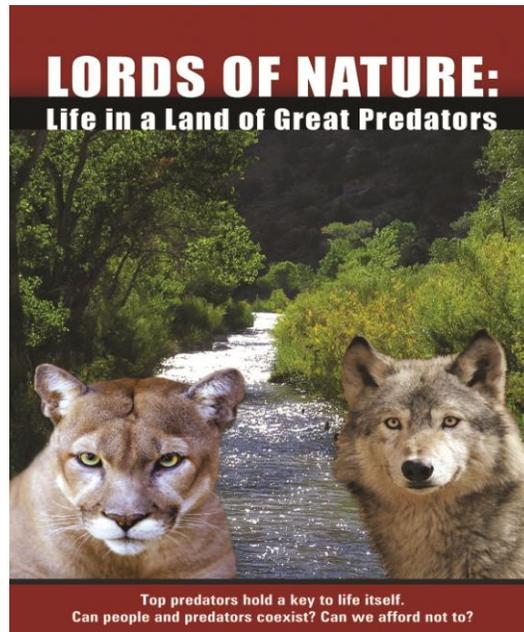


The Arizona Wildlife Education Foundation, in cooperation with Green Fire Productions, is pleased to present this *Lords of Nature* study guide for secondary schools in Arizona.



<http://www.arizonawildlifeeducationfoundation.org/>



<http://greenfireproductions.org>

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- The high school teachers throughout Arizona, whose dedication to our human and wildlife heritage is extraordinary.

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LORDS OF NATURE: STUDY GUIDE

Desired Results

Establish Goals:

1. Examine the roles of predator and prey within an ecosystem.
2. Analyze the complexities of intended and unintended consequences created by manipulation of a component within an ecosystem
3. Offer opportunities for critical thinking, relative to ecosystem management and diverse stakeholder opinions.
4. Investigate factors that contribute to scientific integrity as the basis for creating policy.
5. Create a model for local ecosystem sustainability that maintains ecological integrity, social equity, and economic prosperity.

Correlations to academic standards are included at the end of this document.

Big Ideas/Understandings:

Students will understand that . . .

- Ecosystems are comprised of biotic and abiotic components, all of which are interrelated.
- Attitudes toward wildlife as a natural resource have changed significantly since 1900.
- Scientific research can provide guidance to those who create policy.
- To be successful, decisions about predator management should include considerations of ecological integrity, economic prosperity, and social equity.

Essential Questions:

Students will ask such questions as . . .

- What happens when a component (either biotic or abiotic) within an ecosystem is altered? Are these changes temporary or permanent? How long might it take for these changes to manifest themselves?
- How have attitudes toward wildlife management changed throughout history? How have they changed in America from 1900 to the present? What factors gave rise to these changing attitudes? Are those factors still in play today?
- What are the hallmarks of “good science”? How can one determine what is “good science”?
- What does “sustainability” mean? How can sound scientific research become a basis for policies that contribute to long-term sustainability? What role do ecological integrity, social equity, and economic prosperity play in the development of a sustainable future?

Knowledge:

Students will know . . .

Interrelationships within natural systems
Prey-predator relationships

Skills:

Students will be able to . . .

Investigate and analyze ecosystem interrelationships

<p>Factors contributing to ecological effectiveness</p> <p>Potential impacts from the manipulation of components within an ecosystem</p> <p>Intended and unintended consequences</p> <p>Role of Aldo Leopold in modern wildlife management</p> <p>Reintroduction of endangered species</p> <p>Stewardship of wild lands and stakeholder responsibilities</p>	<p>Compare and contrast wildlife management techniques practiced since 1900</p> <p>Hypothesize potential consequences of various actions (or lack thereof) toward an ecosystem</p> <p>Summarize results of independent research</p> <p>Offer alternatives that mitigate negative consequences</p> <p>Debate factors that contribute toward a sustainable future, including ecological integrity, economic prosperity, and social equity</p> <p>Create a sustainability plan for a local predator</p>
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Key Vocabulary

Ecosystem	Stakeholder	Ecological effectiveness
Prey	Intended consequences	Trophic cascade
Predator	Unintended consequences	Biotic
Abiotic		

Assessment Evidence

Possible Performance Tasks (dependent upon the portions of film used in class):

