology: Texas Edition**

### **B. Climate Change (Global Warming) & Greenhouse Effect**

None of the textbooks contain a proper discussion of climate change and the theory of recent global warming that is supposedly caused by increased burning of fossil fuels. The grade 6 and grade 7 texts have only cursory coverage that is skewed and wholly fails to prepare students for critical thinking exercises related to the topic. The grade 8 text ignores this topic.

## **Section V. Holt Science & Technology: Texas Edition**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 6**

With few exceptions, this text gives students incomplete and one-sided coverage of the scientific debate that surrounds the global warming issue. While students are made aware that a scientific debate exists, they are given little or no scientific information to be able to critically think about the alternative theories that attempt to explain climate change.

Introducing this topic with such brief factual information, has little educational value and creates the opportunity for harm. Factual coverage of climate change should mention that temperatures on the earth have risen and fallen over time, creating ice ages and warmer periods. It would also note that scientists only a few decades ago were speaking about a coming time of “global cooling,” and that even recent satellite data suggest a cooling of the upper troposphere. This text only provides the basics of the “human-caused” global warming theory - that burning fossil fuels has increased levels of the greenhouse gas carbon dioxide in the atmosphere, leading to increased temperatures.

The fact that the atmosphere’s CO<sub>2</sub> content has increased is not in dispute. The graph on page 304 of the Holt grade 8 text shows this increase clearly. Some might say that graph is on the low side. What is disputed among scientists is that this increased CO<sub>2</sub> concentration has “caused” global warming. Except for a brief reference to the scientists who believe that warming might be from natural causes, students are not given the scientific information to evaluate either theory. Nor does the text show that CO<sub>2</sub> is but a minor component of the atmosphere, which is mostly nitrogen and oxygen, or that most CO<sub>2</sub> in the atmosphere comes from natural sources, or that water vapor is more prevalent in the atmosphere and is the more important greenhouse gas. Nor does the text state that CO<sub>2</sub> is necessary for plant growth.

- P. 516            Unfortunately, the discussion of global warming in Chapter 19 fails to tell students that most global warming predictions are based on computer models and that these models have limitations, just as the population models do. [OMISSION, BIAS]
- P. 517            While the “Activity” suggests that students may find weaknesses in the hypothesis that human activity has led to global warming, the text itself does not. [OMISSION]
- P. 517            The section, “Keeping the Earth Livable,” makes the confusing statement that only “some” scientists accept that global warming is a natural process. Perhaps

the authors intend this statement to refer only to alleged warming in the latter half of the 20<sup>th</sup> Century, or to possible warming in the 21<sup>st</sup> Century. Tree planting is a longstanding tradition - even though the text fails to mention Arbor Day, a U.S. tradition over 100 years old that is now celebrated on the last Friday in April. Texans are urged to plant pecan trees on that date. [USEFUL INFORMATION, BIAS]

- P. 517 The text states that, “Many of the world’s nations have signed a treaty to reduce activities that increase greenhouse gases in the atmosphere.” It should specify which treaty, and explain whether its provisions are enforceable or voluntary. [OMISSION]

## **Section V. Holt Science & Technology: Texas Edition**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 7**

Chapter 16, Climate, provides limited and selected information about global warming, but does not include sufficient scientific facts and comprehensive theory for students to understand this important topic.

- P. 148 The “Scientists at Odds” section suggests that students use newspapers and magazines to write a “balanced essay” on the global warming debate. Yet, while newspapers and popular media may be more attractive and accessible to students, these media are not academic or scientific (and often not even factual) sources of information on any topic. Students should instead be referred to scientific journals such as *Nature* and *Science*, where they can find information on the different scientific theories and arguments that surround the global warming debate. [USEFUL INFORMATION]
- P. 408 Figure 29 shows sunlight streaming through a car with closed windows such that heat is trapped inside. Students are then told that, “The earth’s atmosphere acts like the glass windows in a car,” but this is misleading. Students should understand that the term “greenhouse effect” is itself somewhat of a misnomer. The important distinction is that greenhouse gases trap infrared energy emitted from the earth, which is far different from the way a car or an actual greenhouse is heated by the sun. [INACCURACY]
- P. 408 The paragraph entitled “Window to the World” provides only one “hypothesis” for increasing temperatures - that the rise in global temperatures is due to an increase in carbon dioxide as a result of human activity. The text should also include information that (a) NASA satellite temperature data show no warming since 1979, (b) most of the warming over the past 100 years took place prior to 1938, and (c) there is an alternative global warming hypothesis that relates the earth’s temperature to changes in the sun’s energy output as documented by the sunspot cycle. Without this added information, the text fails to equip students for thinking critically about the global warming issue. [OMISSION, INACCURACY]

- P. 408      The inset, “Brain Food,” tells students that, “On the planet Venus, global warming is a serious problem” thanks to a runaway greenhouse effect. This is a stretch at best, as there is no information to the effect that temperatures on Venus are rising higher than they had been in the past. This “greenhouse effect” may keep temperatures on Venus hot enough to melt lead, but for there to be “global warming” there, these temperatures would have to be steadily increasing. [INACCURACY]
- P.409      The section, “Consequences of Global Warming,” contains only negative predictions suggested by some scientists, and fails to present the beneficial effects of increased carbon dioxide levels (including increased crop production, faster growing forests, and enlargement of growing areas) that have been championed by other scientists. [BIAS]
- P. 409      The sidebar “Apply” misleads students by proposing that a city manager might receive a “warning from EPA” for exceeding the automobile fuel emissions standards. The only real “fuel emissions standard” that exists is the one used by state inspection stations to ascertain whether individual vehicles must be repaired or taken off the road. The National Ambient Air Quality Standards address all sources of emissions of targeted pollutants, and emissions from vehicles make up varying percentages of emissions of each pollutant. Cities may receive warnings that they are not meeting the NAAQS - but not individual emission standards (except for individual vehicles within city-owned fleets). In addition, fuel manufacturers may be required to produce specific gasoline and diesel formulations that, when burned in engines, generate fewer polluting emissions than traditional blends, but this also has no direct bearing on city managers. A better choice here might be to state that, “A city manager has been informed by EPA that without significant reductions in automobile or other emissions, the city may become subject to sanctions under the Clean Air Act.” [INACCURACY]
- P. 417      The topic section “Science, Technology, and Society” presents information about the complexity of climate computer models but fails to provide sufficient examples for students to understand both the strengths and weaknesses of these models. The text inaccurately presents the predictions of climatic disaster (pages 408-409) as fact, rather than as predictions of computer models. For students to fully discuss, as the teacher’s edition suggests, “shortcomings of climate modeling,” they must be fully informed about the strengths and weaknesses of the global warming computer models and therefore of the limitations of any predictions based on these models. [INACCURACY, OMISSION]

## **Section V. Holt Science & Technology: Texas Edition**

### **C. Human Population Dynamics**

The two texts in which population growth is covered are far from agreement even on the simple issue of future world population. Page 17 of the grade 6 text cites the United Nations in a graph that projects world population to be 9.46 billion in 2100. But page 291 of the grade 8 text

includes a graph that suggests no end to exponential population growth. This is combined with text stating that by 2100, the world population may be 14 billion - yet no source is cited for this estimate.

Neither text shows relative population growth (or birth rates) by nation, per capita income, continent, or other relevant factor, though the grade 8 text (ATE) does show varying growth rates of some countries as information to be shared with “advanced” students. There is no coverage of population growth in the grade 7 text.

More significantly, brand-new research, reported in *Nature* on August 2, 2001, suggests that world population will level out far sooner, and at a far lower number, than previous studies have indicated. This study, led by Wolfgang Lutz of the International Institute for Applied Systems Analysis, states there is an 85 percent chance that global population will peak before the year 2100, and a 60 percent chance that this peak will be under 10 billion. Rapid declines in birth rate in many nations are the principal reason for these predictions, which were statistically achieved.

## **Section V. Holt Science & Technology: Texas Edition**

### **C. Human Population Dynamics - Grade 6**

The discussion of population growth would be much improved with a corresponding discussion of how world food production has kept up with growth, but that the distribution of available food is sometimes thwarted as a result of political instability or oppression.

- P. 17            The authors use a well-sourced graph that provides United Nations projections of future human population growth to 2150. This graph shows the predicted leveling by 2050 at an estimated 9.75 billion people. Yet, the discussion of human population growth in Chapter 8 (pages 221-225), which is mainly devoted to plant and animal population concepts, mentions only exponential growth and ignores the United Nations prediction that world population will level off within the next 50 years or so. [INACCURACY]
- P. 225            If, as is stated here, Darwin “learned” from Malthus, his learning was flawed, because Malthus expected that exponential human population growth would dwarf the growth in world food supplies. Of course, had that happened, starvation and competition for food would have quickly ended the exponential growth in population that Malthus feared. It would be better to state that Darwin relied on Malthusian theory to develop his own theory of natural selection. But why bring Malthus into this discussion at all? [BIAS]
- P. 225            Also on this page, the authors try to reinforce the Malthusian error in the “QuickLab” entitled “Will We Run Out of Food?” This experiment uses two egg cartons and rice grains to drill into students’ minds the supposed relationship between exponential population growth and linear growth in food supplies. The teacher edition states that students should draw the conclusion that there will soon not be enough food to support the fast-increasing population. While this may be a fine mathematical exercise for showing the difference between exponential and

linear growth, it has little to do with real-world plant, animal, or human population and food supply dynamics. A better illustration would be to explain to students that annual quotas and seasons are set for hunting of game animals so that the animal populations will be maintained but not allowed to increase such that the game animals will not be able to find enough food in the wild. [INACCURACY]

## **Section V. Holt Science & Technology: Texas Edition**

### **C. Human Population Dynamics - Grade 8**

The only coverage of human population growth in this text is in a section of Chapter 11: Maintaining the Environment called, “Environmental Problems.” A single paragraph for students and a “Math and More” exercise for advanced students found in the teacher edition - both on page 291 - lead students to the conclusion that human population growth is likely to remain exponential and become an insurmountable environmental problem. This contradicts evidence that the recent exponential growth in world population is already slowing and that even the United Nations expects that population will stabilize at under 10 billion by 2050 or so. The text also fails to state the reasons for the recent exponential growth or show that growth has already virtually ceased in most developed nations, though the “Math and More” exercise shows the minuscule growth rates in the developed world.

P.291 Text suggests a world population in 2100 of 14 billion, contradicting information in the grade 6 grade text (page 17) that shows United Nations population estimates of 9.46 billion people in 2100. In fact, the UN’s Population Division provides a low estimate of population in 2050 that is only 1.6 billion above the year 2000 figure of 6 billion. [INACCURACY]

The section also contains statements of opinion inaccurately represented as fact, including the comment that “human population is already too large for earth to support.” While this is presented only as the belief of “Some people,” in reality this opinion is held by a very small group of demographers, and no alternative theories of human “carrying capacity” are provided. One scientist, for example, has estimated that the world could support 47 billion people living on a diet enjoyed by most Americans in the 1960’s. [INACCURACY]

Figure 8 shows human population growth as virtually non-existent from 8000 BCE to just before 2000 CE and indicates that population has increased exponentially over the past 300 years. While the graph accurately portrays the fact that total world population has increased rapidly in recent centuries, it does not show that the growth rate has been declining since the late 1960’s. Nor does it show that demographers now predict, based on the recent change in growth rate, that world human population growth will slow dramatically in the 21<sup>st</sup> Century. This graph also states that earth’s human population is NOW doubling every few decades, which is no longer true. Why not use the United Nations graph shown on page 17 in the grade 6 text? [INACCURACY]

## **Section V. Holt Science & Technology: Texas Edition**

### **D. Acid Rain**

The Holt series fails to discuss, or even mention, the findings of a 10-year study of acid rain by the National Acid Precipitation Assessment Program (NAPAP), or information from the Acid Rain Home Page maintained by the U.S. Environmental Protection Agency. This leaves Holt's coverage of this important topic lacking in factual information and impedes the ability of students to use "critical thinking and scientific problem-solving to make informed decisions."

Moreover, the goal of the authors appears to be convincing children that, because acid rain is very bad, those who continue to use coal to fire power plants are the enemies of society. One of the worst errors, which is repeated many times, is that the text provides erroneous information about the acidity of acid precipitation that greatly exaggerates the acidity range.

The only comment on acid rain in the grade 6 grade text (page 7) "informs" students that "air pollution can lead to acid precipitation, which can hurt plants and damage buildings." This statement, offered without context, would lead students to conclude, without a factual foundation, that the utility industry should be regulated or eliminated. One way to provide balance would be to note that, in response to the 1990 Clean Air Act Amendments, there has been a massive reduction in the amount of sulfur dioxide released to the air from coal-fired power plants.

## **Section V. Holt Science & Technology: Texas Edition**

### **D. Acid Rain - Grade 7**

The coverage of acid rain lacks coherence. Information is presented without the logical sequencing required for students to understand concepts. Any proper discussion of acid rain would begin with a discussion of pH, including an explanation that the pH scale is logarithmic, but this information is provided only in the teacher's "Connect to Physical Science" (page 481). The only text discussion of the pH of acid rain - in the appendix (page 689) - provides erroneous information that contradicts the error-filled information on pH provided elsewhere in the Holt series.

The NAPAP study reported that the pH of normal rainfall is about 5.6 (with 7.0 being neutral), while the EPA's acid rain page now states that normal rainfall may have a pH of 5.5. NAPAP study found the pH range of acid rain to be as low as 4.2 but normally about 4.6, while EPA now says the most acidic acid rain is about pH 4.3. Yet the appendix shows acid rain with a pH as low as 2.4 - exaggerating the acidity of acid rain by a factor of about 60 times. This error is repeated in the teacher transparency.

The first mention of acid rain (page 7) repeats the statement from the grade 6 text (see above). The second mention is on page 148 (Chapter 6, Energy Resources) [see comments under "Energy and Natural Resources" above]. The subject is broached again in Chapter 19, Weathering and Soil Formation."

- P. 481 The section on “Acids in Precipitation” begins with a discussion of sulfuric acid in car batteries - yet does not state that the pH of this acid is about 0.4 - one of the strongest of all acids (other than stomach acid). The text then states that “a weaker form of sulfuric acid” can be found in nature, then transitions to the statement that, “precipitation such as rain and snow is naturally acidic and contains carbonic acid. While both of these statements are true, the text needlessly confuses students by comparing one of the mildest acids - carbonic acid in rainwater, with one that is more than 1 million times stronger - sulfuric acid found in car batteries. [INACCURACY, OMISSION, BIAS]
- P.481 The teacher edition suggests that advanced students study different aspects of acid precipitation and organize a task force presentation for the school or community - an effort that would represent uninformed blind activism without providing students with the findings of the NAPAP report or the current EPA information. [BIAS]
- P. 482 The text presents information about acid rain without any pH levels to use as factual reference points. Instead, the text states, “Acid precipitation contains more acid than normal precipitation, so it can cause very rapid weathering of rock.” This section also claims that it “can be harmful to plants and animals...” Both of these statements are contradicted by the NAPAP study, the largest scientific review of acid precipitation ever conducted, and by current EPA information. [INACCURACY, BIAS]

The NAPAP study and its 1998 update found no widespread forest or crop damage from acid rain, and that in the United States fewer than 5 percent of lakes and fewer than 10 percent of streams were found to be “chronically acidic.” The NAPAP report further concluded that, while acid rain does contribute to weathering of buildings and statues, the magnitude “has been difficult to assess.” EPA’s acid rain page also notes that, “Many lakes and streams examined in a National Surface Water Survey suffer from chronic acidity, a condition in which water has a constant low pH level.... In areas like the Northeastern United States, where soil buffering is poor, some lakes now have a pH value of less than 5.” EPA goes on to note that over three times as many lakes and streams are only temporarily acidic as a result of storms and spring snowmelt. [USEFUL INFORMATION]

## **Section V. Holt Science & Technology: Texas Edition**

### **D. Acid Rain - Grade 8**

The grade 8 text repeats the errors from the grade 7 text and is equally disappointing in its presentation of this important topic.

- P. 95 The graph repeats erroneous information about the acidity of acid rain found in the identical graph on appendix page 689 of the grade 7 text. [INACCURACY]

- P. 96 This misinformation is repeated with the statement that rainwater can have a pH as low as 3, well below the NAPAP and EPA lower boundaries for acidity of 4.2 and 4.3, respectively. But at least, this text begins early with a discussion of pH that includes information that some soils have a normal pH of 4.0 to 6.0. [INACCURACY]
- The text on page 96 further states that “fish and other living things might die” when the pH of lakes is lowered. The section should be clarified to indicate that the severity of the effects of acid precipitation on the environment is a matter disputed among scientists. The largest scientific study of acid rain concluded that less than 5 percent of lakes nationwide were “chronically acidic.” Other streams and lakes are temporarily acidic after heavy storms or spring snowmelt. [INACCURACY, OMISSION]
- P. 287 The “Apply” sidebar states that power plants near Isabel’s home emitted sulfur dioxide that became toxic when mixed with water vapor and led to the deaths of nearby trees, as well as in aquatic life in a lake hundreds of kilometers away. The text provides no documentation that the damage to trees in the photo was actually caused by acid rain from power plants near her home, or acid rain at all. There is no mention that opposing research findings differ on the degree and magnitude of the effects of acid rain on the environment. At least the teacher commentary admits that the linkage between sulfur dioxide from power plants nearby Isabel’s home and the deaths of trees and fish a long distance away is only a possibility - not a fact. But the students have not been given information that could lead them to this more accurate conclusion. [INACCURACY]
- P. 489 The section on air pollution on page 489 likewise shows dead fish and trees and notes that acid precipitation “can kill” these living things - but nowhere is it stated that such deaths could be attributed to other causes, such as natural acidity in nearby soils, ice storms, drought, or even low dissolved oxygen in the water. [OMISSION]

## **Section V. Holt Science & Technology: Texas Edition**

### **E. Endangered Species & Tropical Rainforests**

The coverage of endangered species in the Holt texts (which do not mention “threatened” species) is entirely negative. Worse, the text implies that highly civilized societies are the ones primarily responsible for habitat destruction and species loss, which contradicts the real-world facts that only with the ascendancy of the First World has there been any real focus on protection of plant and animal species at all. Nor is there any discussion of how economic incentives and disincentives affect species and habitat protection in ways both positive and negative.

The coverage of rainforest destruction (grade 7 text) is typical, in that the references to the area destroyed over time are not supported by sources. The entire group of middle school “science” textbooks is guilty of using numbers that lack citation or sources. The Holt grade 7 text (page 398) states that, “Scientists estimate” that 130,000 square kilometers of tropical rain forests are



being cut every year, and that if this trend continues there will be no remaining rain forests in 30 years.

This information (for which no source is provided) differs dramatically from data reported in the Glencoe series that 310,000 square kilometers per year of rain forest are being cut, and from data in the Prentice Hall series that use official Brazilian government data to state that, from 1978 to 1996, 12.5 percent of the entire Amazon rain forest had been destroyed, and that in 1995 alone 30,000 square kilometers had been cut. Using the 1978-1996 data, it took 19 years to destroy one-eighth of the rain forest; at that rate, it would take 152 years - not the 30 years predicted here - to wipe out every rainforest tree.

For those unaccustomed to calculating in metric units, 1 square kilometer (or 100 hectares) is equal to 0.386 square mile, or 247.1 acres. Thus,  $130,000 \text{ km}^2 = 50,193 \text{ mi}^2 = 32 \text{ MM acres}$ , and  $300,000 \text{ km}^2 = 115,800 \text{ mi}^2 = 74 \text{ MM acres}$ .

