Unit 5: Land & Water Use
UNIT PLAN

AP Environmental Science
Unit 5
Suggested Duration: 7 Days

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UNIT NARRATIVE

This unit covers the remainder of the topics from the College Board CED Unit 5 – Land & Water Use that have not been previously covered in other units. There are only three big topics remaining that can be treated as case studies and the order they are covered in is not significant.

- Mining and Acid Mine Drainage (3 days)
- Urbanization and Urban Water Runoff (2 days)
- Forestry Management & Sustainable Forestry (2 days)

Mining practices will be explored using a simulation lab where students will "mine" for chocolate chips in a chocolate chip cookie to discover the significance of the environmental impacts of mining and the difficulty of mine reclamation (2 Days). Acid mine Drainage should be facilitated after the Cookie Mining Lab. Students will describe and explain the Three C's (Chemicals, Causes, Consequences) of acid mine drainage (AMD) by working in partners to explore videos and readings explaining AMD.

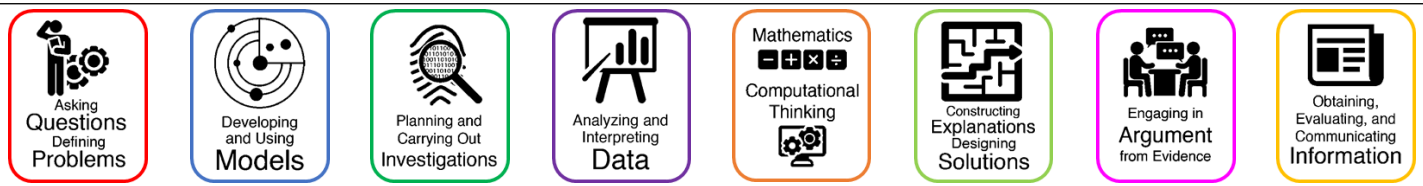
The urbanization section starts with a guided case study about Urban Runoff (precipitation). Students will work in small groups to analyze data about increasing urbanization in a fictitious city and describe and explain how it impacts the water cycle and the risk of flooding in this city. This lesson concludes with students writing a letter to a politician proposing solutions to decrease the impacts of Urbanization and Urban Runoff and describing advantages of each to support their proposals (Day 01). On the second day of this section students will explore a variety of other topic related to increasing urbanization (urban sprawl, saltwater intrusion, urban heat island effect) working in partners to analyze online video and reading resources.

Students will work in groups in a jigsaw activity to research a forestry practices and create simple skits that highlight the advantages and disadvantages of the forestry practice. Students will also work in partners to review online resources explaining sustainable forestry and describing resources that can help consumers make more sustainable choices.

NOTE: there is no Unit Exam for this Unit, but ALL TOPICS from this Unit will be included on the Semester Exam.

Focus on Disciplinary Literacy

In science, disciplinary literacy is synonymous with the science and engineering practices. The SEPs are the context through which all science concepts should be taught. In the lessons, you will find the Science and Engineering practices icons when the SEPs are being explicitly used by students.



UNPACKED CONTENT STANDARDS

Below are the standards **taught** and **assessed** in this unit.

Topic		Learning Objective		Essential Knowledge	
5.2	Clearcutting	EIN-2.B	Describe the effect of clearcutting on forests.	EIN-2.B.1	Clearcutting can be economically advantageous but leads to soil erosion, increased soil and stream temperatures, and flooding.
				EIN-2.B.2	Forests contain trees that absorb pollutants and store carbon dioxide. The cutting and burning of trees releases carbon dioxide and contributes to climate change.
5.9	Impacts of Mining	EIN-2.K	Describe natural resource extraction through mining.	EIN-2.K.1	As the more accessible ores are mined to depletion, mining operations are forced to access lower grade ores. Accessing these ores requires increased use of resources that can cause increased waste and pollution.
				EIN-2.K.2	Surface mining is the removal of large portions of soil and rock, called overburden, in order to access the ore underneath. An example is strip mining, which removes the vegetation from an area, making the area more susceptible to erosion.
		EIN-2.L	Describe ecological and economic impacts of natural resource extraction through mining.	EIN-2.L.1	Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane.
				EIN-2.L.2	As coal reserves get smaller, due to a lack of easily accessible reserves, it becomes necessary to access coal through subsurface mining, which is very expensive.
5.10	Impacts of Urbanization	EIN-2.M	Describe the effects of urbanization on the environment.	EIN-2.M.1	Urbanization can lead to depletion of resources and saltwater intrusion in the hydrologic cycle.
					Urbanization, through the burning of fossil fuels and landfills, affects the carbon cycle by increasing the amount of carbon dioxide in the atmosphere.
					Impervious surfaces are human-made structures—such as roads, buildings, sidewalks, and parking lots—that do not allow water to reach the soil, leading to flooding.
					Urban sprawl is the change in population distribution from high population density areas to low density suburbs that spread into rural lands, leading to potential environmental problems.
5.13	Methods to Reduce Urban Runoff	STB-1.B	Describe methods for mitigating problems related to urban runoff.	STB-1.B.1	Methods to increase water infiltration include replacing traditional pavement with permeable pavement, planting trees, increased use of public transportation, and building up, not out.
5.17	Sustainable Forestry	STB-1.G	Describe methods for mitigating human impact on forests.	STB-1.G.1	Some of the methods for mitigating deforestation include reforestation, using and buying wood harvested by ecologically sustainable forestry techniques, and reusing wood.
				STB-1.G.2	Methods to protect forests from pathogens and insects include integrated pest management (IPM) and the removal of affected trees.