Report on one of the following topics:

- intended vs. unintended consequences resulting from a natural or manmade alteration within a local ecosystem
- economic data, pre- and post wolf reintroduction into Yellowstone OR of a species within Arizona (e.g., Mexican wolf, black-footed ferret, California condor, Gila trout)
- North American wildlife management over the last century
- the ethic of Aldo Leopold

Problem-based learning (PBL) task:

- finding common ground for ecological integrity, economic prosperity, and social equity, re: the role of a local prey or predator species
- risk management: create an event tree for a proposed action

Product :

- visual depiction of a food web
- multimedia portrayal of local oral history, concerning a local prey or predator species
- create a personal essay addressing what you perceive to be the “art of living among predators”
- debate: should species be protected via the Endangered Species Act (ESA) or a Conservation

Agreement?

- management plan for two species (one aquatic, one terrestrial)
- participate in (or create) a phenological study
- write an article for a newspaper
- create a state map depicting management agencies and “hot spots”
- design a Facebook page or series of Public Service Announcements (PSAs)
- write a paper explaining why Aldo Leopold should be acclaimed the “Father of Ecology”

Other Evidence:

On task with discussions and questions

Participation in small group assignments

Independent research that is scientifically valid, thorough, concise

Work completed thoroughly and on time

Ability to cite scientific evidence that validates a specific point of view

Action Plan

Learning Activities:

Note to teachers: While the entire documentary is extremely relevant to the understanding of modern ecology and is especially relative to the role of top predators within ecosystems, we recognize that a 60-minute video may be difficult to accommodate within the confines of most secondary school schedules. The producers have therefore divided the content into manageable chapters of one to twelve minutes each, allowing for robust discussion. To assist the classroom teacher, we have provided correlations to the Arizona Academic Standards (refer to the end of this document). These include the “Common Core” standards for Math and ELA published in 2010.

Additionally, we have recommended specific activities for each chapter of this documentary. (Note there are Arizona-specific activities recommended that extend the learning potential for this film.)

Chapter 1: Introduction (8:00). Also recommend Chapter 4: Yellowstone (12:00)

Background: Bill Ripple and Bob Beschta have been researching the Yellowstone ecosystem for a number of years. What do they mean when they say, “Out of death comes life?” or “Predators may hold the key to life itself?”

Intended and unintended consequences. Every human action has consequences upon a habitat or ecosystem. It often happens that what we intend to accomplish has unexpected results that may be deleterious to the system overall, and it may take years or even decades before those become apparent. What parallel events occurred at approximately the same time within the Yellowstone ecosystem (circa 1930’s and 1940’s)? What were some of the unintended consequences resulting from the eradication of wolves? Is it possible to overturn those without creating additional problems?

Cite examples of both intended and unintended consequences to the Yellowstone ecosystem created by the eradication of wolves. Research an ecosystem close to where you live. Can you find other examples of intended and unintended environmental consequences created by human actions? How long ago did those actions occur? Have any actions helped to counteract any negative consequences? If so, how would you

(or your community) rate their success? If possible, try to learn about any financial costs that may have been incurred in environmental changes and/or in mitigation measures. Share your research via a PowerPoint.

Chapter 2: Leopold (9:00)

Background: In 1944, Aldo Leopold wrote his reflection *Thinking Like a Mountain*. Previously, he had operated under the accepted norm that “The only good predator is a dead predator.” What gave rise to his change of philosophy? Why is Leopold often credited with being the “father of ecology”? Why was his idea of land health (the increased capacity of land for self-renewal) considered to be a revolutionary description of conservation? (You can read this brief essay at <http://www.eco-action.org/dt/thinking.html>.)

Food webs/interdependence. Create a visual depiction of a food web in Yellowstone while wolves were absent. Create another that includes the wolves after reintroduction. Compare and contrast the similarities and differences. What indicators show a healthy ecosystem with each food web? What indicates an unhealthy system? What are the likely consequences of each?

Chapter 3: Wolf Introduction (2:00)

Background: Aldo Leopold was the first to propose the restoration of wolves into the Yellowstone ecosystem. The 1973 passage of the Endangered Species Act created the opportunity for gray wolves to be reintroduced into Yellowstone, the red wolf into North Carolina, and the Mexican wolf into Arizona.