The December 13, 1993, issue of *U.S. News and World Report* explained that a single Brazilian scientist in 1988, using satellite data on fires burning in the Amazon at that time, came up with the number 40 MM acres a year through various extrapolations. This number soon became popular, though Holt and Glencoe texts found their own numbers. In summer 1996, however, two U.S. researchers, David Skole of the University of New Hampshire and Compton Tucker of NASA, undertook a much more rigorous review of satellite data and found that the average rate of rainforest loss in the Amazon was 3.7 MM acres per year - and, with Amazon loss commonly stated as representing half the world's loss of rainforest area, the worldwide total would be about 7.5 MM acres per year - or just over  $30,000 \text{ km}^2/\text{yr}$  - 10 percent of that reported by Glencoe estimate, and less than 25 percent of that reported by Holt. Other researchers have shown that even these rainforest destruction numbers are probably overblown, as many of the fires used in these calculations were in savannah areas, not rainforest areas. Almost all of this destruction has taken place on the periphery of the rainforest, as the heart of the rainforest is virtually inaccessible except by boat.

Of course, even these numbers can be misleading, given that other evidence shows that many forest acres were destroyed long before modern times. Moreover, nothing in the texts is presented to suggest alternatives (other than for students to collect money to purchase freedom for a rainforest acre or two) that might actually encourage the local residents in equatorial nations (where the rainforests tend to be) to find other ways to feed, clothe, and house themselves. Possible ways include debt forgiveness - but that would have to be tied to economic incentives for peasants who are cutting forests to plant food crops or else third-world governments would be likely to ensure their funds through use of force against peasants.

## **Section V. Holt Science & Technology: Texas Edition**

### **E. Endangered Species & Tropical Rainforests - Grade 6**

- P. 393      The sole reference to a species deemed endangered in this text comes in an “Environment Connection” that incorrectly states that, “Today, elephant hunting is illegal.” This may be true in Kenya and some other nations, but in nations like

Zimbabwe, legal elephant hunting is hailed as a fruitful element in an overall elephant habitat conservation strategy. [INACCURACY]

Hunting advocate Dr. Bill Morrill of the International Wildlife Management Coalition [www.iwmc.org] states that, “The African elephant is a natural resource that lends itself to assignable ownership, and that ownership, coupled with benefits produced from hunting, provides an incentive for conservation.” He continues: “Hunting of the African elephant by foreign tourists has a long-standing tradition and is one of the uses of choice by many African nations today.... Elephant hunting by foreigners generates both finances for management and, with the emphasis on local people in management, it has increasingly begun to provide incentives to the people living with the wildlife [not to kill them indiscriminately].”

Morrill further states that, “We conserve only what we have incentives to conserve. Wildlife has three economic values. Legal value is the value assigned with regulated use. Illegal value would be the use outside of laws or regulation (for instance, poaching). No value means that the resource will effectively be ignored.” He also notes that, “In a world beset by many demands for land, if a species is to survive, a use which can be sustained both economically and ecologically provides independence that will favor survival in the most tumultuous of times.”

In fact, the numbers of African elephants in Zimbabwe and other nations that have allowed such controlled hunting have been increasing. The typical endangered species policy ignores the benefits of species management as a tool for ensuring survival. Such management may not involve hunting or killing. Photography is also an option that can be revenue producing. Other wildlife management preserves charge for the privilege of observing the animals in “the wild.”

## **Section V. Holt Science & Technology: Texas Edition**

### **E. Endangered Species & Tropical Rainforests - Grade 7**

- P. 423      Tropical rain forests are discussed briefly in Chapter 17, which covers the earth’s ecosystems. Students learn that 1,400 species of birds live in the treetops of rain forests which have more biological diversity than most places on earth. The nutrients in rain forests are in the plants and trees - not in the thin, poor soils. This mention of soil quality stimulates questioning about why students are not told that one way to limit the destruction of rain forests is to teach indigenous farmers how to add nutrients to soils in areas already cleared so that they can maintain crop production without having to cut more forest land. [OMISSION, BIAS]

## Section V. Holt Science & Technology: Texas Edition

### E. Endangered Species & Tropical Rainforests - Grade 8

- P.292 In a discussion of habitat destruction, students are taught that clearing rain forests not only destroys biodiversity but also badly damages the thin tropical soils. Here the claim is that tropical rain forests are being cleared “rapidly,” rather than at any specific rate, yet as shown above, how one defines “rapidly” may determine the accuracy of this statement. [INACCURACY]
- P. 292 Also in the discussion of habitat destruction, students are introduced to the concept of “biodiversity.” Text states that, “Many species have been driven to extinction because their habitat was destroyed.” This statement could be true or false depending on the meaning of “many.” In fact, some research estimates catastrophic extinction rates when habitat is destroyed, while other, equally valid research, estimates low levels of extinction even when large areas of habitat have been converted to farms and ranches. [INACCURACY, OMISSION]
- It is incorrect for the text to draw a direct positive correlation between habitat destruction and extinction. The science is more complicated than that, and the range of estimates of species loss due to habitat destruction, as determined in widely varying scientific studies, should be clearly stated. [INACCURACY]
- P. 297 The section on “Species Protection” states that, in the United States, the Endangered Species Act (ESA) is designed to protect individual species. The commentary also states that, “Many new species need to be added to the list,” an action that “takes a long time.” There is no mention of “threatened” status, or of the actions to protect species long before they reach even that status. Instead, the text continues (page 298) to state that, “Waiting until a species is almost extinct to begin protecting it is like waiting until your teeth are rotting to begin brushing them.” [OMISSION, BIAS]
- This statement suggests that the Endangered Species Act (ESA) is not protecting species because of a slow-moving bureaucracy that does not even get geared up to save a species until it is “almost extinct.” There is also no mention of either private efforts to save species or the unintended consequences of legislation that severely restricts the use of private (and public) land in its effort to keep humans from destroying habitat or taking endangered (or threatened) flora or fauna. Nor does the text acknowledge that the Endangered Species Act is widely used as an anti-development tool. [OMISSION, BIAS]
- P. 298 Figure 17 could lead students to believe that species can only be protected by government preserves on public lands. This is a political held by certain special interest groups and represents opinion, not fact. Government actions have not always benefitted species or habitat. State governments once paid bounties to those who killed mountain lions, hawks, and other predators. The Brazilian

government sponsored road building into the rain forest so that farmers could better clear land for farms and ranches. [INACCURACY, OMISSION]

Certain government efforts designed to save species and protect habitat under the ESA have had negative results. Many have argued that the law is written so as to pit private landowners against species and habitat in a battle for survival. Tree farmers may harvest trees before they mature if they fear that the government may prohibit any harvesting (or even “trespassing”) upon finding a threatened or endangered species, and the current law does not properly provide for compensation for the taking of private land for species protection. Others simply work hard to prevent species from using their property as habitat, so their land cannot be taken. [INACCURACY, OMISSION]

Many have argued that the ESA needs to be rewritten to better encourage landowners to provide species habitat by allowing them to continue non-interfering normal activities. Yet even without any refocusing of the ESA, there are many private efforts, some involving public-private partnerships, in which species and their habitats are being protected. One example dates to the 1930's, when private parties established the Hawk Mountain Sanctuary to protect hawks at a time when the Pennsylvania government was paying bounties for killing the predators. In Texas, there are many private preserves, including the Bamberger Ranch (shown on page 315 of the grade 6 grade text), which provides habitat for bats and other species. [BIAS, OMISSION]

## **Section V. Holt Science & Technology: Texas Edition Additional Comments**

Unlike some texts, the Holt series only lightly touches on water and air pollution, hazardous waste, and a number of other topics that are part of everyday life in the real world of environmental protection and resource conservation. One area that is covered is air pollution.

The statement on page 7 of the grade 6 text that “lighter cars make less pollution” is not technically true. Cleaner burning engines and cleaner burning fuels reduce pollution, though it is true that the same engine will burn less fuel if the vehicle is aerodynamically designed and uses lighter weight materials. [INACCURACY]

On page 490 of the grade 8 text, there are glowing comments on the clean air rules approved by President Clinton in 1997, but the text ignores the 1990 Clean Air Act Amendments signed by President George H. W. Bush, which contain the rules that even today are the major focus of regulatory action (that is, compliance with the one-hour ozone standard). The 1997 rules, which call for for tougher, eight-hour ozone standard and a new standard for fine particulate matter, have been challenged in court (not mentioned in this text at all) and have yet to take effect. [OMISSION, BIAS]

## Section VI

### *Glencoe, McGraw-Hill – Review of Grades 6, 7 & 8*

#### ***Glencoe Texas Science Teacher Wraparound Editions: 2002 Grades 6, 7, and 8***

The Glencoe/McGraw-Hill texts include some excellent work on water quality issues and a few other topics, but present insufficient and inaccurate information on air quality and many other issues. A significant concern with this series is the referrals to ancillary materials that were unavailable for review.

One of the major omissions in these texts is the failure to provide information about the current and projected costs of production and delivery of energy and natural resources. Another is the lack of information about alternative energy sources. No information is provided on the link between inexpensive energy and national prosperity, the engine that drives our ability and motivation to improve our nation's environmental performance and to export our concerns about environmental protection abroad.

Without such information, students may find it difficult to engage in critical thinking and scientific problem solving, or to analyze, review, and critique scientific explanations. Textbooks should prepare students for the real world of today and tomorrow by discussing cost-benefit analyses and other factors that are considered in making decisions about how to allocate human and natural resources for desired ends.

The texts also provide misleading information about human population dynamics that contradicts current best science information, and leaves students with the impression that human population will continue to increase exponentially. Instructional materials omit the National Acid Precipitation Assessment Program's findings on acid rain that have become the centerpiece of federal policy on that important issue. The texts should include a reference to the U.S. Environmental Protection Agency's acid rain home page, another excellent source of scientific information on acid precipitation.

## **Section VI. Glencoe Texas Science Energy and Natural Resources**

### *Summary of Grades 6 - 8*

The coverage of energy and natural resource issues is concentrated in the grade 6 and grade 7 texts, although the grade 8 text touches on a few points within this category. The Texas edition textbooks should focus on the strength and diversity of the energy industry in Texas, which includes production of oil, natural gas, coal, nuclear, hydro, geothermal, wind, and solar energy in significant quantities. Such information, among other things, will prompt students to pay better attention, learn more, and perhaps even visit these facilities. These texts do include excellent drawings that show how various power plants work.

## **Section VI. Glencoe Texas Science A. Energy and Natural Resources - Grade 6**

P. 130      The “Science Content Background” (p. 130E) includes an excellent discussion of geothermal heat pumps that is missing from most other texts; however, a drawing would add much to the students’ understanding. The Teacher FYI on page 150 adds to this discussion, as does the textual material on that page. President Bush has installed a geothermal heat pump at his Crawford ranch. A Texas company has been seeking approval to link this technology with regular water supply lines, but water system operators have argued that the heating of the water in the scheme could pose dangers by encouraging the growth of pathogens. [USEFUL INFORMATION]

This section also includes a statement that burning fossil fuels “produces carbon dioxide and other pollutants.” Carbon dioxide does not “pollute” the air. It is an essential part of photosynthesis that is necessary for all life on Earth. In past geologic time, increases in atmospheric carbon dioxide led to a greening of the Earth that, in fairly recent time, encouraged Viking exploration of the now-glacier-covered island of Greenland. [INACCURACY]

P. 146      It is misleading to suggest that, “Earth may run out of oil before the end of this century.” As oil (and any other resource) becomes scarcer, and thus more expensive sometime in the future, society will likely convert to other, less expensive energy sources before the oil supply is completely exhausted. Students should understand that the price of oil, adjusted for inflation, has remained relatively constant despite price spikes in the 1970's and that oil remains abundant. [INACCURACY]

P. 148      The “Problem Solving Activity” that asks whether energy consumption outpacing production begs the “yes” answer if one is speaking only of U.S. consumption and production. The U.S. has long imported a far greater proportion of a number of vital minerals, many of which are not present in any minable U.S. deposits; the issue as framed could have relevance in an economics text or if this text included a discussion of energy economics. Yet even more curious is that the authors are

not showing students this graph to lead them to consider that the U.S. might do well to step up energy production from all, or even from specific, sources - while perhaps also using energy more efficiently. This conglomerate graph also does not address the issue of energy uses for which the U.S. is increasingly relying on energy imports - which is mainly in the transportation sector. [INACCURACY]

P. 148 The section on hydroelectricity provides an excellent list of pros and cons.

P. 149 The section on “Solar Energy” acknowledges that the general cost of harnessing this energy is prohibitively expensive but predicts that the economics of solar power will soon become more favorable. The same could be said for a number of other energy sources, and if a way is found to harness the energy from nuclear fusion, that source may become much more popular than solar. [BIAS]

Students are also not told that solar energy already has some cost-effective uses and is even cost-competitive in sunny (mostly rural) areas or for special uses. However, the technology has not advanced to the extent that even small cities could operate on solar power regardless of its price. [OMISSION]

More importantly, these texts should prepare students for the real world of today and the near-term future. The fact remains that, despite a few artificial spikes in the price of oil, such as the 1973 Arab oil embargo and other times when crude oil supplies were limited, the price of oil has remained fairly constant since the end of World War II. The artificial withholding of supply by some nations has also sparked new exploration and development that eventually led to the abandonment of the embargo strategy. Had the authors included energy economics in their discussions, they could have noted that the U.S. has provided various subsidies for extraction and development of certain energy sources - from oil and gas to solar and wind power - at various times that have made those sources more competitive for consumers. [OMISSION]

P. 151 The section on wind power does not list its pros and cons, though the needed information is in the teacher’s answer to the question posed in Figure 21. The text should provide students with information about the land area needed for wind farming, the injuries to birds that occur when they get caught in the turbines, and the costs of transmission of wind energy from its typically remote generation sources to large-scale users. [OMISSION]

P. 151 The “Conserving Energy” section encourages students to conserve energy to avoid shortages, rather than as a way to lower their personal cost of living. The premise behind this is itself false -- that energy shortages “may occur” chiefly due to the exhaustion of fossil fuel supply. Just two pages earlier, in the section on solar energy, the text claimed that all that was holding back a switch to solar energy is that the price is still too high. While this may have been an exaggeration, the fact is that other energy sources could produce significant amounts of energy if the price were right. Energy shortages today and tomorrow

are more the result (and California is a prime example) of a failure to plan for supply assurance, to build out the energy transmission grid, to allow construction of new power plants that rely on any energy source, or as a result of military conflict or natural disaster. [OMISSION, INACCURACY, BIAS]

- P. 151 The “Challenge” in the teacher section urges students to favor “alternative” fuels over fossil fuels. Item three in the section assessment asks students to “give a number of reasons why depending on fossil fuels for energy will lead to trouble in the long run.” The mantra continued on page 152, in “Energy to power your life.” [BIAS]
- P. 154 Is it true (see Discussion in teacher section) that 18 percent of the energy used worldwide is from solar energy? What nations are relying on this difficult to harness resource? This is hardly true in the United States, where solar energy accounts for no more than one percent of total energy use (unless, perhaps, one includes solar energy that helps crops grow). Thus, for this statement to be true, the rest of the world would have to be relying on solar for at least one-third of its energy. [INACCURACY]
- P. 155 Since very few Americans have any idea what 6 km/L means, why not use the term “hybrid” cars powered by gas and electricity? The text also fails to point out that these hybrid vehicles are just now becoming viable, and have yet to be offered for sale in quantity, or that all-electric vehicles have become more of a curiosity for highway use, though all-electric wheelchairs, golf carts, and other vehicles needing only low energy output are commonplace. [OMISSION]
- P. 160 The title of this TAAS Practice is misleading. “Electric cars” are neither the wave of the future nor the proper topic of this passage. After years of research, scientists concluded that the all-electric vehicle was impractical and that a hybrid that uses gasoline and an electric motor with a larger battery was the only hope for the mass market. The passage also fails to discuss the problems of battery disposal or having batteries too heavy for many people to handle. The large batteries required for these vehicles may also pose health and safety threats to those operating vehicles (including from battery acids). Hybrid vehicles do not require the kind of plug-in recharging that is shown for all-electric vehicles. [INACCURACY]

## **Section VI. Glencoe Texas Science**

### **A. Energy and Natural Resources - Grade 7**

- P. 176 Rather than state that, “Sometimes hot water released from power plants can upset river and lake ecosystems ...,” the text should explain how this might happen; for example, a cooling tower failure. Students should learn that water is used in the power generation process. It is sent to cooling towers before it is released back into the environment and may sometimes be released when it is still too hot. The



caption to Figure 5 on page 586 in the grade 8 text explains the work of cooling towers. The explanation should be offered in this passage. [OMISSION]

- P. 647 The section “Supply and Demand” incorrectly analyzes the problems of scarce water and firewood. The caption for Figure 2 states, “In parts of Africa, firewood has become scarce,” but does not provide an answer as to why this may be true. In many parts of Africa, firewood is gathered on land that is commonly, not privately, owned. Since everyone, and thus no one, owns the land, individuals gather wood for their private use, but no one has any real incentive to increase the supply by, for example, planting more trees. Private ownership of land assures a level of stewardship, if only for the profit motive, that encourages replanting and harvesting of wood as a cash crop. [INACCURACY]
- P. 648 The “Fossil Fuel Conservation” tells students that the Earth’s supply of fossil fuels is “limited” and that they will become “more expensive and difficult to obtain.” Yet over the last half century the price for fossil fuels, adjusted for inflation, has remained nearly constant, even though the production, refining, and transmission and marketing of these fuels have all absorbed huge environmental costs that are reducing the impact of the environmental problems caused by these activities. Unlike the grade 6 text (page 151), this section includes an economic reason for practicing energy conservation, though the primary focus is more altruistic. Of course, savings from energy conservation are not limited to reducing fossil fuel energy use, but apply to cutting back on energy use no matter the source. [INACCURACY]
- P. 649 The section on hydroelectric fails to mention impacts on salmon and other fish whose spawning habits are interrupted by large dams. [OMISSION]
- P. 650 The section on wind power fails to mention how birds can get tangled in the turbine blades in some areas. While wind power accounts for only tiny amounts of electricity in the U.S. and Europe, students may be led by this statement to believe that wind power is widely used to generate electricity just about everywhere else. Texas is a national leader in new wind power capacity, and ranks second (behind North Dakota) in wind power potential. Wind power projects in Texas are proving to be cost-competitive, thanks to the rising price of natural gas. [OMISSION]
- P. 650 Rather than say that the safe disposal of nuclear waste is a problem that has not yet been solved, it would be more accurate to say that people are still not convinced that proposed methods of disposal of nuclear waste are safe. [INACCURACY]
- P. 651 The statement that “Geothermal energy is available only where natural geysers or volcanoes are found,” is incorrect. The grade 6 Glencoe text, for example, notes that, “You don’t need to live near a volcano to use geothermal energy,” and that there are at least 400,000 U.S. homes using geothermal heat pumps. This

technology has tremendous potential in many parts of the United States.  
[INACCURACY]