				STB-1.G.3	Prescribed burn is a method by which forests are set on fire under controlled conditions in order to reduce the occurrence of natural fires.

KEY UNDERSTANDINGS AND QUESTIONS

Important big ideas and processes for the unit.

Key Understandings

- ❑ Describe the process of surface mining including reclamation
- ❑ Identify and explain ecological impacts of surface mining (habitat destruction, soil erosion, water pollution, biodiversity loss).
- ❑ Identify and explain economic impacts (job creation, raw materials for industries, costs of reclamation, health impacts).
- ❑ As the more accessible ores are mined to depletion, mining operations are forced to access lower grade ores. Accessing these ores requires increased use of resources that can cause increased waste and pollution.
- ❑ Surface mining is the removal of large portions of soil and rock, called overburden, in order to access the ore underneath. An example is strip mining, which removes the vegetation from an area, making the area more susceptible to erosion.
- ❑ Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane.
- ❑ Explain major environmental impacts of urbanization (excess water runoff, sprawl, urban heat island)
- ❑ Describe environmental benefits to high density urban populations (public transit, reduced energy for heating/cooling)
- ❑ Urbanization can lead to depletion of resources and saltwater intrusion in the hydrologic cycle.
- ❑ Urbanization, through the burning of fossil fuels and landfills, affects the carbon cycle by increasing the amount of carbon dioxide in the atmosphere.
- ❑ Describe the main forest management strategies
- ❑ Clearcutting can be economically advantageous but leads to soil erosion, increased soil and stream temperatures, and flooding.
- ❑ Forests contain trees that absorb pollutants and store carbon dioxide. The cutting and burning of trees releases carbon dioxide and contributes to climate change.
- ❑ Some of the methods for mitigating deforestation include reforestation, using and buying wood harvested by ecologically sustainable forestry techniques, and reusing wood.
- ❑ Methods to protect forests from pathogens and insects include integrated pest management (IPM) and the removal of affected trees.
- ❑ Prescribed burn is a method by which forests are set on fire under controlled conditions in order to reduce the occurrence of natural fires.

Key Questions

BIG IDEA 3 - *Interactions Between Different Species and the Environment*

- How does your use of natural resources impact the world?
- How are resources removed from forested areas and why must sustainability be the guiding principle in forestry management?
- What are the economic, environmental and human health impacts of pests and how do we deal with them?
- What are the economic, environmental and human health impacts from mineral extraction?

BIG IDEA 4 – *Sustainability*

- Why are sustainable practices difficult to implement? (on multiple scales: individual households, cities/states, companies, etc)

- How are minerals most commonly extracted from the ground? What are the environmental impacts of mineral extraction? How can the impacts of mineral extraction be minimized?
- What aspects of urban life are more sustainable than rural life? Which are less sustainable?
- How can humans engineer cities to maximize human benefits and minimize environmental degradation?

ROADMAP

AT A Glance: Unit #:				
Day	**Date**	**Lesson**	**Lesson Title**	**Lesson & Pacing Notes**
1		01	Lab – Cookie Mining – Day 1	
2		02	Lab – Cookie Mining – Day 2	
3		03	Acid Mine Drainage	
4		04	Case Study – Urban Runoff	
5		05	More Urbanization	
6		06	Forestry Management	
7		07	Sustainable Forestry	
	No Unit Exam for this Unit in preparation for the Semester Exam			