Policy and law. The Endangered Species Act (ESA) passed in 1973 provided protection for species determined to be at risk of extinction. Research how this law came into existence, species it has helped save, merits of the law, challenges associated with the law, species that have gone extinct since this law was created, how the law has been used by various stakeholders, and how a species is declared either “threatened” or “endangered” under this law. What species in your county and state have been listed as threatened, endangered, or species of special concern – and how are each of those categories defined? Based on your personal research, what is the future of the ESA? How does protection under the ESA compare with protection provided under a Conservation Agreement?

Create a flow chart depicting each step of a process in which a species is being offered protection under both the ESA and a Conservation Agreement. Debate the merits of both processes and identify weaknesses in each. (Find ESA basics at http://www.fws.gov/endangered/esa-library/pdf/ESA_basics.pdf . Information about conservation agreements can be found at <http://www.fws.gov/endangered/what-we-do/cca.html> . A specific example of a conservation agreement may be found at http://www.azgfd.gov/w_c/es/jaguar_management.shtml .)

Chapter 4: Yellowstone (12:00)

Background: Once wolves were extirpated from the Yellowstone ecosystem (circa 1926), elk herds flourished to the point that there were “no new forests.” In 1995, wolves were brought back into this “ailing web of life” as “life returned to Yellowstone.”

Prey and predator coexistence. How can the presence or absence of one key species completely alter an entire ecosystem? Can restoration efforts ever return an ecosystem to its previous status? What factors need to be considered?

Analyze the statement: “Yellowstone with wolves is dramatically different than Yellowstone without them.” Write an editorial that could be submitted to a local newspaper that explains the rationale behind

this statement, relative to the Greater Yellowstone ecosystem.

See also:

- **Intended and unintended consequences: See Chapter 1.**
- **Food webs/interdependence: See Chapter 2.**

Chapter 5: Minnesota (11:00)

Risk management. Farmers and ranchers confront many issues that improve or diminish their potential to earn a living: fluctuations in crop and commodity prices, impacts of weather, general costs of doing business (livestock feed, fertilizer, gasoline or diesel fuel to operate farming equipment, etc.). How do predators factor into this? What role does a farmer or rancher play in the overall health of an ecosystem? What role does the community play in a farmer or rancher's well-being?

Identify one potential change that might be made in a local ecosystem and develop an "event tree" to predict possible outcomes of that action. Compare and contrast various outcomes as to their economic, esthetic, social, or environmental merits. (Example: a local energy company has determined that your area is suitable for erecting wind turbines to create a wind farm.)

Personal action. The "lords of nature" refers to "the art of living among predators." What is meant by this statement? How might an individual practice this "art"? What fears and perceptions would an individual need to confront in order to coexist with large predators?

Develop a Venn Diagram that offers perspectives from five or more diverse stakeholders, including your own, with each circle being a different stakeholder. Use this as a basis to write an essay answering the question: "Can reintroduction of wolves to the Greater Yellowstone ecosystem become a model for other species reintroductions?" Include scientific evidence, economic data, and various points of view.

Chapter 6: Idaho (7:30)

Livestock-predator conflict. How can we strike an appropriate balance between one's economic livelihood (livestock ranching) and the threat of losing significant income to potential predation? What management issues need to be resolved – and how can we accommodate diversity of stakeholder opinions? What does "experimental, non-essential population" mean and why was this used with the reintroduction of the Mexican wolf into Arizona and the American Southwest?

Visit the website of the US Fish and Wildlife Service (USFWS) to locate and read the original [November 1996] Environmental Impact Statement (EIS) at

http://www.fws.gov/southwest/es/mexicanwolf/pdf/MW_EIS.pdf . Compare and contrast the possible scenarios for reintroduction, identifying advantages and disadvantages of each. Assuming the role of a journalist for an Eastern newspaper, pre-introduction, write an article for your paper that discusses the merits and challenges of each of the proposed actions.

Chapter 7: Zion and Conclusion (7:00)

Ecological effectiveness. The Lords of Nature alludes to the issue of "ecological effectiveness" - e.g., there may still be a remnant population of cougars living within an ecosystem but there may be too few to be effective at keeping prey numbers in check. What are some of the biotic and abiotic components of an ecosystem? Examine the larger ecosystem within your community and identify changes that may have occurred over the past century. As change took place, what ecological factors were impacted? If lost to the ecosystem, was there another component that moved in or assumed the role of the one that was lost?