- P. 651 The text makes the misleading statement that solar energy is a “leading alternative” to fossil fuels. The statement is not based on actual development of energy resources in the U.S. or worldwide. An accurate statement would be that solar energy has potential to provide a larger portion of the world’s usable energy supply. The text fails to mention the downside of solar energy. Students are given no cost data for solar (or any other) energy sources, even though one major drawback to the use of solar energy (except in isolated locations) is its high cost. Nor is any information provided regarding maintenance of solar panels. Students should learn whether dust, hail, or other objects could damage or lower the efficiency of solar collectors, for example. [INACCURACY, OMISSION, BIAS]
- P. 651 The “Teacher FYI” notes that non-governmental organizations (NGO’s) are working to promote the use of solar cooking in regions where firewood has become scarce. While this may be a short-term solution to the cooking problem, it does nothing to solve the deforestation problem that is typically the product of common ownership (or no ownership at all) of land. The Activity on page 668 repeats this story, again without teaching the lesson of the tragedy of the commons that is a chief cause of firewood scarcity. The text fails to ask whether solar cooking is even the most viable option. [OMISSION]
- P. 653 Is this solar power plant still in operation? Another publisher showed a very similar photo of a solar power plant in the Mojave Desert in California that is no longer in operation. If it has been shut down, the text should explain why. [OMISSION]
- P. 658 The section on indoor air pollution provides useful information and even explains how super-insulated homes are at risk. One more statement as to how to combat indoor air pollution would be very useful. The Health Integration information on carbon monoxide should be linked to specific information on why natural gas units in homes must be vented, and why charcoal grills cannot be used indoors. [USEFUL INFORMATION]

## **Section VI. Glencoe Texas Science**

### **A. Energy and Natural Resources - Grade 8**

- P. 46 The section on radioactive waste could be enhanced by: explaining the difference between low-level radioactive waste and other wastes; discussing “assured isolation” and long-term above-ground storage; and explaining the NIMBY problem. [OMISSION]
- P. 558 The sentence in the opening paragraph pertaining to water consumption by Americans gives students the impression that water is NOT a renewable resource. [INACCURACY]

P. 568      The message behind Figure 12, “Yearly Consumption Per Person,” and the statement in text (which is not sourced) that Americans consume 30 percent of the world’s natural resources, is that Americans are guilty of high rates of resource consumption, and that this is somehow an ethical flaw. Moreover, it is not true that we consume 30 percent of the world’s resources, though it may be true that U.S. use constitutes 30 percent of worldwide resource use. For comparison, students could be told what percentage is consumed by Western Europeans. They could also be told that this ability to use resources effectively is the primary reason for this nation’s position as a world leader. [INACCURACY, OMISSION, BIAS]

The intended message in this section is that students should learn to reduce, reuse, and recycle in order to reverse the national trend toward a “throwaway lifestyle.” One excellent way to bring this message is to explain that, as industrial facilities have been pressed to follow these guidelines, many have found that they have saved money and increased profitability from these practices. Students could also be told, for example, that at one time oil companies flared natural gas that is commingled with crude oil deposits, but now this natural gas is as valuable as the oil. Other former waste products have become just as valuable. In addition, the way we handle waste products matters. Some secondary uses are more economically, and even more environmentally, beneficial than others. [OMISSION]

P. 580      The “Identifying Misconceptions” section asks teachers to have their students discuss the problems of ocean oil spills. Table 1, which shows the total yearly volume of oil spilled from 1970 to 1999, demonstrates that spills have been decreasing since the introduction of double walled hulls on oil tankers. Table 2 shows the small relative size of the Exxon *Valdez* spill compared with spillage from other accidents. Teachers and students, however, are not provided with information on improvements in oil spill response (or even the basics of oil spill response). Nor is information provided on the environmental impacts of oil spills, which a Congressional Research Service study found to be was “relatively modest and...of relatively short duration.” [OMISSION]

P. 596      The Cultural Diversity item in the teacher edition explains that burning biomass in open stoves creates health problems. This information should be include a discussion of the use in Europe, China, and now in the United States of anaerobic digesters that extract the heat content from animal waste and also can treat the remaining waste to eliminate nutrients. An even newer technology, thermal depolymerization, is also being used to turn biomass into energy. [OMISSION]

P. 596      While it is good to note that electrostatic precipitators can eliminate 99 percent of the particulate matter from burning fossil fuels, the text should also state that the new selective catalytic reduction equipment that is being virtually required in Texas and elsewhere can provide similar reductions in nitrogen oxides emissions. This equipment, while expensive, makes burning coal less of an environmental

concern than in the past. These new technologies change the whole picture of coal in particular as a polluting fuel whose use must be ended as quickly as possible. [OMISSION]

- P. 597 The Getting Around section fails to explain just how much we are reducing air pollution from motor vehicles and does not include a discussion on the differences between automobiles and trucks. Diesel emissions are very different from auto emissions, and yet this major subject is ignored. [OMISSION]

## **Section VI. Glencoe Texas Science**

### **C. Climate Change (Global Warming) & Greenhouse Effect - Grade 6**

The grade 6 text only once touches on the issue of climate change (global warming). On page 285, the discussion of the composition of the atmosphere provides data about the two major “trace gases” - water vapor and carbon dioxide. CO<sub>2</sub> is credited with helping keep Earth warm, but nothing more is said to identify this as the greenhouse effect. The Teacher FYI notes that after Mount Pinatubo erupted in 1991, “Earth cooled by about 0.5E C” as a result of the dispersal of huge quantities of aerosols, but there is no context for this information.

## **Section VI. Glencoe Texas Science**

### **C. Climate Change (Global Warming) & Greenhouse Effect - Grade 7**

- P. 644 In a section purportedly on the greenhouse effect, teachers are told that CO<sub>2</sub> is the “one of the most abundant of the greenhouse gases,” but that when it is emitted into the atmosphere as a “waste product” of energy production, this is different [in a bad way] from the releases of CO<sub>2</sub> as a consequence of respiration. Teachers are not told here that ordinary water vapor, most often in the form of clouds, is the most abundant greenhouse gas, information that would be relevant to discussion of the greenhouse effect. [OMISSION, INACCURACY]

- P. 656 Figure 13 wrongly links the greenhouse effect with the way heat is captured in an actual greenhouse. The main drawing indicates that greenhouse gases trap some of the reflected sunlight and warm the Earth’s atmosphere, and the small illustration of an actual greenhouse incorrectly reinforces the analogy. This illustration should be corrected to show that the Earth gives off infrared energy, some of which travels into outer space and some of which is reflected back into the atmosphere by greenhouse gases. This is not the same process that heats a plant greenhouse, which receives direct radiant energy from the Sun that heats the air and objects in the greenhouse. [INACCURACY]

The text also states that carbon dioxide is “one of the most important greenhouse gases” and calls it a “waste product” from the burning of fossil fuels. Students are not told that CO<sub>2</sub> is vital to plant growth, or that the relative abundance in the atmosphere provides an opportunity for increasing plant yields that at the same time would absorb this increased available CO<sub>2</sub>. Nor are they told that the greenhouse gas water vapor is more abundant in the atmosphere, or that these

gases together constitute a very small portion of the atmosphere.  
[INACCURACY, OMISSION]

An oversimplified explanation of the “global warming” issue fails to note that most of the increase in Earth’s temperatures in the past century was prior to 1938, thus before the increases in atmospheric CO<sub>2</sub>. The text also fails to note that NASA satellite temperature records show no warming at all in the upper troposphere, or that this indicates that what may be being passed off as “global warming” is just as likely to be surface warming in highly populated areas that is largely the result of “heat islands” created by buildings and other structures (including roadways) that trap heat and make urban temperatures higher than nearby rural temperatures. Because these urbanized areas constitute such a small percentage of Earth’s surface, the true “global” effect is minimal. The text also fails to note that recent discoveries indicate that scientists have overestimated ocean temperatures and are having to recalculate the temperature record as a result. Finally, no other alternative explanations for short-term warming, such as fluctuation of the energy output of the Sun indicated by the sunspot cycle, are provided. [OMISSIONS]

The “Teacher FYI” does indicate that some scientists think that higher CO<sub>2</sub> levels would help plant growth because “plants will be able to use it to grow faster.” This statement should be expanded and moved to the student edition, together with other information on possible positive effects of a warmer Earth.  
[OMISSION]

## **Section VI. Glencoe Texas Science**

### **C. Climate Change (Global Warming) & Greenhouse Effect - Grade 8**

Chapter 17 includes an excellent discussion of the scientific debate that surrounds *past* changes in the Earth’s climate (pp. 502-504). Students are taught about the change in the Earth’s tilt, the changes in solar output, crustal plate movement, and the effects of volcanic and meteorite collisions. These pages represent an excellent example of how a science text should teach science. The concluding paragraph is a model for explaining to students how competing scientific theories contribute to the explanation of complex natural phenomenon. Unfortunately, the commitment to scientific objectivity is abandoned in the next section on *current* and *future* climate change. Selected evidence is presented about possible global warming that is intended to motivate students to take action (pp. 505-509, p. 517). The discussion includes biased and distorted information.

P. 438      While the discussion of the ozone layer is adequate, the photos in Figure 10 are misleading. Students are not told that the “hole” is smaller in most other months of the year. Moreover, students are not provided with alternative scientific explanations as to why the size of this “hole” has changed over time. The lack of long-term data on this phenomenon makes it difficult to know whether this “hole” has perhaps cycled larger and smaller over millennia. [INACCURACY, OMISSION]

- P. 492 Is this chart accurate? Is there really an average 9E-10E F difference from downtown to the suburbs? Or is this just for math purposes? The text states only that there can be this temperature differential, not that it is an annual average. As noted above, the urban-rural temperature differential is one reason that urban residents are willing to believe predictions of a much warmer Earth in the absence of scientific evidence that this has occurred or will occur in the near future. [OMISSION]
- P. 503 The discussion in the text and in Health Integration of particulates is incomplete, and the Fun Fact about the Little Ice Age provides students with no context, even though this is a very important backdrop for today's climate conversations. The text should provide more information on the Little Ice Age from which the Earth is still emerging. [OMISSION]
- P. 505 Figure 14 repeats the errors of the grade 7 text in misrepresenting the science of the greenhouse effect. While the way a plant greenhouse traps heat is similar to the way Earth's greenhouse effect operates, the two processes have significant differences. The Earth radiates infrared energy, a portion of which is trapped by the greenhouse gases, while the rest escapes into outer space. Greenhouses are heated by direct solar radiation. [INACCURACY]
- P. 506 Other evidence of advocacy is in the statement that, "you will learn how human activity may add to global warming, and you will find out what you can do to help decrease this problem." It is misleading to cast "global warming" as a problem rather than a scientific phenomenon. The text fails to mention that most polluting power plants and factories in the world are not in the United States, which has some of the cleanest, but in nations like China that make little effort to clean the air. [INACCURACY, BIAS]
- P. 506 The "Global Warming" section is incomplete. While it correctly states that the Earth has warmed in the last 100 years, it fails to add that most of that warming occurred before 1938, or that most of the increase in atmospheric carbon dioxide that has come from burning fossil fuels entered the atmosphere after 1938. Inclusion of this fact would stimulate discussion about the scientific concepts of correlation and causation. [INACCURACY, OMISSION]
- The text presents information that could lead students to predetermined conclusions. For example, students are told that today's higher temperatures "might be a result of more greenhouse gases," but not that they might also result from changes in the solar output of the Sun, or even of natural changes of the Earth coming out of the Little Ice Age. Moreover, the NASA satellite temperature data suggest that there may be no global rise in Earth's temperature at all. The text should present all of these possibilities. [BIAS, OMISSION]
- The lack of optional explanations and the use of selective information also applies to the discussion of possible rises in worldwide sea level. The text suggests that

teachers have students “Make a Model” of sea level rise. But the model described does not approximate real world science based on what is known. Instead, it distorts scientific knowledge by about 60 times. The Intergovernmental Panel on Climate Change (IPCC) predicts a 5 to 20 inch rise in sea level by 2100 from possible global warming, yet this exercise asks students to “observe” which of a group of selected cities will be under water if sea level rises by 30 meters (approximately 1,180 inches.) If the information in the text was based on IPCC figures, none of the selected cities would be below sea level. Moreover, New Orleans and much of The Netherlands is already below sea level, yet neither is under water. [INACCURACY, OMISSION, BIAS]

The text is also biased in stating that, “Some climate models show that in the future, Earth’s temperatures will increase faster than they have in the last 100 years,” because it fails to mention that other climate models - and most empirical data - do not come to that conclusion. The text should explain that, while computer models are highly complex, they are imperfect because they are no better than the information fed into them. None of the models created to date has been able to predict known climate changes in the past, such as the Little Ice Age, based on data available today that are entered into the model. Moreover, students should be made aware that much simpler computer models used to predict the daily weather forecast are often wrong. [BIAS]

- P. 508      Again, this is purportedly a science text, yet once again, the primary purpose of the section, “How To Reduce CO<sub>2</sub>” is pure political advocacy that has little scientific foundation. The authors have obviously concluded that reducing CO<sub>2</sub> is a societal goal, and thus instruct students in how they should take action - and presumably encourage others to do the same - toward this goal. Has Texas ordered publishers to make such political judgments? And how does this blatantly politicized material possibly encourage students to develop critical thinking skills or to make decisions based on sound science? [BIAS]
- P. 509      The distortion of the greenhouse effect is heightened by the “Activity”, which asks students to place thermometers in each of two jars and one between the jars in direct sunlight, then to place a lid on one of the jars and record the temperatures at 5, 10, and 15-minute intervals. While this experiment might help students understand how a plant greenhouse traps heat, it does not demonstrate how the greenhouse effect works. [INACCURACY]
- P. 516      Review item 11 asks why global warming might lead to more extinctions. Given the theory that what is bad for some species may be good for others, one could argue that any real global warming could also bring about the evolution, creation, or other generation of new species. It is more likely that a single volcanic eruption would have a greater impact on species. [BIAS]
- P. 562      The Extension asks students to write reports linking carbon dioxide concentration in the air and global temperature increases. That might be hard to do, given that

carbon dioxide has been increasing, but since 1940 there has been little if any increase in global temperatures, according to satellite data. [BIAS]

## **Section VI. Glencoe Texas Science**

### **D. Human Population Dynamics - Grade 6**

P. 449 Chapter 15, Interactions of Living Things, includes an excellent biological discussion of plant and animal population concepts. Population size, density, spacing, limiting factors, and carrying capacity are all correctly explained. The graph of human population growth here is out of place, especially in the absence of any information that explains how human population dynamics is not bound by the same constraints as animal and plant population dynamics. [INACCURACY]

If the authors do wish to introduce the topic of human population growth, why not use a better graph that shows long-term changes and projections, rather than this very short time span? Moreover, any discussion of human population dynamics, in order to provide students with useful information, should note that most researchers predict that the massive slowdown, and even reversal, of population growth in the developed nations is likely to expand worldwide within the next century, such that we might reach zero population growth by as early as 2050. [OMISSION]

## **Section VI. Glencoe Texas Science**

### **D. Human Population Dynamics - Grade 7**

Once again, the authors have integrated an incomplete discussion of human population dynamics into a chapter that primarily focuses on animal and plant populations. The concepts that govern human population dynamics and plant and animal populations are very different and should be presented separately, so as not to allow students to believe otherwise.

P. 593 Figure 6, which shows human population densities of countries, is placed in a section on the biological concepts of competition and limits to growth as applied to plants and animals. Yet there is very little relationship between human population density and health, life span, and population growth, while population density is critical to plant and animal health and life spans. The Mini Lab “Observing Seedling Competition” (p. 593) makes the point that, while densely packed radish seedlings may grow taller, seedlings with more space are “greener, fuller, and more robust” - healthier. Students who read this section and conduct the Mini Lab, then look the human population map, may conclude that people in nations with dense human populations are also likely to be less healthy. [INACCURACY]

P. 599 Figure 11 shows a graph of human population from 1750 to 2050 that, among other things, fails to show the predicted leveling of human population growth at or about that time. Instead, text explains only that the graph shows that the Earth’s human population is growing exponentially and that, “By the year 2050, it is



estimated that Earth’s human population could reach 10 billion people.” This information could leave students with the impression that population is either at carrying capacity at that number, or that by 2100 or 2150, world population may double again. There is no information presented to document the vastly declining (or even nonexistent) growth rates in developed nations, or the predictions that similar significant drops in growth rates are on the horizon worldwide. [INACCURACY, BIAS]

## Section VI. Glencoe Texas Science

### D. Human Population Dynamics - Grade 8

The errors of omission in the grades 6 and 7 texts are compounded here by the statement in the “Science Content Background” section (page 554E) that, “The current population explosion is likely to continue and may even gain momentum.” This statement is incorrect on both counts. The current population explosion began to wane in the late 1960's when the world population growth *rate* began to decline; since then, this decline has accelerated. All credible population projections indicate that exponential growth will end before the end of this century. Unfortunately for students and teachers, the discussion in Chapter 19 is based on a misunderstanding of the facts and is motivated not by the desire to teach science, but to urge students to take action.

- P. 553        The text predicts continued exponential population growth and blames humans for all manner of evils without stating that humans have the potential to properly steward the Earth. [BIAS, INACCURACY]
- P. 554        This “Fun Fact” is another assault on American eating habits and on burger chains. One quarter-pounder takes 1.25 pounds of topsoil, and with 100 billion served by McDonald’s alone, this would be 125 billion pounds of topsoil just from one hamburger chain, not to mention the water, grain, and other products needed to satisfy our burger hunger. These appear to be junk science statistics, not real-world numbers. [INACCURACY, BIAS]
- P. 557        Figure 2 and the textual material are incomplete and misleading. The text states, “By 2100, the population is predicted to be about 11 billion – nearly twice what it is now.” This statement is contradicted by nearly every major world population projection - from the United Nations to the U.S. Census Bureau to the brand-new work reported in the August 3, 2001, issue of *Nature*. All of these predict that world population is most likely to top off at about 9.5 billion, and all indicate that the declining growth rates in the developed world are likely to be exported to the developing world within the next few decades. [BIAS, INACCURACY]
- P. 560        This text states that all farming except organic farming threatens the Earth and actively encourages children to buy organic produce, which is very narrowly defined and excludes many products grown without pesticides, for example. [BIAS]

- P. 561           The section on feeding livestock informs students that some (good) people argue that it is better to eat grain than to feed it to livestock and then eat meat and dairy products. Figure 6 also ignores several facts, including (a) oftentimes livestock are grown on land that does not support produce, (b) sometimes livestock are grown on land lying fallow from more intensive crops, (c) we have retired huge amounts of acreage and still grow more than enough food, and (d) no one wants to eat cabbage jerky. [BIAS, INACCURACY]
- P. 572           The Activity, “A World Full of People,” which asks students to model human population growth rates using a map and popcorn kernels, assumes a constant growth rate that is not supported by most researchers. [BIAS, INACCURACY]

## **Section VI. Glencoe Texas Science**

### **E. Acid Rain**

Because the Glencoe series fails to discuss, or even mention, the findings of a 10-year study of acid rain by the National Acid Precipitation Assessment Program (NAPAP), or the U.S. Environmental Protection Agency’s Acid Rain Program, coverage of this important topic cannot provide students with sufficient information necessary for them to use “critical thinking and scientific problem-solving to make informed decisions.” NAPAP was and remains an interagency scientific research, monitoring and assessment program on the effects of sulfur and nitrogen oxides on the environment and human health. NAPAP acts as a coordinating office between six federal agencies - NOAA, EPA, DOE, DOI, USDA, and NASA - and also fosters cooperation among its members, other governments, states, universities, and the private sector.

For example, the National Oceanic and Atmospheric Administration states on its website that, “During the 1980’s, the NAPAP greatly improved our technical understanding of acid rain and produced a wealth of information that is embodied in NAPAP’s 27 “State of Science and Technology Reports” and the “1990 Integrated Assessment Report.” Since 1990, NAPAP has conducted an integrated assessment of the costs, benefits, and effectiveness of the federal acid rain controls mandated in Title IV of the 1990 Clean Air Act Amendments.