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Day 01 **Cookie Mining Lab - Activity** **Day 02** **Cookie Mining Lab - Analysis**	**Standard(s)** Topic 5.9: **Impacts of Mining** **EIN-2.K Describe** natural resource extraction through mining. **EIN-2.L Describe** ecological and economic impacts of natural resource extraction through mining. SWBAT: **Describe** the process of surface mining and reclamation **Describe** the ecological impacts of mining. **DISCIPLINARY LITERACY FOCUS:**  	**KEY UNDERSTANDINGS CHECKLIST:** ❑ Describe the process of surface mining including reclamation ❑ Identify and explain ecological impacts of surface mining (habitat destruction, soil erosion, water pollution, biodiversity loss). ❑ Identify and explain economic impacts (job creation, raw materials for industries, costs of reclamation, health impacts). ❑ As the more accessible ores are mined to depletion, mining operations are forced to access lower grade ores. Accessing these ores requires increased use of resources that can cause increased waste and pollution. ❑ Surface mining is the removal of large portions of soil and rock, called overburden, in order to access the ore underneath. An example is strip mining, which removes the vegetation from an area, making the area more susceptible to erosion. ❑ Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane. **LESSON CONTEXT FOR LESSON MASTERY:** Students will mine a chocolate chips cookie (or cupcake) for the chocolate chips, then reclamation of their cookie to explore all the processes of surface mining. On day 2 of this lesson students will work in groups to analyze data from the cookie mining activity and answer reflection questions designed to help illuminate the environmental impacts of surface mining. **LOOK-FORS 🔍 (What to observe students doing or producing)** While doing the cookie mining lab, students accurately use terms like overburden, tailings, reclamation, erosion, runoff. Can diagram or explain the surface mining process in order. Can articulate both ecological and economic perspectives in a discussion or debate.	**TEACHER CONTENT BACKGROUND RESOURCES** • **Smedes – 5.9 Mining**

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
		COMMON MISCONCEPTIONS ⚑ (Historical/widespread misunderstandings) • Mining only provides negative impacts (students may forget the economic and industrial necessity). • Reclamation always fully restores the ecosystem to its original state. • Surface mining = drilling into the ground (confusing with subsurface mining). **MAKING CONNECTIONS** • Surface mining destroys the entire ecosystem from the ground up and mining reclamation attempts to put it back together so that succession can begin but this succession will not be regular secondary succession starting with soil and some life in the soil because the soil food web would be all but destroyed as well • Surface Mining did not have any legal requirement to include any steps to put the land/ecosystem back together when a mine was abandoned unit the **Surface Mining Control and Reclamation Act of 1977** (**SMCRA**) is the primary federal law that regulates the environmental effects of coal mining in the United States. SMCRA created two programs: one for regulating active coal mines and a second for reclaiming abandoned mine lands.	
Day 03 **Acid Mine Drainage**	**Standard(s)** **Topic 5.9: Impacts of Mining** **EIN-2.L Describe** ecological and economic impacts of natural resource extraction through mining. **SWBAT: Describe** the process that creates acid mine drainage and **explain** the environmental impacts of acid mine drainage	**KEY UNDERSTANDINGS CHECKLIST:** ❑ Mining wastes include the soil and rocks that are moved to gain access to the ore and the waste, called slag and tailings that remain when the minerals have been removed from the ore. ❑ Mining helps to provide low cost energy and material necessary to make products. The mining of coal can destroy habitats, contaminate ground water, and release dust particles and methane. **LESSON CONTEXT FOR LESSON MASTERY:** Students will explore the cause, environmental impacts and potential solutions for acid mine drainage from abandoned mines by watching videos with guided questioning and discussion.	**TEACHER CONTENT BACKGROUND RESOURCES** • TreeHugger -What is Acid Mine Drainage?

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
	DISCIPLINARY LITERACY FOCUS: 	**LOOK-FORS 🔍 (What to observe students doing or producing)** ▪ Students connect Acid Mine Drainage to real-world consequences (dead zones in rivers, fish population collapse, costly water treatment). ▪ Students identify both short-term economic benefits and long-term economic costs of mining. ▪ Students use key vocabulary: leaching, contamination, remediation. **COMMON MISCONCEPTIONS ⚑ (Historical/widespread misunderstandings)** Only small streams are affected (it can spread through entire watersheds). **MAKING CONNECTIONS** Acid mine drainage is one of the ways that heavy metal pollutants move and get concentrated into surface waters	
Day 04 **Urban Runoff Case Study**	**STANDARD(s)** **Topic 5.10: Impacts of Urbanization** **EIN-2.M - Describe** the effects of urbanization on the environment. **Topic 5.13: Methods to Reduce Urban Runoff**	**KEY UNDERSTANDINGS CHECKLIST:** ❑ Explain major environmental impacts of urbanization (excess water runoff, sprawl, urban heat island) ❑ Describe environmental benefits to high density urban populations (public transit, reduced energy for heating/cooling) ❑ Urbanization can lead to depletion of resources and saltwater intrusion in the hydrologic cycle. ❑ Urbanization, through the burning of fossil fuels and landfills, affects the carbon cycle by increasing the amount of carbon dioxide in the atmosphere.	**TEACHER CONTENT BACKGROUND RESOURCES** • Khan – Impacts of Urbanization • Smedes – Impact of Urbanization