What body of evidence exists to document the original ecosystem and the changes that occurred? Did changes transpire over a long or a relatively short period of time? What are the current impacts to that ecosystem today? How do you think they might alter that system over the next 25 years? 50? 200?

Assume the role of a wildlife manager and develop a plan for the long-term preservation of one terrestrial and one aquatic species found within your area.

Citizen Science

Phenology. Phenology is the study of annual natural events – e.g., when flowers bloom or when birds migrate. Monitoring phenological events is a [long-standing tradition](#) for the Leopold Institute, named after Aldo Leopold who is sometimes considered the “father of modern wildlife management.” Leopold kept phenology records at the Shack (a small cottage in Wisconsin, where much of his early work took place) in the 1930s and 40s. His daughter Nina continued his records from 1976 to the early years of this century.

The National Phenology Network (<http://www.usanpn.org/>) offers opportunities for “citizen scientists” to become involved with scientific monitoring. A similar program, Project Budburst (http://www.windows.ucar.edu/citizen_science/budburst/) is one such possibility. Learn about the importance of scientific protocol, accurate data collection and reporting, and sharing research by participating in a study relative to one plant in your area. Read the excerpt (name and page numbers here) from *How We Know What We Know about Climate Change* by Lynn Cherry to identify how data collected by school children in Canada in the early 1900’s is providing scientific clues to climate change today. How can one citizen make an inference? From a scientific perspective, what are the differences between “short-term” and “long-term” data? Which provides more validity? How many data points are necessary to provide reliable information? What is scientific integrity? What role might it play for policy makers?

Register to participate in data gathering for either of the above organizations OR create your own research project to address the phenology of a species (plant or animal) found in your area.. Develop the prototype for a website that can be used for disseminating this information and sharing it with the scientific community.

Arizona-based Learning Activities:

Finding common ground. What conflicts have resulted between livestock ranchers and Mexican wolves, since the reintroduction of wolves into Arizona? What actions have some ranchers taken to accommodate predators on their land? How successful have these projects been and why? [HINT: try to locate information about “predator-friendly beef”] What resolutions have been proposed? Have those been successful? How is “success” determined in the Mexican wolf reintroduction program and what is its current status?

Research the history of Mexican wolf reintroduction and how wildlife managers with the US Fish and Wildlife Service (USFWS) and with the Arizona Game and Fish Department (AZGFD) have been assigned to oversee this program. Create a timeline that depicts critical decisions made and develop a key to briefly explain results of those decisions so that a middle school student could follow this historical event.

Livestock grazing on public lands. For decades, public lands have allocated grazing allotments for ranchers to provide forage for cattle. What do we mean by “public lands”? Who determines acceptable uses of public lands? What did Aldo Leopold include in the Wilderness Act of 1964 that helps bring

confidence for ranchers even today? What is the Enabling Act and what is its role, re: public lands in Arizona? What portion of Arizona is designated for each of these and what is the role of the agency that manages each? What is the federal cabinet level that oversees each federal agency identified below, and what is the state agency that oversees state trust lands?

- State Trust Lands
- National Forests
- National Parks
- National Wildlife Refuges
- Bureau of Land Management (BLM)

Analyze the public lands of Arizona: percentage of total acreage allocated to each, economic activities associated with each, historical and current uses, management plans. (Especially note the Travel Management Plan for each national forest.) Draw a large map and label the appropriate management agency. Provide a key to each agency: location of the managing office, mission, management plan highlights, problems or “hot spots” where litigation is underway, any area for citizen science to be employed.

Reintroduction of predators into Arizona. In addition to Mexican wolves, black-footed ferrets have also been reintroduced into the state. What is their ecological niche? What factors led to, and what brought them back from, the “brink of extinction”? What were the intended and the unintended consequences of the actions that led to their demise?