Moreover, the goal of the authors appears to be convincing children that, because acid rain is very bad, those who continue to use coal to fire power plants are the enemies of society. One of the worst errors, which is repeated many times, is that the text provides erroneous information about the acidity of acid precipitation that greatly exaggerates the acidity range.

## **Section VI. Glencoe Texas Science**

### **E. Acid Rain - Grade 6 Text**

- P. 244           The “Science and History” insert in the teacher edition states that some acid rains are as low as pH 3.0, and that naturally occurring ash and gas from volcanoes, bacteria, and plankton account for 10 percent of the carbon dioxide in the air, and the rest is the result of human activities. While normal rainfall is mildly acidic (pH 5.6 or so), acid rain typically runs about pH 4.6 and can be as low as pH 4.2, according to the NAPAP study. EPA uses slightly different numbers - 5.5 for

normal rainfall, and 4.3 for the most acidic acid rain. Moreover, it is simply not true that 90 percent of the carbon dioxide in the atmosphere today is the result of human activities. This must be a misprint. [INACCURACY]

- P. 244 This section, and the accompanying student edition section on “Crumbling Monuments,” blames acid rain for “eroding some of the world’s most famous monuments.” Acid rain is said to be a “huge problem affecting national monuments and treasures in just about every urban location in the world.” It is true that acid rain is a contributor to stone erosion, but it is hardly the only factor. A 1998 U.S. Geological Survey Report, “Statistical Compilation of NAPAP Chemical Erosion Observations,” Open-File Report 98-755, states that, “the rate of stone erosion is weakly dependent on the type of calcareous stone, the ambient temperature, and the H<sup>+</sup> concentration [acidity] delivered in the incident rain. The analysis also showed that the rate of stone erosion is strongly dependent on the rain-delivery conditions and on the surface morphology and orientation.” This research is the product of over a decade of work by the National Acid Precipitation Assessment Program’s Materials Research Program. [INACCURACY]
- P. 270 Here it is noted that carbonic acid makes groundwater naturally acidic, just as it makes rainwater acidic. The same process that makes caves impacts monuments. [OMISSION]

## **Section VI. Glencoe Texas Science**

### **E. Acid Rain - Grade 7**

- P. 655 Figure 12 gives students a diagram of the pH scale that suggests acid rain may have a pH as low as 3.0, which is not supported by competent science (EPA and NAPAP, for example). Students are not told that the pH scale is logarithmic with each number 10 times the previous number; nor are they given the pH of other acids (or bases), including acidic normal rainfall, for comparison. The text compounds these errors by telling students that air pollution reacts with “water in the atmosphere to form strong acids,” a statement that may lead students to believe that acid rain is as acidic as sulfuric acid. [INACCURACY]

The discussion of effects of acid rain cites the theory that acid precipitation causes severe damage to lakes, streams, forests and statues, whereas EPA and NAPAP studies found that acid rain may contribute to these problems but is far from their sole cause. The Mini Lab (teacher edition) on measuring acid rain may enable students to learn the acidity of rainfall (when it occurs) in various parts of Texas, but Texas is not noted for acid rainfall, and any reading that shows a pH anywhere near 4.0 from such experiments in Texas (or anywhere else, for that matter) would be highly questionable. [INACCURACY]

## **Section VI. Glencoe Texas Science**

### **E. Acid Rain - Grade 8**

P. 593            The pH scale in Figure 12 should include information about natural rainwater and acid rain. The statement in the caption that natural rainwater is about pH 5.6 should be indicated on the scale. In addition, typical acid rain at about 4.6 and some of the most acidic acid rain at about 4.2 should also be added to the scale. [OMISSION]

Students should be told that natural rainwater is slightly acidic because moisture in the atmosphere reacts with atmospheric carbon dioxide to form carbonic acid. An easy demonstration of this is to have students measure the pH of distilled water, which should be 7, then fill a container half full with this distilled water and shake it. When the students re-measure the water, it should be slightly acidic. [OMISSION]

## **Section VI. Glencoe Texas Science**

### **F. Endangered Species & Tropical Rainforests**

The grade 6 text does not include a section on endangered species, though it uses data on endangered species in the “Tables and Graphs” section on pages 57-59. The information shown (number of endangered species in the U.S. (Figure 14) and Table 4 (page 57) and the two graphs in Figure 16 (page 59) may give students the erroneous impression that U.S. policies are forcing more and more species into extinction, when the reason for the increasing number of listed species has more to do with the bureaucratic workings of the Endangered Species Act related to species listing. The data in Figure 15 are more innocuous. None of these graphs shows threatened species, species in recovery or de-listed, or even an explanation of the listing process. Without an appropriate section on endangered species that includes such facts, students may be left with a false impression of the status of species protection in the United States.

The coverage of rainforest destruction (grade 8 text) is typical, in that the references to the area destroyed over time are not supported by sources. The entire group of middle school “science” textbooks is guilty of using numbers that appear to have been drawn out of a hat. The Glencoe grade 8 text (page 562) reports that 310,000 square kilometers per year of rain forest are being destroyed, and that up to 25,000 species worldwide might become extinct each year due to the loss of rainforests.

This information (for which no source is provided) differs dramatically from data reported in the Holt grade 7 text (page 398), which claims (again, with no source) that, “Scientists estimate” that 130,000 square kilometers of tropical rain forests are being cut every year, and that if this trend continues there will be no remaining rain forests in 30 years.” The Prentice Hall series, meanwhile, uses Brazilian government data to state that, from 1978 to 1996, 12.5 percent of the entire Amazon rain forest had been destroyed, and that in 1995 alone 30,000 square kilometers had been cut. Using the 1978-1996 data, it took 19 years to destroy one-eighth of the rain forest; at that rate, it would take 152 years - not the 30 years predicted here - to wipe out every

rainforest tree. Someone has these numbers very wrong - and only one textbook publisher has cited a source at all.

For those unaccustomed to calculating in metric units, 1 square kilometer (or 100 hectares) is equal to 0.386 square mile, or 247.1 acres. Thus,  $130,000 \text{ km}^2 = 50,193 \text{ mi}^2 = 32 \text{ MM acres}$ , and  $310,000 \text{ km}^2 = 119,660 \text{ mi}^2 = 75 \text{ MM acres}$ .

The December 13, 1993, issue of *U.S. News and World Report* explained that a single Brazilian scientist in 1988, using satellite data on fires burning in the Amazon at that time, came up with the number 40 MM acres a year through various extrapolations. This number soon became popular, though it is clear here that the authors of the Holt and Glencoe texts found their own numbers. In summer 1996, however, two U.S. researchers, David Skole of the University of New Hampshire and Compton Tucker of NASA, undertook a much more rigorous review of satellite data and found that the average rate of rainforest loss in the Amazon was 3.7 MM acres per year - and, with Amazon loss commonly stated as representing half the world's loss of rainforest area, the worldwide total would be about 7.5 MM acres per year - or just over 30,000  $\text{km}^2/\text{yr}$  - 10 percent of that reported by Glencoe estimate, less than 25 percent of that reported by Holt, and presumably only half of that reported by Prentice Hall.

Other researchers have shown that even these rainforest destruction numbers are probably overblown, as many of the fires used in these calculations were in savannah areas, not rainforest areas. Almost all of this destruction has taken place on the periphery of the rainforest, as the heart of the rainforest is virtually inaccessible except by boat.

Of course, even these numbers can be misleading, given that other evidence shows that many forest acres were destroyed long before modern times. Moreover, nothing in any of the texts is presented to suggest alternatives (other than for students to collect money to purchase freedom for a rainforest acre or two) that might actually encourage the local residents in equatorial nations (where the rainforests tend to be) to find other ways to feed, clothe, and house themselves. Possible ways include debt forgiveness - but that would have to be tied to economic incentives for peasants who are cutting forests to plant food crops or else third-world governments would be likely to ensure their funds through use of force against peasants.

## **Section VI. Glencoe Texas Science**

### **F. Endangered Species & Tropical Rainforests - Grade 7**

The discussion of endangered species briefly in a section on "Mammals Today" (page 281) contains the incorrect assertion that species are endangered solely because their habitats are being destroyed. While this is the primary reason, a science text should be more complete and discuss, for example, the competition from non-native plant and animal species that also contributes to species loss. Again, the paucity of information leaves students with erroneous impressions of the status and dynamics of species protection. [INACCURACY]

## Section VI. Glencoe Texas Science

### F. Endangered Species & Tropical Rainforests - Grade 8

Once again, there are several unconnected references to endangered species, some of which are found in a section entitled, “Species and the Environment,” but no thorough explanation of the status and dynamics of species protection. Students are not told how the species extinction estimates were made, nor even that they are only estimates.

- P. 355        The “Extinction of Species” section contains the scientifically indefensible statement that, “The rate of extinction today is as great or greater than at any time in the past, as shown in Figure 16.” Scientists simply do not know how many species are being lost. In fact, this issue is currently being debated in the scientific journals. Students need to know that extinction is a concern, but they need to be presented with both sides of the scientific debate, as well as with enough factual information to enable them to draw their own conclusions. [INACCURACY, OMISSION]
- P. 420        This “Science Stats” section on extinction includes a graph (p. 421) of “great mass extinctions of species,” which is at best speculative based on the available, probably incomplete fossil record. Note that the text fails to include any estimates (or supposed calculations) of species generation (or creation) over time, though there is considerable discussion of selective breeding and mutation. [INACCURACY, OMISSION]
- P. 562        Text states that 310,000 km<sup>2</sup> of rainforest is cut down every year (see comments above). Just as curious is the statement in the caption to Figure 7 that southeast Asia has lost 72 percent of its original rain forest over the past 8,000 years. This, too, is mere speculation, and it also says nothing about the reasons why this may have happened. Figure 7 also shows “tropical rain forests” in North Korea, Japan, and even Tibet, which we did not realize had tropical climates. [INACCURACY]
- P. 563        Figure 8 states that “some communities” set aside land that cannot be developed, ignoring the work of private entities to create green space. Does Glencoe want students to believe that only government is good and able to protect the Earth from predatory ordinary humans? Perhaps government workers are a super race that is not subject to normal human failings. [OMISSION, BIAS]

## Section VI. Glencoe Texas Science

### Additional Comments

The Glencoe texts include considerable discussion of issues, such as waste management and water quality, that are largely ignored by some publishers. We note that “suvivors” (page 644A of the grade 7 text) should be “survivors” in the description of videos in the National Geographic teacher’s corner.

The “Connections” section on page 601 of the grade 8 text (teacher edition) has a list of environmental organizations that lacks balance. This list should also include groups like the National Wilderness Institute and the Environmental Conservation Organization. The list also includes a “Department of National Resources,” which must be a misprint. [OMISSION, INACCURACY]

### ***Waste Management***

The “story” of Love Canal presented on page 250E of the grade 6 text is largely myth that reflects the popular wisdom, but is far from accurate as to both the scientific and political facts in the case. This is a gross error that cannot be allowed to be in a textbook except as a presentation of environmental mythology. [INACCURACY]

The text states that in 1953 officials “unknowingly” built an elementary school and playground on a previously covered dumpsite. The record, however, shows that Hooker Chemicals & Plastics Corp., which had buried the 22,000 tons of chemical waste in the canal between 1942 and 1953, “tried desperately” to convince the city of Niagara Falls ... not to build on the site,” according to author Michael Fumento in his book, “Science Under Siege.” Eric Zuesse, writing in Reason magazine in 1981, stated that the city school board applied massive pressure to obtain the land despite Hooker’s repeated warnings of potential health hazards. Hooker finally caved to local pressure and sold the land for one dollar.

It is true that there were heavy rains and snows in the late 1970's and that waste was raised to the surface and was exposed. But the chief reason for this was that the city decided to build a housing project over this well known toxic waste dump, and the excavation for that project is what brought the waste to the surface. It is also true that the cleanup was costly. But Hooker successor Occidental Chemical Corporation \$129 million to cover the federal government’s cleanup costs, plus \$98 million more paid to New York State for its cleanup efforts. This is not an estimate, but a historical fact. It is also true that scientific studies done by the State of New York Department of Health and the federal government have confirmed that Love Canal residents had no more illness than would be expected in any other area of similar size. Yet it has been politically useful to maintain the myth of Love Canal, just as it was politically useful to maintain the myth of Times Beach - despite the major backtracking by the federal government over the dioxin problems in that Missouri town.

The Love Canal story is also cited on page 574 of the grade 8 text. Here, the focus is on the incineration of hazardous waste. The text can be commended for providing logical arguments for both sides of the incineration debate.

Figure 11 (page 262, grade 6) does a nice job of showing how landfills work, but this drawing does not show the use of monitor wells, or even of vent gas pipes (which in many landfills link to collectors that enable burning methane as fuel). [OMISSION]

The graph (page 125, grade 7) showing “projected recycling” in 2000 makes little sense, given that the prior year shown is 1995. Better to show a longer span, which might capture the increase in recycling over say the last 20 years. [OMISSION]

One good discussion question for students would be why it is that household hazardous wastes (see discussion on page 662, grade 7) are not be placed into bins similar to recycling bins for regular at-home pickup. Requiring people to gather up these wastes and drive them to a centralized collection center that is accessible only on specified days is an awkward methodology for waste management. [USEFUL INFORMATION]

Figure 21 (page 664, grade 7) could also mention that scrap tires and tire pieces are burned in incinerators for heat content. The sections on Reduce and Reuse are much more like preaching than science. [OMISSION, BIAS]

Text (page 666, grade 7) here says that at least 25 percent various steel products is recycled, but the graph on page 125 of the grade 7 text shows that 36.5 percent of ferrous metal was recycled in 1995, with year 2000 projections of up to 46 percent. These data appear to be inconsistent. [INACCURACY]

Is the Nevada site (page 564, grade 8) different from the Yucca Mountain facility, which page 46 of this text states has been in operation a while? This page also contains a decent discussion of sanitary landfills and hazardous wastes, but would be better with statistical data to support the claim that new technologies that help recycle hazardous waste have decreased the need to dispose of them. [INACCURACY]

Not until page 571 of the grade 8 text do students learn that there are actually disadvantages to recycling. Why not state this fact up front?

### **Water Quality**

The sections (page 252, grade 6) on groundwater, despite the Love Canal mythology up front, are very well done, and cover ground missed by most other publishers seeking Texas' blessing.

Figure 3 (page 254, grade 6) does not truly show the Ogallala Aquifer's boundaries, but suggests that there is one single huge aquifer that stretches over most of the South and Midwest. Adding a line boundary for the Ogallala would solve this problem. This omission makes the text reference on page 267 ("you learned earlier about the Ogallala Aquifer") virtually meaningless. [OMISSION]

Here in Texas, phosphorus has replaced nitrates as the most troubling pollutant in runoff from animal feedlots. Text (page 265, grade 6) should also mention that many farmers now recover manure for various uses, and that anaerobic digesters can remove the methane from manure for use as fuel and at the same time reduce the nitrate and phosphorus concentrations in the manure. [OMISSION]

The section (page 638, grade 7) on wastewater provides much very useful information on a major environmental concern. Natural attenuation, by the way, is quite common here in Texas, and in lots of places in Texas there are new "constructed wetlands," many being overseen by the Galveston Bay Program. [USEFUL INFORMATION]



As with the more thorough discussion in the Grade 6 text, there is a good presentation (page 659, grade 7) on water pollution that is not diminished by politicized statements but sticks to facts.

The section on ocean water (page 660, grade 7) would be improved by adding information about natural attenuation of ocean pollution. [OMISSION]

The section on water pollution beginning on page 582 of the grade 8 text provides useful information to students, and the diagram in Figure 4 (page 585) is excellent. Text could be improved by again referencing natural attenuation and other methods of sewage management, including septic fields.

The before and after photos on page 587 (grade 8) of the Cuyahoga in Cleveland show that humans can reverse environmental degradation. This is good. But the “Reducing Water Pollution” section “extension” is very vague and misleads students into thinking that some members of Congress want to end all federal regulation of water quality. A more accurate representation of the views of many in Congress is that some water quality regulations impose too heavy a burden on communities where the requirements do not match up with real-world conditions. A better choice would be to target atrazine or even arsenic requirements. [INACCURACY]

### ***Air Pollution***

Figure 9 (page 591, grade 8) shows that cars are responsible for 60 percent of smog. Is this a national average? This is not true in the Houston and Beaumont areas; the Beaumont area is not even required to perform emissions inspections on motor vehicles. Moreover, this pie chart omits biogenic sources of smog, a gross oversight. There would be no smog problem in the Smoky Mountains, or even in Big Bend National Park, without biogenic sources. [INACCURACY, OMISSION]

The statement (page 592, grade 8) that smog is not a problem where winds disperse pollutants is not entirely accurate. Winds transport ozone hundreds of miles in some cases, and the Texas attainment plans all recognize this fact. [INACCURACY]

The discussion of indoor air pollution (page 594, grade 8) would be improved by a discussion of black mold that has become a significant problem in Texas and which is not an industrial pollutant. [OMISSION]

## Section VII

### *Prentice Hall, Inc. – Review of Grades 6, 7 & 8*

#### ***Prentice Hall Texas Science Explorer Teacher’s Editions: 2002 Grades 6, 7, and 8***

These textbooks are notable for the “Science and Society” and “Science and History” sections. The grade 6 text provided perhaps the freshest read of any of the dozen middle school textbooks reviewed. The text was readable, and in many cases there was ample exposition of varying points of view regarding controversial topics. Pages 2-9 should attract student interest with a thorough discussion of the Wind Engineering Research Center activities at Texas Tech University. This is followed by a well-written presentation of “what is science,” all before Chapter 1 begins.

Page 92 has an excellent annotated graph showing the speed of transportation over the past two centuries, and page 110 provides an excellent map of a river’s path to the ocean. This, and other information in the early chapters, is just good science well presented science. The section “Understanding Nature’s Designs” is notable in that the authors are agreed that nature has design, that life begets life, and that spontaneous generation is a myth. On page 152 we see a photo of Santa Gertrudis cattle on the King Ranch as part of a section explaining selective breeding. The unfolding of the plant and animal kingdoms, too, is orderly and well supplied with photographs, drawings, and other materials to hold children’s interest. When the topic turns to ecosystems, it is introduced with a tale of a Texas prairie dog town.

The grade 7 text, too, begins with a very interesting Texas Field Trip - to the Texas Heart Institute - then transitions to an interesting discussion concerning the meaning of science. The grade 8 text starts by taking children to NASA in Houston. Many of the Science and Society sections (grocery bag, irradiated food, and light pollution) provide opportunities and sufficient information for children to exercise critical thinking skills. A special treat was the section on how to build a crystal radio, something students did more than four decades ago.

There are, however, too many pages encouraging students to take action on sometimes questionable environmental grounds. Science texts should instead encourage students to perform

scientific experiments, or to do further reading on scientific controversies, or even to contact research institutions or the authors of scientific journals. If students on their own are inclined to political action, that is fine, but it should not be the purpose of science classes to train students in political activism. It is especially improper to provide students with inadequate, or even biased or incorrect, information and to encourage political actions based on such information.

One of the major omissions in these texts is the failure to provide information about the costs of production and delivery of energy and natural resources, or of the projected costs in the future, adjusted for inflation. Nor do the texts discuss the impact of scarcity on cost and the resulting drive to seek alternative sources of whatever materials (including energy sources). Nor is there information provided on the link between inexpensive energy and national prosperity, the engine that drives our ability and motivation to improve our nation's environmental performance and to export our concerns about environmental protection abroad.

Without such information, students will find it difficult to engage in critical thinking and scientific problem solving, or to analyze, review, and critique scientific explanations. Textbooks should prepare students for the real world of today and tomorrow, not for a utopia that does not require cost-benefit analyses and consideration of other factors in making decisions about how to allocate finite human and natural resources for desired ends.

The texts provide misleading information about human population dynamics that contradicts current best science information, and leaves students with the impression that human population will continue to increase exponentially. The texts also ignore the National Acid Precipitation Assessment Program and its findings on acid rain that have become the centerpiece of federal policy on that important issue, as well as information on the topic supplied by the U.S. Environmental Protection Agency's Acid Rain Program. NAPAP was and remains an interagency scientific research, monitoring and assessment program on the effects of sulfur and nitrogen oxides on the environment and human health. NAPAP acts as a coordinating office between six federal agencies - NOAA, EPA, DOE, DOI, USDA, and NASA - and also fosters cooperation among its members, other governments, states, universities, and the private sector.

## **Section VII. Prentice Hall Science Explorer**

### **A. Energy and Natural Resources**

#### *Summary of Grades 6 - 8*

The grade 6 text provides students with thorough coverage of various energy sources, with much good and useful information. Neither the grade 7 nor grade 8 texts cover this topic, which is quite surprising, given the importance of energy and natural resources to almost every scientific field, and the fact that the TEKS appear to require such coverage. The chief problem with the presentation is that it relies on a distorted view of nonrenewable resources (fossil fuels) that ignores technological and economic realities.

## Section VII. Prentice Hall Science Explorer

### A. Energy and Natural Resources - Grade 6

Chapter 9, “Energy Resources,” does an excellent job in showing how electric and nuclear power plants generate electricity, and also of explaining the importance of energy in our society. Yet the text fails to explain the benefits of maintaining and continuing to develop a diverse energy base for power generation and other energy uses in this nation. There is insufficient information on the pros and cons of each energy source, in particular, information on the costs of providing energy from each source to consumers, and information on what is being done to overcome the down sides of utilizing each energy source. One very useful item would be to explain how the energy grids work - that energy from different sources enters the same grid, and at peak load times in particular, the oldest, least efficient power plants provide energy without which there would be massive power outages that could disrupt entire communities.

The unevenness of the text is made evident through a side-by-side comparison of how the strengths and weaknesses of each energy source are presented. [Solar is expensive and only generates usable energy when the sun is shining, yet solar energy is supplied by an inexhaustible source, and so on.] It is not necessary to divide the discussion of resources into separate pros and cons sections, but the goal should be first to teach students how we derive energy from each type of energy source, perhaps at that time explaining the benefits of using that source. Then there could be a section that compares the costs and benefits, both economic and environmental, of using each source - and what society is doing (and has done) to mitigate the down sides of using that source [sort of a “Consumer Reports” methodology]. Students should learn from this type of presentation why it is that particular energy sources are used at particular locations, and what changes may be needed before certain energy sources either increase or decrease in use.

- P. 295      The statement that, “If fossil fuels continue to be used more rapidly than they are formed, they will eventually run out,” is true in theory, but very likely not true in the real world. The fact is that, as fossil fuels (or any product) become scarcer, their price will rise, and people will switch to other fuels - the economic message ignored throughout the text. This error is repeated on page 313, in a section that explains the value of fossil fuels today and the need to search for alternative fuel sources. Rather than say, “They won’t last forever,” say something like, “As fossil fuels become scarcer, they will also become more expensive, making other energy sources more attractive for supplying our power generation needs.”  
[INACCURACY]
- P. 296      There is a good explanation of petroleum’s value as an energy resource and of some problems that can arise from its mishandling and of the air pollution problems that must be addressed as we continue to rely on fossil fuels. There is an excellent “Background” for teachers that explains how the U.S. removed lead from gasoline that is not found consistently in other texts.
- P. 298      The discussion of coal that notes some of its advantages and disadvantages without saying that other fuels are “better.” But the section fails to mention the new clean coal technology (particulate scrubbers and nitrogen-oxides-removing

selective catalytic reduction techniques, for example) that are significantly reducing air emissions from power plants and other coal-burning facilities. [OMISSION]

P. 300 There is an excellent description of solar technologies, noting that “solar cells are used mostly in areas where fossil fuels are difficult to transport.”

P. 302 There is an excellent drawing of how a hydroelectric power plant generates energy, as well as an explanation that hydro has its own drawbacks. The following section on Biomass actually speaks about (but does not use the term) anaerobic digesters, and the Background (for teachers) explains that one California project burns cow manure to generate electricity and eliminates a disposal problem. The text also discusses drawbacks of biomass fuels. An even newer technology, currently being tested in Missouri under a federal grant, uses thermal depolymerization to turn animal wastes into usable energy. [USEFUL INFORMATION]

The short section on Geothermal energy would be improved by a discussion of geothermal heat pumps, which rely on the differential between surface and below-ground temperatures to heat and cool hundreds of thousands of U.S. homes (including President Bush’s ranch in Crawford, Texas). The section on Wind would be better with a discussion of Texas’ new commitment to wind energy, and by noting that Texas has the greatest potential outside North Dakota for wind power generation. The section should also mention that in some places, wind turbines pose a danger to birds. This text even mentions the possibilities of harnessing the power of hydrogen as a fuel. [OMISSION]

P. 308 Moving to nuclear energy, the Background explains that Chernobyl will not happen in the U.S. There is also an allusion (page 310) to French use of nuclear power, but a better statement would be that nuclear supplies 76 percent of France’s total energy needs. For that matter, several U.S. states - Vermont, in particular - rely heavily on nuclear energy. [OMISSION]

While the text reassures children that, “a meltdown can be avoided by careful planning,” it fails to note that it is more than just safety features (for example, litigation costs) that make nuclear plants expensive to build and operate. [OMISSION]

P. 314 The discussion of energy efficiency fails to discuss the cost of energy as a motivator for fuel switching. The discussion should explain that transportation costs (including the cost of transmission lines, pipelines, etc.) affect the local price of a particular energy source, as do other factors - including government subsidies of varying types and the environmental costs, both of which are often obfuscated. This omission is significant and is common throughout most of the textbooks reviewed. [OMISSION]

- P. 314 The Background for teachers discusses super-insulated homes, but fails to mention that these homes - because they are airtight - can sometimes be plagued with indoor air quality problems. Filters need regular replacement, and ducts may need to be cleaned regularly to avoid the buildup of pollutants in the home. [OMISSION]
- P. 316 The statement that cars that run on electricity may provide the most energy savings of all ignores the more likely alternative of hybrid vehicles that rely on gasoline, rather than power plants, to recharge the batteries and thus makes the vehicles more versatile. The text also fails to note that the numerous batteries required for electric vehicles themselves present a waste management problem. The statements on page 444 about electric cars are better. [OMISSION]
- P. 317 The teachers' chart, Advantages and Disadvantages of Energy Sources, would be better if it also contained some energy cost information or other information that could be used to predict the likelihood of an energy source's use. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 6**

- P. 436 The "Composition of the Atmosphere" section states that, "Rising carbon dioxide levels *may* be raising earth's temperature." Students are not, however, told that rising CO<sub>2</sub> levels a millennium ago provided a virtual feeding frenzy for plant life that resulted in increased yields and a more bountiful harvest for Earth's population - and even turned Greenland (named at that time) into a garden. [OMISSION]
- P. 465 The text correctly indicates that "water vapor, carbon dioxide, methane, and other gases" form the "blanket" that warms the earth's atmospheres, but incorrectly compares this to the warming of a plant greenhouse, which operates from direct solar heating of the interior and then the transfer of heat through convection. [INACCURACY]

## **Section VII. Prentice Hall Science Explorer**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 7**

The Background misleads students by noting that 160 nations "agreed" to the Kyoto Protocol, and fails to note that the U.S. Senate voted 95-0 to discourage that treaty's ratification shortly after the Kyoto conference. Moreover, the treaty was radically modified this summer so as to make it more palatable to European nations, only one of which (Romania) had actually signed the unmodified treaty. Any discussion of Kyoto should explain that developing nations like China, not a U.S. ally, are given favorable treatment under this treaty, while European nations under the modified treaty can take advantage of the shutdown of highly polluting power plants in Eastern Europe to account for their emissions reductions, such that their economies are not

hindered. In addition, if the treaty is followed to the letter, the projected decrease in world temperatures, as calculated by its supporters, would be only 0.05E C. [OMISSION, BIAS?]

Moreover, the Background inexplicably discusses CFC's and Kyoto in the same section. There is no comparison between the relationship between CFC's and the stratospheric ozone layer and allegations that increases in carbon dioxide in the atmosphere may be affecting temperatures and weather at the surface. [INACCURACY]

## **Section VII. Prentice Hall Science Explorer**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 8**

The Test Preparation map that purports to show effects of global warming could hardly be used by students to arrive at the purported answer to question 28 - which is that global warming might cause wetter soils in deserts. What the maps show is wetter soils in Canada, Alaska, and Mexico and drier soils in the U.S. and most of South America. In addition, the suggestion that certain areas are threatened by rising ocean levels belies the fact that much of The Netherlands and the city of New Orleans (for example) are both below sea level today, yet both are thriving. Further, the map cannot "show" that global warming will have any specific effects on crop yields, inasmuch as at best this map is a prediction and not scientific fact. Moreover, predictions of crop yields based on climate change alone are largely irrelevant. The Israelis turned what amounted to a desert into a fertile growing area through irrigation, which is also making land in South Texas and many other places very productive. This entire exercise is flawed, and there is not a source cited for the map and its predictions. [INACCURACY, OMISSION]

Chapter 15, Climate and Climate Change, generally provides a thorough overview of this topic that is missing in most texts. Climate change is seen as a common, naturally occurring phenomenon, which is the correct viewpoint. Human-induced climate change is thus a subset, and perhaps a small subset at that, of the climate change story. Students are provided with an accurate discussion of the scientific evidence: Temperatures have warmed 0.5E C over the last 120 years, greenhouse gases have increased in the atmosphere due to human activity, and the cause of the warming is a matter of scientific debate.

P. 539      It is commendable that the authors explain that the "human caused warming hypothesis is just one of several hypotheses to explain variations in climate. Page 539, for example, discusses causes of climate change and includes Earth's position, solar energy variations, and continental drift. It is also commendable that the authors explain that, if additional warming occurs, the effects will be positive and negative.

Sadly, the most important positive effect of increased CO<sub>2</sub> levels is not mentioned--crops and forests will grow faster. Nor does the text mention that predictions of warmer temperatures are based on computer models that have both strengths and weaknesses, or that satellite data do not indicate any warming of the upper troposphere. The text also fails to discuss the "heat island effect," which explains that urban areas retain heat and thus may give the impression that "warming" is more widespread to those living in cities. Nor does the text note

that scientists have recently recognized they had been miscalculating ocean surface temperatures. [OMISSION]

P. 519 Text discusses El Niño but not La Niña. The two work in tandem. [OMISSION]

P. 541 The section on the carbon cycle makes unsupported claims of “equilibrium” of carbon dioxide in the atmosphere that has been “upset” by recent human activity. The fact that “carbon sinks” are absorbing much of the additional carbon dioxide that has been generated suggests that Earth has its own ways of maintaining this equilibrium. The U.S. and Italy have just agreed to new studies on the carbon cycle that should provide important data on climate change. [INACCURACY]

What is the purpose of the “Reading Strategies” item at the bottom of the page (teacher edition), which asks teachers to “suggest” that students begin their concept maps of this section by stating that human activities can add greenhouse gases and CFCs to the atmosphere? This appears to be a way of leading students in a particular direction. [BIAS]

P. 541 The “Discover: What Is the Greenhouse Effect?” student activity has no relationship to the global greenhouse effect. This activity asks students to place thermometers in two shoe boxes and cover one box with plastic wrap. Then students shine a light on both boxes and record the temperature changes. This activity misrepresents the global greenhouse effect because the Earth, not the Sun, is the source of the infrared energy that is the primary source of energy in the greenhouse effect. [INACCURACY]

P. 544 The Background misleads students by noting that 160 nations “agreed” to the Kyoto Protocol, and fails to note that the U.S. Senate voted 95-0 to discourage that treaty’s ratification shortly after the Kyoto conference. Moreover, the treaty was radically modified this summer so as to make it more palatable to European nations, only one of which (Romania) had actually signed the unmodified treaty. Any discussion of Kyoto should explain that developing nations like China, not a U.S. ally, are given favorable treatment under this treaty, while European nations under the modified treaty can take advantage of the shutdown of highly polluting power plants in Eastern Europe to account for their emissions reductions, such that their economies are not hindered. In addition, if the treaty is followed to the letter, the projected decrease in world temperatures, as calculated by its supporters, would be only 0.05E C. [INACCURACY, OMISSION]

P. 544 The definition of the greenhouse effect and Figure 20 are both inaccurate. The text notes that greenhouse gases “trap solar energy.” This is false. Greenhouse gases trap some, not all, of the infrared energy emitted by Earth. This is critical for students to understand, because it is the important distinction between the greenhouse effect and the operation of a plant greenhouse. Figure 20 seemingly corrects this by labeling the reflected sunlight in the greenhouse as “infrared radiation.” But the illustration compounds the confusion by stating that this



radiation “cannot pass through greenhouse roof.” This is false for both a plant greenhouse and for the greenhouse effect. *Some* of the infrared radiation radiated from the Earth escapes into outer space. In fact, this is the remarkable thing about the greenhouse effect. Just the right amount of radiation is retained in the atmosphere by the greenhouse gases to keep the Earth “just right” for life on Earth. Students must be taught the details of how this critical function operates before they can critically think about potential operation of global warming. [INACCURACY]

P. 545 This text also delivers the message that the scientific debate has concluded and that students should take personal action to decrease their carbon dioxide output. The “Real-Life Learning” section in the teacher’s edition suggests that students form groups that “formulate a plan to reduce their carbon dioxide output. Encourage groups to present their plan to the class.” This activity is based on the theory (not proven fact) that the increase in human-created carbon dioxide is “causing” global warming and that this warming will have harmful effects on the environment. This student activity ignores the content of the text to lead students to an unscientific conclusion. To make matters worse, the activity invites students to take personal action based on that unscientific conclusion. Quality education trains students to think critically about environmental problems based on a well-rounded understanding of science. [INACCURACY, BIAS]

P. 548 The answer to question 19 in the Chapter 15 assessment (Thinking Critically) admits that large amounts of carbon dioxide would increase photosynthesis, leading to increased plant growth, which in turn would tend to remove carbon dioxide from the atmosphere. This answer alone suggests that over time natural processes should alleviate short-term excesses of carbon dioxide generated by the burning of fossil fuels. [USEFUL INFORMATION]

## **Section VII. Prentice Hall Science Explorer**

### **C. Human Population Dynamics - Grade 7**

Figure 3 shows growth in world population from 1000 BC to 2000 AD, a timespan that ends with the geometric growth of the past 350 years and does not show the projected leveling off of population growth within the next century. It also presents the truism that, “as the population has continued to grow, the demand for resources has also grown.” This Malthusian presentation is misleading on several counts. First, it fails to note that developed nations now have virtually flat population growth, or that many developing nations are also experiencing similar slowdowns in birth rates. Second, it fails to account for the fact that the supply of energy, food, minerals, etc., has more than kept pace with population growth and resource use. This is indicated by the fact that fossil fuels, and most metals and minerals are cheaper today, adjusted for inflation, than they were 100 or even 50 years ago. [INACCURACY, OMISSION, BIAS?]

Brand-new research, reported in *Nature* on August 2, 2001, suggests that world population will level out far sooner, and at a far lower number, than previous studies have indicated. This study, led by Wolfgang Lutz of the International Institute for Applied Systems Analysis, states there is

an 85 percent chance that global population will peak before 2100, and a 60 percent chance that this peak will be under 10 billion. Rapid declines in birth rate in many nations are the principal reason for these predictions, which were statistically achieved. [USEFUL INFORMATION]

The text should state that, in places where improvements in medicine, agriculture, and sanitation have enabled people to live longer and be more prosperous, birth rates have tended to decline within a couple of generations, and that this trend is likely to reoccur in developing nations as they, too, achieve greater prosperity and longevity. Likewise, the teacher's 1998 population charts of selected countries should show 1950 (or some other baseline year) population levels to demonstrate how these nations have been changing over the past few decades. [INFORMATION]

## **Section VII. Prentice Hall Science Explorer**

### **D. Acid Rain - Grade 6**

P. 442      The Background has erroneous data about the pH of rainfall. The “average pH” of normal rainfall is slightly acidic, about 5.6, not the 4.2 (or even 4.8, depending on one's reading of the presentation) stated here. According to NAPAP, 4.2 is the pH of the most acidic acid rain; EPA's Acid Rain Program says the most acidic rain has a pH of about 4.3. This makes it extremely doubtful that rainwater anywhere has become as acidic as 1.8, even in Los Angeles. Of course, the authors have actually said that this is the pH of water vapor in the smog, not in the (very rare) rain that actually falls on the city. The text fails to mention that air pollution is decreasing nationwide, as humans have made advances in technology based upon scientific evidence of the need to do so. [INACCURACY]

The “Acid Rain” activity is also distorted. It asks students to put one penny in tap water and one in vinegar and let them stand overnight. Students are supposed to be observing the effects on acid rain on metals. Students are not told that vinegar is about 20 times more acidic than the most acidic acid rain. This exercise caused students to believe in falsehood - not facts. [INACCURACY]

P. 443      Even more striking is the section on “Acid Rain” written for students. The authors ignore the findings of the largest study of acid rain ever conducted, the 10-year National Acid Precipitation Assessment Program (NAPAP) study that was completed in 1990. Instead, they provide information that directly contradicts the NAPAP findings, which were reaffirmed in a 1998 NAPAP document. NAPAP found that acid rain harms forests, crops, etc., only in rare circumstances, and that harm to lakes and streams is minor and confined largely to Northeast States. And NAPAP found that damage to buildings and statues is difficult to assess. Students must be taught these scientific findings. The text also fails to mention that adding lime to neutralize either natural or added acidity is an effective strategy for combating acidity in lakes and acidic soils. [INACCURACY, OMISSION]

## Section VII. Prentice Hall Science Explorer

### D. Acid Rain - Grade 7

P. 104 This section correctly notes that normal rainfall is slightly acidic because of the reaction of water vapor and carbon dioxide in the air. The text even provides the chemical formula for the students. Unfortunately, the remainder of the section provides students with false information that needs to be corrected.