Research the natural history of the black-footed ferret, including its former range and distribution, factors that led to its near extinction, the rediscovery of this animal once believed to be extinct, the efforts to conserve the remnant population, reintroduction plans, recovery efforts, critical factors employed to help ensure its long-term survival. Create a “story” for the black-footed ferret that could be uploaded to YouTube or Facebook that would advocate on behalf of this animal, develop a series of 3-5 PSAs bringing this animal’s story into focus for elementary students, OR write a children’s story with the ferret as the main character.

Correlation to Arizona Academic Standards

NOTE: *Arizona has adopted the national “Common Core Standards” for both English Language Arts [ELA] and for Mathematics. These correlations utilize both, as well as those for Arizona Social Studies (2006) and Science (2004).*

Overall, this film addresses the standards identified below. More specific correlations are identified for each chapter or section.

English Language Arts [ELA]: reading (expository text, visual representations), writing (persuasive essay, editorial). **NOTE:** ELA correlations in this guide refer directly to the national Common Core standards and do not reflect the Arizona numbering system for ELA.

Science: intended and unintended consequences, ecosystem services, trophic cascade, endangered species, ecological restoration

Math: using models (event tree, Venn diagram, point of view), economics

Social Studies: geography, economics, historical perspectives, land ethic, policy and law, models for wildlife management

Chapter 1: Introduction

ELA: Reading [Informational Text]

Craft and Structure

4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone.

Science

Strand 1: Inquiry Process

S1C3PO3: Critique reports of scientific studies

Strand 3: Science in Personal and Social Perspectives

S3C1PO1: Evaluate how the processes of natural ecosystems affect, and are affected by, humans.

S3C1PO5: Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.

S3C2PO5: Evaluate methods used to manage natural resources.

Strand 4: Life Science

S4C3PO1: Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

S4C3PO2: Describe how organisms are influenced by a particular combination of biotic and abiotic factors in an environment.

S4C4PO4: Predict how a change in an environmental factor can affect the number and diversity of species in an ecosystem.

Math

Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)

HS.S-ID.9. Distinguish between correlation and causation.

Statistics and Probability: Making Inferences and Justifying Conclusions (S-IC)

HS.S-IC.6. Evaluate reports based on data.

Statistics and Probability: Using Probability To Make Decisions (S-MD)

HS.S-MD.7. Analyze decisions and strategies using probability concepts.

Standards for Mathematical Practice

HS. MP.2. Reason abstractly and quantitatively.

Social Studies

Strand 4: Geography

S4C3PO5: Analyze how humans impact the diversity and productivity of ecosystems.

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Chapter 2: Leopold

ELA: Reading [Informational Text]

Key Ideas and Details

2. Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone.

Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 2: History and Nature of Science

S2C1PO1: Describe how human curiosity and needs have influenced science, impacting the quality of life worldwide.

S2C1PO2: Describe how diverse people and/or cultures, past and present, have made important contributions to scientific innovations.

S2C1PO3: Analyze how specific changes in science have affected society.

S2C1PO4: Analyze how specific cultural and/or societal issues promote or hinder scientific advancements.

Strand 3: Science in Personal and Social Perspectives

S3C1PO1: Evaluate how the processes of natural ecosystems affect, and are affected by, humans.

S3C1PO5: Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.

S3C2PO5: Evaluate methods used to manage natural resources.

Strand 4: Life Science

S4C3PO1: Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

S4C5PO4: Diagram the energy flow in an ecosystem through a food chain.

Social Studies

Strand 4: Geography

S4C3PO2: Analyze different points of view on the use of renewable and nonrenewable resources in Arizona.

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Chapter 3: Wolf Introduction

ELA: Reading [Informational Text]

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
2. Determine a theme or central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Integration of Ideas and Knowledge

8. Delineate and evaluate the argument and specific claims in a text, assessing whether the valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.

ELA: Writing

Text Type and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences of events using effective technique, well-chosen details, and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 3: Science in Personal and Social Perspectives

S3C2PO5: Evaluate methods used to manage natural resources.

Social Studies

Strand 4: Geography

S4C5PO6: Analyze policies and programs for resource use and management.

Chapter 4: Yellowstone

See also Chapter 1: Introduction

ELA: Writing

Text Type and Purposes

2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
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Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 4: Life Science

S4C3PO1: Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

S4C3PO2: Describe how organisms are influenced by a particular combination of biotic and abiotic factors in an environment.