The text states that acid rain can be as acidic as pH 3.0 to 3.5. The NAPAP study indicates that the most acidic acid rain is about pH 4.2, and EPA uses pH 4.3 as the lower boundary for acid rain. This error should be corrected. The text then states that acid rain can “damage statues and buildings, destroy forests and kill fish in lakes.” To demonstrate the point, figure 21 shows a photograph of dead trees with a caption that reads, “The trees in this forest show the damaging effects of acid rain.” The text provides no documentation for the claim that acid rain caused the dead trees in the photo. In fact, this is in stark contrast to the NAPAP findings that state that only in rare circumstances does acid rain damage trees and in many cases, the nitrogen in acid rain helps them. The claim that acid rain kills fish in lakes is grossly oversimplified. NAPAP researchers found that the absence of fish in lakes in the Northeast United States can be attributed to several causes, including naturally acidic soils, changes in water levels, and introduction of predators. In addition, there is some evidence that these lakes were fishless in pre-industrial times, became less acidic thanks to intensive deforestation, and are returning to their natural condition now that the forests are returning to full growth. To blame this on acid rain alone is not scientifically accurate. [INACCURACY, OMISSION]

P. 230 There is further discussion of acid rain in the section on chemical weathering. The text explains how air pollution creates acid rain and then concludes, “Acid rain causes very rapid chemical weathering.” This statement cannot be substantiated by science. The NAPAP study agreed that acid rain contributes to weathering, but that the magnitude of this weathering “has been difficult to assess.” The statement in this text should be changed to reflect this scientific finding. [INACCURACY]

Based on this faulty and biased science, the teacher’s edition urges teachers to get their students to take action. The “Integrating Environmental Science” section invites teachers to ask students, “What do you and your family do to contribute to the problem of acid rain?” The suggested answer is driving and using electricity. Since acid rain is primarily produced by coal-burning power plants in the Midwest and Northeast, this question and answer is largely irrelevant to students in Texas. And students who use their critical thinking skills will see that and correctly answer that they do next to nothing to contribute to acid rain. [BIAS]

The section goes on to suggest, “How could students reduce their contribution to this problem?” The text again suggests the answer, “...using more efficient vehicles and electric appliances or using them less often.” As noted above, students in Texas do not contribute to acid rain. Thus, the correct answer is that they can do next to nothing to “reduce” their contribution to the problem. It seems that this text is less concerned with the scientific, than the “politically correct,” answer to these questions. [BIAS]

- P. 234 The Science and Society challenge for developing critical thinking skills and the Background both point out that not all damage to monuments is recent, and that there is acid rain in nations other than the United States. Students learn that windblown sand is another cause of weathering. There is the hint that normal rain also contributes to weathering, but students should be told that even normal rain is slightly acidic. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **D. Acid Rain - Grade 8 Text**

- P. 450 The “Air Pollution” section correctly explains how air pollution reacts with moisture in the air to form acid rain. The text fails to report the scientific findings of the NAPAP study, and instead reports unscientific claims regarding the destruction caused by acid rain. The claim that, “Whole forests have been destroyed by acid rain,” directly contradicts the scientific findings of the NAPAP report. Text could state that, some scientists believe that whole forests have been destroyed by acid rain, but the National Acid Precipitation Assessment Program, reporting on a 10-year study of acid rain, found that, “There is currently no widespread forest or crop damage in the United States related to [acid rain]. The NAPAP study also found that some areas may benefit through nutrient enrichment by nitrogen and sulfur disposition.” In regard to the statement about fish and their eggs, this text should be modified to make clear that the causal factors related to damage to fish are more complex than just stating that acid rain is “the cause” of these problems in the Northeast United States. [INACCURACY, OMISSION]

Moreover, the Background section disagrees with the Background section on page 442 of the grade 6 Prentice Hall text. The grade 6 text erroneously states that the average pH of rain water is about 4.2, while here the correct statement is made that the pH of rainwater is normally about 5 to 6. In addition, vinegar is said to have a pH of 3.0, while in the grade 6 text vinegar is rated at pH 2.8. Also, the authors suggest that the larger acid rain problem is in New England, while the grade 6 text speaks of extremely acid rain in the smog over Los Angeles. Nowhere does this text mention the National Acid Precipitation Assessment Project (NAPAP), completed in 1990 at a cost of over \$500 million, which produced highly regarded results on acid rain that have been completely ignored by virtually all textbook writers. This is a serious problem, and the failure to

include the NAPAP study results inevitably biases accounts of acid rain away from scientific findings. [INACCURACY, BIAS, OMISSION]

- P. 451      The text notes that badly damaged lakes have been restored by adding lime to neutralize the acid - one of the NAPAP recommendations - but it fails to note that NAPAP found that many naturally acidic streams had become less acidic as a result of logging or other land use practices that had little if anything to do with the burning of fossil fuels in power plants, then returned to natural acidity. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **E. Endangered Species & Tropical Rainforests**

The grade 6 text does not address endangered species, though it does have a section on wildlife biology and protecting desert wildlife.

The grade 7 text (page 574) uses Brazilian government data to state that, from 1978 to 1996, 12.5 percent of the entire Amazon rain forest had been destroyed, and that in 1995 alone 30,000 square kilometers had been cut. Using the 1978-1996 data, it took 19 years to destroy one-eighth of the Amazon rain forest; at that rate, it would take 152 years - not the 30 years predicted in the text - to wipe out every rainforest tree in Brazil. Yet even this discussion, which uses a credible reference point, appears to be fundamentally flawed. Additionally, it fails to extrapolate from the Amazon to worldwide rainforest status. [INACCURACY]

The entire group of middle school “science” textbooks use numbers that appear to have been drawn out of a hat. The Glencoe grade 8 text (page 562) reports that 310,000 square kilometers per year of rain forest are being destroyed, and that up to 25,000 species worldwide might become extinct each year due to the loss of rainforests. That information (for which no source is provided) differs dramatically from data reported in the Holt grade 7 text (page 398), which claims (again, with no source) that, “Scientists estimate” that 130,000 square kilometers of tropical rain forests are being cut every year, and that if this trend continues there will be no remaining rain forests in 30 years.”

For those unaccustomed to calculating in metric units, 1 square kilometer (or 100 hectares) is equal to 0.386 square mile, or 247.1 acres. Thus,  $130,000 \text{ km}^2 = 50,193 \text{ mi}^2 = 32 \text{ MM acres}$ , and  $310,000 \text{ km}^2 = 119,660 \text{ mi}^2 = 75 \text{ MM acres}$ .

The December 13, 1993, issue of *U.S. News and World Report* explained that a single Brazilian scientist in 1988, using satellite data on fires burning in the Amazon at that time, came up with the number 40 MM acres a year through various extrapolations. This number soon became popular, though it is clear here that the authors of the Holt and Glencoe texts found their own numbers. In summer 1996, however, two U.S. researchers, David Skole of the University of New Hampshire and Compton Tucker of NASA, undertook a much more rigorous review of satellite data and found that the average rate of rainforest loss in the Amazon was 3.7 MM acres per year - and, with Amazon loss commonly stated as representing half the world’s loss of rainforest area, the worldwide total would be about 7.5 MM acres per year - or just over 30,000

km<sup>2</sup>/yr – 10 percent of that reported by Glencoe estimate, less than 25 percent of that reported by Holt, and presumably only half of that reported by Prentice Hall.

Other researchers have shown that even these rainforest destruction numbers are probably exaggerated, as many of the fires used in these calculations were in savannah areas, not rainforest areas, of the Amazon basin. This research also indicated that most of this destruction has taken place on the periphery of the rainforest, as the heart of the rainforest is virtually inaccessible except by boat.

Of course, even these numbers can be misleading, given that other evidence shows that many forest acres were destroyed long before modern times. Moreover, nothing in any of the texts is presented to suggest alternatives (other than for students to collect money to purchase freedom for a rainforest acre or two) that might actually encourage the local residents in equatorial nations (where the rainforests tend to be) to find other ways to feed, clothe, and house themselves. Possible ways include debt forgiveness - but that would have to be tied to economic incentives for peasants who are cutting forests to plant food crops or else third-world governments would be likely to ensure their funds through use of force.

## **Section VII. Prentice Hall Science Explorer**

### **E. Endangered Species & Tropical Rainforests - Grade 7**

- P. 574 Chapter 17, Ecosystems and Biomes, includes information on tropical rain forests. The Background section states that burning these forests contributes to global warming by releasing large quantities of carbon dioxide. While forest fires, either naturally or humanly caused, do release carbon dioxide and also prevent the capture of additional carbon dioxide, the link to global warming has not been scientifically established and is still a matter of scientific debate. [INACCURACY]
- P. 586 The text notes that, despite a huge fire in 1988 that raged through Yellowstone National Park, signs of life had returned within a few months and the forest was coming back. No other text informs students that forest destruction may not be permanent - though elsewhere this text implies that rainforest destruction is permanent and irreversible. It is recommended that the text emphasize modern agricultural practices that would help equatorial farmers to grow more crops, thus reducing their incentive to cut rainforest trees to gain access to the poor soils beneath them. [USEFUL INFORMATION]
- P. 615 Chapter 18, Relating to the Environment, is a discussion of adaptation and animal behavior that shows how creatures with mobility can survive, even thrive, despite changing environmental conditions. But here, the text notes that “human construction and oil drilling have begun to threaten” the migratory path of the caribou herd in Alaska. The text does note that people and corporations are working to find ways to save this migration path - but students are not told that they are doing such a good job that the herd has been increasing in recent years. [OMISSION, BIAS]

P. 628 The text is incorrect; piñon nuts from piñon pines are edible. Some people find them very tasty as well. [INACCURACY]

P. 629 The Social Studies Connection should be expanded, because the tragedy of the commons is one of the chief problems we are facing with regard to over-fishing issues. While people own most of the forestland, ownership of ocean areas is still in dispute, thanks to the failure of the Law of the Sea treaty and other efforts. There are many excellent studies on this problem - some done by Fred Singer - that explain this problem. [OMISSION]

The discussion of forestry here is interesting, but the Managing Forests Inquiry Challenge fails to inform students that federal forest policy today bars selective or shelterwood cutting in most national forests and thus contributes to the ferocity of forest fires like those last year in New Mexico. [OMISSION, INACCURACY]

P. 631 Here, the discussion of fisheries ignores the commons problem that is at the heart of over-fishing matters. Those who own property tend to manage that property so that it will provide sustainable (or even expanding) yields; those who do not own a property (or in some cases those who own property that can be replicated quickly elsewhere) are more likely to abuse it. This is also true of poaching, because poachers are usually in it for a quick buck. On land, for example, we tend to know what the sustainable deer population is and thus set out hunting limits so as to maintain the population in perpetuity. [OMISSION]

P. 637 The section on Biodiversity attempts some balance, but makes bold statements about species that are not supported here with evidence. For example, text states that, in the last few centuries, the number of species becoming extinct has increased dramatically. Yet there is no evidence to show this fact, and for most of the world (particular regions heavy with species) we have no data that track back 400 years - or even 100 years. [INACCURACY, BIAS]

The text (page 639) is careful to note that species become extinct due to both natural and human causes. This is good. But as the text continues, it presents scientific hypotheses as fact, failing to provide alternative hypotheses so that students can critically think about the scientific evidence and alternatives. Seemingly without recognizing the inconsistency, this text (page 640) labels as a scientific hypothesis the idea that an asteroid striking the earth 65 million years ago caused the extinction of the dinosaurs. Yet when discussing current species extinctions, this text asserts as fact, not hypothesis, that the rate of current extinctions is rapid that Earth's biodiversity is fragile, rather than resilient. [INACCURACY]

Most scientists agree that species are currently going extinct in areas that have had human activity at a rate greater than in areas (or at times) lacking human activity. But the text states as fact that the rate of extinctions has "increased dramatically," and it produces Figure 16 (page 637) to demonstrate this "fact." It

is impossible to evaluate the figure because no source for the data is given, but the message the text and figure give students is that the rate is alarming, and that it is due to human activity. [INACCURACY, BIAS]

- P. 638 The “Background” section provides teachers with disputed facts from the Worldwatch Institute. Nowhere are teachers informed that the Worldwatch Institute is a controversial environmentalist group or that its data on species extinction are hotly debated in the scientific community and should not be presented as fact. [BIAS, INACCURACY]

To correct this mistake, the text should clearly state that scientists disagree about the actual rate of extinction, and also about the definition of a “species” and thus about how many total species exist. The text should also clearly state that some scientists believe, based on the theory of island biogeography, that the rate of species extinction is large and increasing. One 1980 estimate predicted that 500,000 to 600,000 species would go extinct before the year 2000. Other scientists dispute this claim of rapid extinctions, basing their view on evidence from places such as Puerto Rico where massive clearing of the rain forest for farms produced relative few species extinctions. [USEFUL INFORMATION]

- P. 639 This text also asserts as a fact that “Earth’s biodiversity is fragile.” The fragility of nature and even the concept of the “balance of nature” are matters of current scientific debate and must not be presented as facts. To correct this mistake this text should also present the hypothesis and supporting scientific research evidence that the Earth’s biodiversity is resilient. The studies in Puerto Rico (see page 638 comment) is one example of how nature is more resilient than fragile. [INACCURACY]

- P. 640 The “Sharpen Your Skills” section invites students to contact “environmental organizations or your library” to learn about endangered species and to “develop a brochure” about these species. With the permission of the teacher, students are to “distribute the brochure at stores or libraries in your area.” This text should not refer students to environmental organizations for scientific information about endangered species or any environmental topic. Scientific information is found in scientific journals or in science news magazines such as *Scientific American* or *Science News*. The misleading information in this text does not prepare students to create brochures based on critical thinking about endangered species. [BIAS]

- P. 642 The text does note that public and private organizations are working to help endangered species, and that some species are in recovery. But the claim that the Convention on International Trade in Endangered Species is responsible for reducing poaching of African elephants tells only part of the story. Elephant populations are growing in nations like Zimbabwe, whose elephant management policies are paid for through issuance of big-game hunting permits to the wealthy from around the world. Making the elephants a valuable market economy commodity also makes their preservation more secure - and this could also be true



for other species, especially given the poverty and ignorance of (or lack of concern for) the higher environmental values by many in these nations. [INACCURACY]

- P. 647 Text moves from Amazon rain forests to African rain forests - and the Background for teachers states that perhaps the worst record on rain forest destruction on the planet is the island of Madagascar - which few Americans have even visited. The statement is made that, “except for a few patches, the forests that once covered the island’s eastern half have been cleared,” but that 20 percent of the original area remains. Texas, by the way, has more people than Madagascar - so which nation (sic) has more forested area, given the statement that the two nations (sic) are about the same size? [INACCURACY]

Most importantly, there is nothing to suggest how to help these third world peoples to improve their quality of life without further rain forest destruction - or even to encourage them to create policies that would allow reforestation in some areas. This failure to offer solutions is pervasive in environmental textbook writing and in environmental writing in general - and it leaves children in particular feeling frustrated that there is so little that can be done and so much that will inevitably be lost because of the unalterably destructive nature of homo sapiens. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **E. Endangered Species & Tropical Rainforests - Grade 8**

- P. 502 In Chapter 14, The Oceans, the section on Resources from the Ocean fails to fully explain the importance of the tragedy of the commons in its explanations of both over-fishing and the difficulties in startup of ocean mining operations. The suggestion that technology and cost are the only problems with nodule recovery is contradicted by the statement in text that ownership of the ocean floor and its riches is in dispute. The text should be revised to state that “others believe (or argue) that this is unfair .....” Feeling should not be encouraged as a reason for believing. Children should not be taught that acting on one’s emotions is good, especially in the field of science. [OMISSION, BIAS]
- P. 506 The text mentions, but at the end, rather than at the beginning, of the section, where it ought to be, the issue of who controls portions of the ocean, which is a continuous body of water that has no boundaries. [OMISSION]
- P. 634 The section on “Causes of Extinction” states that, “The activities of humans have caused the extinction of many species and endangered the survival of others.” The use of “many” is not scientific and leaves this statement open for misinterpretation. Instead, this text should inform students that the scientific evidence of the rate of current extinction is a matter of scientific debate. As discussed above, this text should inform students that some scientists have evidence of a relatively minor extinction rate, while other scientists have gathered

different evidence that causes them to argue for a relatively rapid extinction rate. [INACCURACY]

## **Section VII. Prentice Hall Science Explorer**

### **F. Water Quality - Grade 6**

- P. 400            The Science History section provides an excellent overview of how people use water, and the time line adds a lot to the discussion. Nothing like this can be found in other textbooks we reviewed.
- P. 414            The section on Aquifers is good, and provides teachers with ample opportunities to add to this discussion by bringing up the aquifers that underlie Texas and the ways that we have drawn down these aquifers, the problems this poses, and possible solutions (including aquifer storage) that are now being proposed for aquifer stabilization. Students might also be directed to the new regional water plans and learn how supplying Texas' future water needs might affect these aquifers. [OMISSION]
- P. 424            The discussion of water conservation is very apropos for Texas, but it could be improved with a few sidebars. For example, the Texas Water Development Board provides agricultural water conservation grants through which districts lend money to farmers at very low interest for the purpose of acquiring water conservation equipment. The statement about the paper industry's more efficient use of water, and comments that industries are working to reduce water use, recycle water, and reuse water are very good - a couple more specific examples (in photos, for example) would be useful here, too. Children may also want to know that desalination is already used to augment the water supply in El Paso, and is being considered for water supply in various locations in coastal Texas. [OMISSION]
- P. 428            The discussion of the Ogallala Aquifer is very good, but again misses the fact that Texas is already providing subsidies to encourage farmers to use water-saving methods of irrigation. Again, the Ogallala is the subject of major studies here in Texas and elsewhere. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **F. Water Quality - Grade 8**

- P. 425            The discussion of desertification fails to explain how poor farming practices and other activities are significant causes, or how this cycle has been reversed in places like Israel. [OMISSION]
- P. 460            The discussion of oil and gasoline fails to mention the spillage from individuals dumping used oil onto the ground or into storm sewers. It would also be better to include mention of how people are working to reduce the threats from leaking storage tanks, open pits, and other pollution threats. [OMISSION]

- P. 461 The discussion of land subsidence wholly ignores the impacts of groundwater withdrawal on freshwater inflows into bays and estuaries. For example, some streams - including Sandies Creek in Gonzales County - are fed during drought periods by groundwater. [OMISSION]
- P. 463 The discussion of the French Broad River is excellent in pointing out that pollution problems can be solved without abandoning all human activity.
- P. 465 While Arcata, California, is a good example of natural attenuation techniques, several Texas communities are similar sewage treatment methodologies. This technology is being funded in Texas coastal areas in part through Supplemental Environmental Projects included in enforcement orders. [USEFUL INFORMATION]
- P. 502 The Facilitate teacher item asks what problems might drilling for oil and gas have on fisheries, ignoring the fact that drilling rigs soon become hangouts for marine life. [OMISSION]
- P. 503 The section on aquaculture omits mention of catfish farms - very important in Texas. The section on mineral resources surprisingly omits mention of the desalination efforts in Utah that have been a major source of magnesium from the Great Salt Lake. Desalination projects are also under discussion for Texas' future water and energy needs and are already being used to provide water for El Paso. [OMISSION]
- P. 505 The statement on oil spills ignores the fact that more oil enters oceans from seepage than from oil spills. What makes oil spills a problem is that they mostly occur in the shallow areas of the ocean where plant and animal life are close at hand. [OMISSION]
- P. 507 The discussion of shrimp farming would be more informative to Texas students by noting that Texas is a major shrimp producer. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **G. Waste Management - Grade 7**

- P. 45 The section, "Cleaning up Metal Contamination" fails to explain that proper deed recordation would prohibit the building of houses on properties cleaned up to lesser levels than "background." This section also fails to provide context for making waste management choices based on such factors as limited funds and time and resources available. There is also no explanation of just "how clean is clean" - that is, what the differing cleanup standards actually mean. Yet, this is a fairly good presentation of the issues involved in cleaning up abandoned sites. [OMISSION]

- P. 626 By contrast, the “Weighing Costs and Benefits” subsection provides an excellent discussion of this important topic. The Real-World Lab on the following page provides students with a real understanding of the limitations of paper recycling, though it fails to suggest alternative ways of recovering value from recycled paper - including harnessing its heat value. [OMISSION]