S4C4PO4: Predict how a change in an environmental factor can affect the number and diversity of species in an ecosystem.

Math

Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)

HS.S-ID.9. Distinguish between correlation and causation.

Standards for Mathematical Practice

HS.MP.2. Reason abstractly and quantitatively.

Social Studies

Strand 4: Geography

S4C3PO5: Analyze how humans impact the diversity and productivity of ecosystems.

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Chapter 5: Minnesota

ELA: Writing

Text Type and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences of events using effective technique, well-chosen details, and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Math

Statistics and Probability: Conditional Probability and the Rules of Probability (S-CP)

HS.S-CP.1. Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events [e.g., Venn diagrams].

Standards for Mathematical Practice

HS. MP.2. Reason abstractly and quantitatively.

Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 4: Life Science

S4C3PO1: Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

S4C3PO2: Describe how organisms are influenced by a particular combination of biotic and abiotic factors in an environment.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Social Studies

Strand 4: Geography

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Chapter 6: Idaho

ELA: Writing

Text Type and Purposes

1. Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences of events using effective technique, well-chosen details, and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Science

Strand 1: Inquiry Process

S1C1PO1. Evaluate scientific information for relevance to a given problem.

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

S1C4PO4. Support conclusions with logical scientific arguments.

Strand 3: Science and Technology in Society

S3C2PO2. Recognize the importance of basing arguments on a thorough understanding of the core concepts and principles of science and technology.

S3C2PO5: Evaluate methods used to manage natural resources.

Strand 4: Life Science

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Math

Standards for Mathematical Practice

HS. MP.2. Reason abstractly and quantitatively.

Social Studies

Strand 4: Geography

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Chapter 7: Zion and Conclusion

See also Chapter 4: Yellowstone

ELA: Writing

Text Type and Purposes

2. Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content.
3. Write narratives to develop real or imagined experiences of events using effective technique, well-chosen details, and well-structured event sequences.

Production and Distribution of Writing

4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge

7. Conduct short as well as more sustained research projects to answer a question or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 4: Life Science

S4C3PO2: Describe how organisms are influenced by a particular combination of biotic and abiotic factors in an environment.

S4C4PO4: Predict how a change in an environmental factor can affect the number and diversity of species in an ecosystem.

Math

Statistics and Probability: Interpreting Categorical and Quantitative Data (S-ID)

HS.S-ID.9. Distinguish between correlation and causation.

Standards for Mathematical Practice

HS. MP.2. Reason abstractly and quantitatively.

Social Studies

Strand 4: Geography

S4C3PO5: Analyze how humans impact the diversity and productivity of ecosystems.

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.

Arizona-Based Learning Activities

Finding Common Ground, Livestock Grazing on Public Lands, and Reintroduction of Predators into Arizona

ELA: Reading [Informational Text]

Key Ideas and Details

1. Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
2. Determine a central idea of a text and analyze in detail its development over the course of the text, including how it emerges and is shaped and refined by specific details; provide an objective summary of the text.

Craft and Structure

4. Determine the meaning of words and phrases as they are used in the text, including figurative and connotative, and technical meanings; analyze the cumulative impact of specific word choices on meaning and tone.

Integration of Ideas and Knowledge

8. Delineate and evaluate the argument and specific claims in a text, assessing whether the valid and the evidence is relevant and sufficient; identify false statements and fallacious reasoning.

Science

Strand 1: Inquiry Process

S1C4PO1: For a specific investigation, choose an appropriate method for communicating the results.

S1C4PO3: Communicate results clearly and logically.

Strand 3: Science in Personal and Social Perspectives

S3C1PO1: Evaluate how the processes of natural ecosystems affect, and are affected by, humans.

S3C1PO5: Evaluate the effectiveness of conservation practices and preservation techniques on environmental quality and biodiversity.

S3C2PO5: Evaluate methods used to manage natural resources.

Strand 4: Life Science

S4C3PO1: Identify the relationships among organisms within populations, communities, ecosystems, and biomes.

Social Studies

Strand 4: Geography

S4C3PO2: Analyze different points of view on the use of renewable and nonrenewable resources in Arizona.

S4C5PO6: Analyze policies and programs for resource use and management.

S4C5PO7: Predict how a change in an environmental factor can affect an ecosystem.