## **Section VII. Prentice Hall Science Explorer**

### **G. Waste Management - Grade 8**

- P. 428 Chapter 12, “Land and Soil Resources,” provides an excellent drawing of a well-designed sanitary landfill that is not found in most other texts. The photo of a waste-to-energy plant is also a plus. But the discussion (page 432) on recycling fails to discuss household hazardous waste - materials that today pose disposal problems for the majority of people who are unwilling or unable to save up these wastes for that rare opportunity to visit the household hazardous waste collection center. This is a waste management issue that remains problematical and one that would provide an excellent opportunity for a student exercise in critical thinking. Why - for example - cannot cities simply provide bins similar to recycling bins for people to deposit their household hazardous waste for pickup? One reason is federal regulations - and the question is whether these rules make sense. [OMISSION]
- P. 435 The text could be improved by discussing homeowner association policies (for example) that often discourage and even include legal action against those who want to compost, recycle, not over-water lawns, and other environmentally wise actions. [OMISSION]
- P. 439 The discussion of radioactive waste disposal in the grade 8 text should include the use of “assured isolation,” something that has received much attention in Texas. [OMISSION]
- P. 440 Here and again on page 466, the text fails to note that some wastes are by law classified as “characteristically” hazardous even in solutions that are very dilute. Text would be much improved by explaining the principle that, “the dose makes the poison.” [OMISSION]
- P. 442 The discussion of formaldehyde fails to explain why this chemical is hazardous. [OMISSION]

## **Section VII. Prentice Hill Science Explorer**

### **Additional Comments**

On page 378 of the grade 8 text, the Integrating Environmental Science item for teachers should be more specific. Here in Texas, surface mining is under the jurisdiction of the Railroad Commission (RRC), while uranium solution mining is governed by both the RRC and Texas Natural Resource Conservation Commission. Mining health issues are overseen in part by the

Texas Department of Health, and other state agencies are also involved in various areas of mining operations. Texas does not have a single “state EPA” that oversees all mining activities. [INACCURACY]

Chapter 13, Air and Water Resources, of the grade 8 text has several problems. The statements on photochemical smog are not accurate in the whole. While, for example, vehicle emissions do account for a majority of the smog problem in the Dallas-Fort Worth area, this is not true in the Houston area. Moreover, natural emissions (such as from trees) play a major role in smog formation, especially in the Houston area and in the Big Bend region. [INACCURACY]

The Background on page 458 of the grade 8 text makes the statement that, “In India, 90 percent of the precipitation occurs during a wet season....” Since it is doubtful that this statement is true from one end of that nation to the other, both north to south and east to west, perhaps this just a national average figure? Otherwise, the text should be more specific as to what part of India this is true. [INACCURACY]

## Section VIII

### *RonJon Publishing – Review of Grades 6, 7 & 8*

#### ***RonJon Select Science® Teacher’s Editions: 2001 Grades 6, 7, and 8***

The publishers note that these are activity-driven texts, built from the premise that students must be taught how to “think,” that is, to problem-solve. The overall approach has produced very readable, “easy to get into” textbooks. Unfortunately, the texts fall down heavily in a number of areas, not the least of which is the fact that pages of the text fall out easily.

Among the chief problems with these texts is the lack of content and incomplete and even inaccurate information on some topics. In these “uncorrected” versions, there were significant grammar lapses in just a few pages that would prompt a closer look throughout the text. Even worse, the authors all too often become preachers or advocates for particular outcomes rather than science educators providing children with information so that they can make their own independent decisions on controversial issues.

Because of this advocacy, it may be difficult to bring these texts up to state standards that require texts to enable students to acquire the information necessary to use “critical thinking and scientific problem-solving to make informed decisions” and to use scientific evidence and information to “analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses.

#### **Section VIII. RonJon Select Science® A. Energy and Natural Resources *Summary of Grades 6 - 8***

The grade 6 text discusses energy and natural resources to some extent (but not adequately), but the grade 7 and grade 8 texts almost wholly ignore this very important subject area. It is almost as though the authors prefer not to discuss energy and resource issues.

## Section VIII. RonJon Select Science®

### A. Energy and Natural Resources - Grade 6

The grade 6 text provides technically accurate but inadequate information on energy and natural resources, and some of this information is even misleading. While many sections of this text are well written, these sections appear to be just thrown together with little thought to the message being provided to students.

- P. 214            The definition of nonrenewable resources correctly indicates that the time frame needed to replace these resources is very long and that it “far exceeds the immediate needs of humans.” Unfortunately, the emphasis on depletion leaves students uninformed about the way humans shift from one resource to another to provide the same service (resource substitution), which typically occurs when prices rise through shortages, typically caused by wars or for political reasons, or in the event of natural disasters, and less often through true resource depletion. This is evidenced by the fact that real-world prices for most minerals, including petroleum, have remained fairly constant for several decades. [OMISSION]
- P. 215            This map of coal deposits (a) fails to show East Texas lignite deposits, (b) wholly omits Alaska, and (c) fails to distinguish among lignite, bituminous coal, and anthracite. The “example” in the teacher edition also fails to mention that lignite is found in Texas. The same applies to text on page 216. This section is extremely weak. One major omission is an explanation of the origin and development of the U.S. power grid, and how our assumptions about energy supply were challenged in 1973 via the Arab oil embargo. [OMISSION, INACCURACY]
- P. 217            Activity Discussion question E only asks students to name disadvantages of using coal for energy. Students should also be asked the advantages of using coal; otherwise, they may think those who have used coal for centuries were impractical. [OMISSION]
- P. 218            The Advanced Learners item in the teacher edition is very strange, and it is also oriented toward a particular political viewpoint and to political action. First, Texas has been debating whether to store radioactive wastes in places in West Texas that are not salt domes. There has been a recent debate, ended by the 77<sup>th</sup> Legislature, over whether and how to store hazardous waste in salt domes. Oil and gas products have long been stored in salt domes, which house among other things the Strategic Petroleum Reserve. [BIAS, INACCURACY]
- P. 219            The name of the “Comanche Peak” power plant, which is owned by TXU, is misspelled. The other Texas nuclear plant is the South Texas Nuclear Plant near Bay City, which is owned by Central Power & Light, a subsidiary of American Electric Power Co. (which recently purchased Central and South West Services, CPU’s parent). As the state has but two plants, both should be mentioned. [INACCURACY, OMISSION]

- P. 223 The “What Do You Think?” section asks students to consider the U.S. dependency on foreign oil supplies and then asks their opinion on whether the U.S. should spend money on looking for domestic oil reserves or on “alternative energy sources such as solar energy.” This exercise oversimplifies highly complex energy issues and presents students with a largely false dichotomy. The search for energy knows no bounds, and both sources (and others as well) should be continually being investigated and developed. [BIAS]

### **Section VIII. RonJon Select Science®**

#### **A. Energy and Natural Resources - Grade 7**

- P. 287 The sole reference to energy and natural resources appears in the section, “Human Impact on the Environment,” which briefly states that we use mostly fossil fuels to generate electricity and to power our vehicles. The tired old statement about exhausting nonrenewable resources is repeated without any reference to economics. As the availability of any resource lessens, its price tends to rise, and society finds substitutes. [OMISSION]

### **Section VIII. RonJon Select Science®**

#### **A. Energy and Natural Resources - Grade 8**

- P. 176 This text provides students a correct, but limited definition of “nonrenewable resources.” Students are told that nonrenewable resource “quantities are limited” and, “When it is used up, it cannot be replenished as fast as it is used.” This is largely meaningless, given that the price of many fossil fuels, metals and minerals have been decreasing. This indicates their abundance, not their scarcity. Finally, students are not told how society converts from one resource to another (wood to coal, coal to oil, etc.) [INACCURACY]
- P. 179 Here, the theme is that mining is bad for the environment, but the grammar itself is more appalling than the message. [BIAS] Examples of poor grammar:
- “Although people benefit from mined materials, it [what is the antecedent here] takes its toll on the environment.”
- “Surface mining is easier to reclaim, although ... “ ”Surface-mined land is easier to reclaim” would be grammatically correct here.
- “Runoff from the mines carry [should be carries] sediment ..... “
- P. 184 The text states that, “A growing number of people *feel* technology should be developed to use renewable sources of energy such as solar and wind.” The text does not provide any context for this statement that would allow students to analyze or critique it. Moreover, we should not encourage anyone to go by their “feelings” in making scientific decisions. [BIAS, OMISSION]



P. 184 The statement is made that nuclear power will not be acceptable to most Americans until the disposal problem is solved. Yet even today, 19 percent of U.S. electric power is supplied via nuclear energy. In France, the total is 76 percent; in Vermont, it is even higher. Recent studies have shown that this source is less expensive than many other power sources. If the “disposal problem” is solved, perhaps nuclear will also be the most common power source for electricity. [BIAS, INACCURACY]

Why not mention the Waste Isolation Pilot Plant by name, as in the grade 6 text?

Further, the text states that the cost of disposal is “probably” included in your power bill if your electricity is supplied by nuclear power. This appears to be an attempt at anti-nuclear bias, given that the environmental costs of using **all** energy sources are included in the power bill - including the cost of using scrubbers for coal-fired plants, the costs of providing fish ladders and other habitat restoration efforts for hydro plants, and so forth. [BIAS, INACCURACY]

P.191 The “What Do You Think” actually found an oil spill other than the *Exxon Valdez*. Even so, the text does not truly show “how our dependence on fossil fuels can harm our environment.” Rather, it shows that mishandling any resource is a bad thing. In Africa and in other parts of the world, people have cut down most of the trees for firewood at times when other energy sources have been cut off (often due to political strife). Other nations still rely on dried dung for fuel - and this contributes to air pollution and disease. Moreover, the authors ask students to decide whether we should use “fossil fuels forever or alternative methods now!” It appears clear which side the authors are on, and they do not intend to give students a real choice. Nowhere does this text discuss fuel diversity - which became U.S. policy after the Arab oil embargo in 1973. [BIAS, OMISSION]

## **Section VIII. RonJon Select Science®**

### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 6**

P. 113 Figure 10, The Greenhouse Effect, is scientifically correct. It could be improved by reminding students of the methods of heat transfer from Activity 3 on the previous page. Students should understand that greenhouses (and parked cars) are heated by radiant energy from the Sun that heats the objects in the greenhouse and then transfers this heat by convection. On the other hand, the greenhouse effect operates as radiant energy from the Sun strikes the Earth, then radiates energy in the form of infrared radiant energy. Some of this radiant infrared energy is trapped by the greenhouse gases and warms the Earth’s atmosphere. What is not trapped travels into outer space. A diagram of a greenhouse that shows the difference would greatly improve student understanding. [INACCURACY]

P.113 The first sentence in the third paragraph contradicts the diagram. It states that greenhouse gases “are responsible for absorbing the Sun’s energy and acting as a

blanket,” whereas in fact greenhouse gases are responsible for absorbing some of the infrared energy radiated from the Earth, thus acting as a “blanket.” [INACCURACY]

The fourth paragraph incorrectly implies that the greenhouse effect operates by the Sun warming the Earth (sand on a beach), with this heat being transferred by convection to the atmosphere. These objects cool at night and in the winter, but they are still part of the Earth that radiates infrared energy at night and in winter. These are important scientific distinctions. [INACCURACY]

- P. 113 The “Spark Learner’s Interest” suggestion in the teacher’s edition asks teachers to remind students about a closed car heated by the Sun. The description is accurate, but its placement next to the discussion of the greenhouse effect could confuse students. Students instead should learn how the heating of a closed car by the Sun is different from the operation of the global greenhouse effect. [INACCURACY]

### **Section VIII. RonJon Select Science®**

#### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 7**

- P. 290 The section “Human Impact on the Environment” states that, “Scientists *feel* that these increased amounts of carbon dioxide enhance the greenhouse effect, warming our planet too much.” This is an unscientific distortion of the current state of scientific debate over possible global warming. Many leading scientists would dispute this claim. In any case, science texts must present accurate and balanced reports about current scientific controversies. This text should state, “Some scientists believe....” and it should also state that “Other scientists dispute this claim and look to other causes for the slight warming over the last 100 years.” Scientists should not rely on their “feelings.” [BIAS, INACCURACY]

### **Section VIII. RonJon Select Science®**

#### **B. Climate Change (Global Warming) & Greenhouse Effect - Grade 8**

- P. 158 This text correctly notes that greenhouse gases have increased “from the pre-industrial period to the present.” The three graphs in Figure 41 demonstrate this fact.
- P. 159 The greenhouse effect is correctly described on this page and in Figure 42. It is notable that this text does not use an illustration of a plant greenhouse, which often misleads students, and that the text correctly states that greenhouse gases trap some of the infrared radiation that is emitted from the Earth’s surface. Figure 43 correctly shows that surface temperature has recently increased, and the text notes the correlation between greenhouse gas and temperature increases. This text provides additional variables that might influence temperature increase including the Earth’s natural temperature fluctuations (Ice Ages) and the role of

solar activity. The text is to be commended for leaving these questions open-ended for students by stating, “We don’t know the answers yet...”

This section could encourage critical thinking by including additional information. Students should understand that one of the scientific uncertainties is the difference between surface and atmospheric temperatures. The NASA satellite temperature data show little or no warming of the upper troposphere since 1979, while Figure 43 shows an increase in surface temperatures starting about that time. Furthermore, many scientists point to the inaccuracy of surface temperature data due to the “heat island” effect surrounding cities where surface temperatures are taken. There have also been recent revelations that errors have been made in ocean temperature measurements.

Curiously, text on page 158 states that levels of atmospheric gases were fairly stable prior to the Industrial Revolution, but page 159 states that studies reveal that concentrations of carbon dioxide gas have fluctuated naturally during Earth’s history. [INACCURACY]

- P.160 Note that Figure 44 shows that vehicular CO<sub>2</sub> emissions have been dropping despite increases in miles traveled. This is correctly attributed (page 161) to the use of catalytic converters. Text would benefit by including a graph that shows CO<sub>2</sub> emissions from natural sources and other energy sources. [OMISSION]
- P. 162 Text states boldly that, “since each gallon of gasoline burned in a vehicle puts 20 pounds of carbon dioxide into the atmosphere, future emissions systems will have to address this issue.” The presumptive reason is that CO<sub>2</sub> is a precursor of global warming - and that the U.S. must dramatically reduce its emissions of CO<sub>2</sub>, an action that this nation has yet to commit to doing. Whether one likes it or not, the U.S. walked away from the Kyoto Protocol, first with a 95-0 vote in the U.S. Senate, and more recently just weeks ago. [BIAS]
- P. 164 Here again the authors admit that scientists still do not fully understand the connection, if any, between climate change and CO<sub>2</sub> levels. Text also gives a “practical” reason for reducing emissions - that reducing all forms of pollution is “in the best interest of life on Earth.” Yet, CO<sub>2</sub> is precisely what plants need in order to grow, and there is still a raging debate as to whether higher CO<sub>2</sub> levels in the atmosphere today are a good or bad thing. [BIAS]
- P. 170 The scientific objectivity displayed in the section on Global Warming is unfortunately not duplicated in the section, Air Pollution and You. This text here strongly implies that the increase in greenhouse gases is a major pollutant that will have negative impacts on the environment. [BIAS]
- P. 184 Students are told that transportation is “the big player” in greenhouse gas production - not the generation of electric power using fossil fuels. There is much preaching on this page - from the “Try This” which urges children to list ways to

reduce global warming. The “Try This Ideas” in the teacher edition includes such suggested answers as buying vehicles that get at least 32 mpg (the sole departure from the metric system in the RonJon textbook) and leaving the car home 2 days a week. [INACCURACY, BIAS]

- P. 187 Again, in the chapter summary, this text loses its objectivity on the role of man-made greenhouse gases. The statement that, “the addition of greenhouse gases to the atmosphere seems to be accelerating this [warming] process” is at odds with the carefully qualified scientific statements in the section on greenhouse gases (pp. 156-160). [BIAS]

## **Section VIII. RonJon Select Science®**

### **C. Human Population Dynamics**

Neither the grade 6 nor the grade 7 texts truly address human population dynamics. The grade 8 text contains a few brief references to human population that, unfortunately, fail to report on ongoing changes in population dynamics. No concrete information is presented on population growth predictions, or on the ability of society to feed a growing population.

Brand-new research, reported in *Nature* on August 2, suggests that world population will level out far sooner, and at a far lower number, than previous studies have indicated. This study, led by Wolfgang Lutz of the International Institute for Applied Systems Analysis, states there is an 85 percent chance that global population will peak before the year 2100, and a 60 percent chance that this peak will be under 10 billion. Rapid declines in birth rate in many nations are the principal reason for these predictions, which were statistically achieved.

## **Section VIII. RonJon Select Science®**

### **C. Human Population Dynamics - Grade 8**

- P. 170 Students are told in Activity 11 that “the rapid growth of Earth’s population...” causes destruction of forests and burning more fossil fuels. The text fails to note that rapid population growth is a new phenomenon and one that projections suggest will stabilize in the not too distant future, especially if Third World nations follow the pattern set by First World nations in that increasing prosperity inevitably has led to lower birth rates. Besides, if there is a direct, unchangeable cause and effect relationship between population growth and worldwide destruction, then it would be futile to address environmental issues other than population. It might equally be argued that the burning of fossil fuels and the conversion of forest land to agricultural use has enabled, together with attendant advances in disease diagnosis and treatment, the world’s population to grow. Yet, as nations have prospered in the wake of these technological breakthroughs, they have dramatically reduced their growth rates, such that the growth rate is near or at zero in some developed nations. [INACCURACY, OMISSION]

But what if the population continues to grow? Increases in world population also cause more production of goods and services, including increased food supplies. Increases in world population cause the discovery of life-saving medicines. Increases in world population cause increased demand for a cleaner environment and environmental improvements. By providing students with only one side of the human growth equation, this text fails to provide the information needed by students to think critically about this issue or to draw conclusions about the effects of human activity on Earth's resources. [OMISSION]

- P. 187 The concluding sentence of this chapter is not a scientific statement but a statement of ideology. "As Earth's population continues to grow in the 21<sup>st</sup> century, we will have to closely examine our current consumption practices and make changes--changes that allow all organisms to live and change as intended." Science does not have the capacity to determine what changes are "intended" only what changes have and are occurring. The world population growth rate is already declining and may be zero before 2100. [BIAS]

## **Section VIII. RonJon Select Science®**

### **D. Acid Rain**

The grade 6 text does not include a section on acid rain, and the grade 7 text contains only a single sentence that is buried in a section on "Pollution." The discussion of acid precipitation in the grade 8 text is inaccurate and incomplete.

## **Section VIII. RonJon Select Science®**

### **D. Acid Rain - Grade 7**

- P. 290 The text correctly notes that, "As sulfur dioxide bonds with water vapor up in the atmosphere, it returns to Earth as acid rain." Although correct, this text misses the opportunity to use this environmental issue to inform students about the pH scale, teach them how scientists investigate cause and effect relationships, or introduce them to the ongoing scientific debate about the possible effects of acid precipitation. [OMISSION]

## **Section VIII. RonJon Select Science®**

### **D. Acid Rain - Grade 8**

This text discusses acid rain in the context of ozone pollution in urban area smog, thus misleading students to think that acid rain is the same as ozone pollution. [INACCURACY]

- P. 170 This text states that acid rain is part of "smog" and it is caused by burning diesel fuels. There is no discussion of the primary source of acid rain - coal burning power plants. There is no discussion of the National Acid Precipitation Assessment Program (NAPAP) study, or of the U.S. Environmental Protection Agency's Acid Rain Program. In fact, this text reports as fact information

directly contradicted by the scientific findings of the NAPAP study and its 1998 update. For example, this text states that “These acids attack and chemically erode limestone, marble and metals.” NAPAP scientists have concluded that the effects of acid rain on these materials is hard to evaluate. For the record (since text does not provide pH data), NAPAP found that normal rainfall has a pH typically about 5.6, and acid rain is typically pH 4.6, but may be as low as pH 4.2. EPA says that normal rainfall has a pH of about 5.5, and that the most acidic rain is about pH 4.3. [INACCURACY, OMISSION]

The text further contradicts NAPAP findings by stating that changes in pH levels of streams and lakes make “these areas unfit for animal life.” NAPAP scientists did not confirm this cause and effect relationship. [INACCURACY]

Nowhere does this text discuss the pH scale, the range of pH levels of acid rain, or the fact that non-pollution rain is naturally acidic. [OMISSION]

- P. 170 Activity 11, Air Pollution and You!, contains two experiments, neither of which is scientifically valid. Part A asks students to prepare slides with a thin layer of petroleum jelly and place these slides in an area where it will collect particulates from the air. The instructions state that ordinary non-pollution “dust” is part of what might be collected in the experiment, but the experiment provides no way for students to evaluate their findings. Students cannot determine what is ordinary dust and what is human caused air pollution. Thus, this so-called experiment seriously misleads students and fails to teach the scientific method. Part B instructs teachers to partially fill 6 test tubes with sulfuric acid. Then teachers put different substances (marble, wood, aluminum, etc.) in the test tubes. Students then observe and record what happens. The pH of the sulfuric acid is not provided. Teachers and students are not informed of the pH range of typical acid rain. Without this information, this activity is an unscientific representation of acid rain science. [INACCURACY, BIAS]

## **Section VIII. RonJon Select Science®**

### **E. Endangered Species & Tropical Rainforests**

The grade 6 text does not include a section on endangered species. The grade 7 and grade 8 texts, however, present incomplete information in convoluted ways, leaving students confused as to how species become endangered and what might be practical means to recover endangered and threatened species. Worse, material in these sections actively encourages students to participate on one side of the political debate.

## **Section VIII. RonJon Select Science®**

### **E. Endangered Species & Tropical Rainforests - Grade 7**

- P. 117 The text states that human efforts have helped restore whale populations that had been dwindling due to over-harvesting by other humans - whom we infer (thanks

to the Advanced Learning exercise) make a ritual out of whaling. The “What Do You Think” exercise on page 161 follows up on this issue with a discussion of the desire of the Makah tribe to resume hunting of the formerly endangered gray whale. Oddly, the presentation notes that today’s whale hunting by this “primitive” tribe involves use of cannons and high-powered rifles - hardly the traditional whaling method used historically by the tribe. [OMISSION]

P 288

In the “Human Impact on the Environment” section, students are offered a discussion of endangered species issues. Central to this discussion is the theme that humans are responsible for “the extinction of many plant and animal species.” As an example, the text tells the story of the extinction of the Passenger Pigeon by commercial hunters. This story is not based on scientific or economic analysis. Students learn only a morality play that humans are guilty for “blatant disregard for animals and land” that has led to the extinction of numerous species. [BIAS, OMISSION]

This section does not offer students information in a way that allows them to engage in critical thinking or analysis of the issue. In telling the story of the Passenger Pigeon, the authors should note that in the 1880's this bird covered vast areas of North America and was so numerous that no one envisioned that the pigeons could be hunted into extinction. The fact that no one “owned” the flocks allowed a commercial hunter to kill as many as he wanted; if he did not, another hunter would kill them and sell them for food to the people in the rapidly growing urban areas. This was much the same story as the buffalo on the Great Plains. Buffalo were saved from extinction when the status of a small herd changed from one that no one owned to one that was privately owned. Because it was privately owned, the herd could be protected from hunters and grew and prospered. By telling both stories, students can then engage in critical thinking about how other species in the U.S. and around the world might be saved from extinction. [OMISSION]

P. 288

A paragraph at the bottom of the page explains the laws which “make sure” that extinctions such as that of the Passenger Pigeon do not “happen again.” This discussion is incomplete because it offers students only the intended and not the unintended consequences of these laws. Any discussion of the Endangered Species Act must provide students with both; it should also offer examples of private alternatives that have helped protect species and their habitat. [OMISSION]

On a better note, this is the only text to even mention hunting seasons (see “Try This”) as a normal part of life. The list of U.S. endangered species is useful, but why not just put an asterisk by species found in Texas to save the children time? [OMISSION]

P. 289

Activity 6, “Endangered Species,” asks students to select one endangered species and write a report about it. This assignment does not require students to analyze,

review, and critique species protection measures prescribed by the federal government. This assignment could be improved by asking students to develop a list of public and private methods to help species and list the pros and cons of each. Another valuable option would be to ask students to write a report outlining the provisions of the Endangered Species Act and list the arguments for and against the law as presently written. [INFORMATION]

- P. 288 The teacher’s edition suggests that teachers can “Spark Learner Interest” by asking students to “take a stand by writing organizations” such as Save a Manatee or Adopt a Whale. This student activity is little more than “bumper sticker” education that does little to introduce students to the complex and varied activities and organizations that help improve species and habitat. [BIAS]

For example, students might also write organizations such as Trout Unlimited, Elk Unlimited, or the Wild Turkey Federation to learn how hunters are improving habitat and saving species. Students might learn about how the wood duck was brought back from near extinction by thousands of individuals who constructed nesting boxes for these birds. Students need to recognize that public and private land development does not always result in harm to species. Students could write the National Association of Home Builders to learn about innovative examples of housing projects which save habitat for species. They could also learn how modern farming practices that produce more crops on less acreage allow farmers to set aside land for wildlife habitat. Helping endangered species is not accomplished just by the federal government (through enforcement of the Endangered Species Act) and a few high-profile organizations. [OMISSION]

## **Section VIII. RonJon Select Science®**

### **E. Endangered Species & Tropical Rainforests - Grade 8**

- P. 177 The text and Figure 55 fail to mention that Texas is the home to 174 whooping cranes at the Aransas National Wildlife Refuge - the premiere recovery facility in the world. [OMISSION]

- P.181 The story of the red-legged frog is actually one of adaptation by that frog and the introduction of predator species (bullfrogs), which had nothing to do *per se* with mining. Again, the text appears not to have been checked for grammar or sentence structure. Better grammar would be something on the order of, “Mining processes used by inexperienced gold hunters destroyed much of the red-legged frog’s habitat by choking streams and removing necessary vegetation.” [BIAS]

The next question is whether the decline in the population of the red-legged frog led to the introduction of the bullfrog as a substitute foodstuff. If so, this is very unclear. The text’s description of frog suffering offers no factual contribution to student learning but serves to emotionalize instruction. And what are “normal freshwater wetlands” - are there “abnormal freshwater wetlands”? Perhaps the authors mean that freshwater wetlands that provide habitat for the frogs have been



filled for agricultural use and development. If so, is this continuing during the era of “no net loss of wetlands” in America? The section also fails to discuss any efforts underway today to protect habitat for these frogs or to reduce the bullfrog population (if there are still bullfrogs in the area) so as to provide for red-legged frog population growth. [OMISSION]

The text also attributes extinction of the blue pike to (a) draining wetlands, (b) building dams, and (c) introduction of non-native species to the Great Lakes ecosystem. The text fails to discuss the negative impacts of these activities on wildlife or how to reverse or reduce those impacts on other species. [OMISSION, BIAS]

- P. 185      When this text reports on species extinctions rates, it reports theory as fact by stating that “human practices are causing rapid extinction rates of organisms.” While humans are undoubtedly having an impact on species extinctions, the rate of extinctions is not scientific fact. Scientists currently debate the rate of extinction by offering and critiquing various theories. These theories, principally the theory of island biogeography, are the appropriate subject for an 8th grade science textbook and should be included in the section about endangered species. [BIAS, INACCURACY]
- P. 185      The text informs students that “one theory” says that one species goes extinct each day, but not how long this has been happening or why. It is hard to imagine a SCIENCE textbook that would contain the sentence, “What if a person develops a heart condition, and a plant in the rain forest becomes extinct due to deforestation? What if this plant contained the one chemical that could cure that particular heart condition?” This is advocacy, not science. It would be far better to stick to facts and include a story on the Pacific yew plant, which is one that has a track record of being medically useful but also threatened. Now that the chemical has been extracted from the yew, it can be synthesized for medical purposes. The hypothetical here is weakened without a reference to the actual. [BIAS, OMISSION]
- P.186      The text includes a good discussion of the extinction of the dodo bird that shows how science has found a substitute (turkey gut) that can be used to activate seeds of the unnamed trees so they could germinate.
- P. 187      Activity 12, Threatened—Endangered—Extinct, misinforms and misleads students about extinction issues. The graph presented provides the total number of endangered and threatened species listed by the U.S. Fish and Wildlife Service by year. The text fails to tell students about the science, bureaucratic process, and politics of listing. Students are not informed that the graph does not show the absolute number of species in trouble, but only those discovered and listed. Students are not told that in 1980, for example, there may have been many more species endangered, but these had not been found and listed. The graph fails to explain the bureaucratic incentives that work to encourage listing of species, but

not the development of effective recovery plans through which species may be delisted. [OMISSION]

The “Activity Discussion” section asks students to read the graph to determine the number of species on the list in 2000. Teachers are given the answer in the teacher’s edition (1,200), but the graph stops at 1999. Students are also asked to predict whether listings will increase or decrease in 2002, but the text biases this response by adding, “if the present trend continues.” The trend in the graph is clearly upward, but careful examination of these data indicates that the rate of change is clearly slowing. The change between 1998 and 1999 is a very slight increase. An unbiased, scientific question would be to ask students about possible changes in the trend based on the data. Students would have to conclude that since the rate of increase is decreasing, the prediction about 2002 cannot be made. It could increase, decrease, or remain the same. Students are encouraged to arrive at predetermined conclusions, not taught how to objectively examine data from a scientific perspective. [BIAS, INACCURACY]

- P. 226      Advanced Learners are asked to write an essay on ways that dolphins might exercise control over the world if they had the chance. Of course, they would probably put people to work on fish and algae farms to increase the food available to them, but this is a pure nonsense exercise that more properly would belong in a creative writing course. [BIAS]

## **Section VIII. RonJon Select Science® Additional Comments**

### **Grade 6**

- P. 104      A critical example of the lack of content is found in the discussion of the oxygen-carbon dioxide cycle. The Advanced Learner item in the teacher’s edition asks teachers to “inform the class about the pollution created from too much methane and discuss solutions,” but the only clue is that high pollution may come from cattle and pig farms. Without adequate informational clues (anaerobic digesters, manure for land application along state highways, etc.), teachers cannot facilitate an informative discussion because the students’ research may be inadequate or one-sided. [OMISSION]
- P. 160      While the discussion of erosion is not bad, it may lead students to believe that acid rain is the ONLY cause of erosion. [INACCURACY]
- P. 185      “What Do You Think” presents a reasonable issue (water conservation) but fails to provide enough information for students to arrive at decisions through critical thinking. The reality is that, in some places, greater emphasis is placed on keeping a green lawn than on conserving water, even in areas that rely on diminishing groundwater supplies. Neighborhood associations’ goals often

conflict with water conservation goals. This is a real problem in parts of Texas. [OMISSION]

- P. 203 The “Try This” activity asks students to think critically about the advantages and disadvantages of clear cutting, but the text gives students no information that would enable them to do so. [OMISSION]

### **Grade 7**

- P. 31 The text lacks information about the long-term scientific value of using animals in research, or of the importance in many scientists’ eyes of the continued use of animals in cancer research (for example). Moreover, the text informs students that some people “feel” one way, while others “feel” another way about this issue. Science should never base policies on “feelings,” but rather on reasoned beliefs and scientific evidence tempered by ethical considerations. “Feelings” is another word for “emotions,” and if science is driven by emotions, it will no longer be science. [BIAS]
- P. 88 The “Activity” encourages students to “purchase these sustainable rain forest products,” which “naturally grow” in those areas, in hopes that this “will help lessen the amount of cutting and burning of these areas for farming and ranching.” This statement is an obvious bias. [BIAS]
- P. 104 The “Information” section ignores the fact that as humans enter biomes, their activities may affect carrying capacity. Yet, humans are resourceful and, when challenged, can play a creative role in restoring ecologic balance even in heavily disturbed areas. A prime example is the work done by Israelis to restore lands that had become deserts into productive fields. [OMISSION]
- P.109 The “What Do You Think” exercise fails to provide students with alternative airport sites as an option. The choice is either to build the airport in this environmentally sensitive area or to build no airport at all. Moreover, the exercise puts the student in the place of a politician who owes his office to big-dollar campaign supporters who are now expecting a payoff, rather than merely a person recognizing the need for additional air traffic capacity in an area whose existing airport infrastructure is overburdened. [OMISSION, BIAS]
- P. 131 The text provides good information on fire ants, something students may find useful in their daily lives. The mention of china berry trees should include the fact that the berries are poisonous; after all, an adult tourist poisoned himself on the berries at a hotel in Florida earlier this year. [OMISSION]
- P. 264 This page features a photo of the largest ever ozone “hole” observed over Antarctica - but the caption seems to run out in the middle. The same photo appears on page 292 with a very different caption. More importantly, these photos only show the size of the “hole” in one month of the year, and do not show

how this “hole” changes from month to month during a given year.  
[INACCURACY, OMISSION]

- P. 271 The discussion of the impact of poaching on biodiversity is good, but would be enhanced by a collateral explanation of the benefits of ownership and wildlife management as opposed to leaving wildlife in commons where there is no law, or in the care of those without any economic investment in their continued well-being. [OMISSION]
- P. 292 The “Information” section is incomplete and inaccurate (see comments under “Acid Rain”). Among other things, the use of CFCs is not yet universally banned, even in the United States. One reason is that there is no alternative to CFCs in some industrial processes. [INACCURACY]
- P. 293 The text is another plea for students to write letters to Congress to address specific environmental issues. This section does not disseminate information, but is solely designed to generate political activism. [BIAS]

### **Grade 8**

- P. 162 Activity 9 appears to show favoritism toward the purchase of one specific consumer product over another. It also suggests that other vehicles are not even worth considering. [BIAS]
- P. 177 The Land Use Resources section urges children not to build new homes when they can live in used homes - but where will the homeless, the young families, and others live if they cannot find used homes, which usually are available because more affluent people have moved into new homes? And where in any Texas metropolitan area are these vacant homes? It is true that acres of farmland are sacrificed to new home building, but so are acres of woodland and urban acreage that is “recycled” for new home building. [BIAS, INACCURACY]

## Section IX

### *Appendix*

#### **CHAPTER 112. Texas Essential Knowledge And Skills For Science Subchapter B. Middle School**

##### **Sections Pertaining to Environmental Science**

##### **Grade 6 Science**

- (6.1) Scientific Processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
- (B) make wise choices in the use and conservation of resources and the disposal and recycling of materials.
- (6.3) Scientific Processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
  - (B) draw inferences based on data related to promotional materials for products and services;
  - (C) represent the natural world using models and identify their limitations;
  - (D) evaluate the impact of research on scientific thought, society, and the environment;
- (6.9) Science Concepts. The student knows that obtaining, transforming, and distributing energy affects the environment. The student is expected to:
- (A) identify energy transformations occurring during the production of energy for human use such as electrical energy to heat energy or heat energy to electrical energy;
  - (B) compare methods used for transforming energy in devices such as water heaters, cooling systems, or hydroelectric and wind power plants; and
  - (C) research and describe energy types from their source to their use and determine if the type is renewable, non-renewable, or inexhaustible.

## Grade 7 Science

- (7.1) Scientific Processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
- (B) make wise choices in the use and conservation of resources and the disposal and recycling of materials.
- (7.3) Scientific Processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
  - (B) draw inferences based on data related to promotional materials for products and services;
  - (C) represent the natural world using models and identify their limitations;
  - (D) evaluate the impact of research on scientific thought, society, and the environment;
- (7.14) Science Concepts. The student knows that natural events and human activity can alter Earth systems. The student is expected to:
- (C) make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources.

## Grade 8 Science

- (8.1) Scientific Processes. The student conducts field and laboratory investigations using safe, environmentally appropriate, and ethical practices. The student is expected to:
- (B) make wise choices in the use and conservation of resources and the disposal and recycling of materials.
- (8.2) Scientific Processes. The student uses critical thinking and scientific problem solving to make informed decisions. The student is expected to:
- (A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information;
  - (B) draw inferences based on data related to promotional materials for products and services;
  - (C) represent the natural world using models and identify their limitations;
  - (D) evaluate the impact of research on scientific thought, society, and the environment;
- (8.11) Science Concepts. The student knows that traits of species can change through the generations and that instructions for traits are contained in the genetic material of the organisms. The student is expected to:
- (A) identify that change in environmental conditions can affect the survival of individuals and species;

- (8.14) Science Concepts. The student knows that natural events and human activities can alter Earth systems. The student is expected to:
- (B) analyze how natural or human events may have contributed to the extinction of some species; and
  - (C) describe how human activities have modified soil, water, and air quality.

## About The Author

Duggan Flanakin, known as Texas' "environmental insider," is editor and publisher of **EI Compliance Report**, a twice monthly review of rulemaking, permitting, enforcement and policy decisions at Texas state agencies which have jurisdiction over human health and the environment. He also edits and publishes the twice monthly **EI NEWS**, which in his words "covers the Texas environmental landscape with news, commentary, argument, and controversy."

Mr. Flanakin, who holds a B.A. in History from Louisiana State University and a M.A. in Public Policy from Regent University, began his career in 1966 as an editor of scientific and technical publications for the Bureau of Mines, U.S. Department of the Interior, once the nation's chief sponsor of basic scientific research. Beginning in 1989, Mr. Flanakin was associated with Environmental Compliance Reporter, Inc., where he began his focus on the Texas environmental regulatory universe. From 1993 through 1996, Mr. Flanakin served as a Senior Fellow with Texas Public Policy Foundation and authored a report on the creation of the Texas Natural Resource Conservation Commission entitled, "Texas Creates an Environmental Super Agency: Will Bigger Be Better?" In this report, Mr. Flanakin traced the history of environmental regulation in Texas through its many legislatively created entities over several decades, and made several recommendations, many since implemented, regarding ways the new agency could ensure its success.

In 1995, Mr. Flanakin was asked to serve on the Texas State Environmental Science Textbook Committee. Building on that experience, Mr. Flanakin in May 1996 published his report, "Sound Science or Pseudo Science: The Future of Environmental Education in Texas." The widespread acceptance of this report, which traced the history of natural resource education in the Lone Star State and provided a pathway for consensus on this controversial issue, led Mr. Flanakin to work with state agencies, corporations, academic institutions, and non-profit institutions to sponsor a statewide conference on environmental education. At that event, held in April 1997, state representative Warren Chisum, Chairman of the House Committee on Environmental Regulation, made commitments that led to the 1999 legislation creating the Texas Environmental Education Partnership Fund Board, which is appointed by the Governor.

In 1998, the Committee for a Constructive Tomorrow commissioned Mr. Flanakin to write a briefing paper, "EPA's Relations with the States: Top-Down Commander or Managing Partner?" This report, built on Mr. Flanakin's experience with state-federal relations on environmental policy implementation, urged a fundamental transformation in the way our nation regulates the environment through greater participation at the federal level by those with state regulatory experience and an improved accountability system.



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