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Day 05 **More Urbanization**	**STB-1.B-** Describe methods for mitigating problems related to urban runoff. **SWBAT:** **Describe** environmental impacts of growing urban populations and possible solutions to mitigate these impacts **DISCIPLINARY LITERACY FOCUS:**  	❑ Impervious surfaces are human-made structures—such as roads, buildings, sidewalks, and parking lots—that do not allow water to reach the soil, leading to flooding. ❑ Urban sprawl is the change in population distribution from high population density areas to low density suburbs that spread into rural lands, leading to potential environmental problems. ❑ Methods to increase water infiltration include replacing traditional pavement with permeable pavement, planting trees, increased use of public transportation, and building up, not out. **LESSON CONTEXT FOR LESSON MASTERY:** Students will explore how increasing urbanization impact ecosystems, climate, and sustainability. Day 1 of this lesson will focus on Urban Precipitation Runoff with a case study and Day 2 will focus on several other environmental problems associated with increasing urbanization (urban sprawl, saltwater intrusion, urban heat island effect). Throughout this lesson students should be pushed to describe possible solutions to these problems AND describe the environmental advantages of urban living. **LOOK-FORS 🔍 (What to observe students doing or producing)** ▪ Students can explain cause-effect relationships (ex: more pavement → heat island effect → higher energy demand for cooling). ▪ Students propose realistic mitigation strategies urban heat islands ▪ Students use correct vocabulary: urban sprawl, heat island, smart growth, infrastructure, sustainability. ▪ Students will explore the environmental impacts of urbanization (other than the obvious loss of habitat and species required to build cities) through a combination of videos and guided questioning. **COMMON MISCONCEPTIONS 🚩 (Historical/widespread misunderstandings)** • Urbanization is only a problem in developing nations (it's global). • More technology automatically makes cities sustainable (depending on usage, equity, and planning).	• **Smedes – Methods to Reduce Urban Runoff**

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
		MAKING CONNECTIONS • Increases in urbanization mean increased amount of impervious surfaces which leads to increased runoff which increases the likelihood of flooding, and decreases infiltration of precipitation into the ground which decreases the recharging of aquifers/groundwater which reduces the available water for cities and in coastal cities can lead to saltwater intrusion • Planting more trees in urban areas helps to mitigate urbanization problems and helps to pull CO_2 from the atmosphere so it helps mitigate climate change as well • **The Genius of China's Sponge Cities** – good description about possible solutions to flooding made worse by urbanization • Urbanization, like population growth and driven by population growth, is a driving force in many environmental problems such as deforestation, loss of ecosystem services, loss of species, etc. • More the half of the world's population now lives in an urban environment and that percentage is increasing so all the environmental issues of urbanization must be addressed or else they will become even more impactful	

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
Day 06 **Forestry Management Techniques** **Day 07** **Sustainable Forestry**	**Standard(s)** **Topic 5.2 - Clearcutting** **EIN-2.B Describe** the effect of clearcutting on forests. **Topic 5.17: Sustainable Forestry** **STB-1.G - Describe** methods for mitigating human impact on forests. **SWBAT:** **Describe** the environmental impacts of clear cutting a forest **Explain** forest management plans to more sustainably to provide timber resources and maintain ecosystem services. **DISCIPLINARY LITERACY FOCUS:**  	**KEY UNDERSTANDINGS CHECKLIST:** ❑ Describe the main forest management strategies ❑ Clearcutting can be economically advantageous but leads to soil erosion, increased soil and stream temperatures, and flooding. ❑ Forests contain trees that absorb pollutants and store carbon dioxide. The cutting and burning of trees releases carbon dioxide and contributes to climate change. ❑ Some of the methods for mitigating deforestation include reforestation, using and buying wood harvested by ecologically sustainable forestry techniques, and reusing wood. ❑ Methods to protect forests from pathogens and insects include integrated pest management (IPM) and the removal of affected trees. ❑ Prescribed burn is a method by which forests are set on fire under controlled conditions in order to reduce the occurrence of natural fires. – *not thoroughly covered in this lesson* **LESSON CONTEXT FOR LESSON MASTERY:** Students will explore the different types of forestry management strategies by working in groups to research, practice and performing a short skit for that class about their forestry management practice. Then students will compare the advantages and disadvantages of different forest management plans with guided questioning led by the teacher and investigating short videos in small groups. Students will also explore resources to help consumers make more sustainable purchasing decisions. **LOOK-FORS 🔍 (What to observe students doing or producing)** • Students clearly describe cause-effect relationships (e.g., clearcutting → soil erosion → sediment in rivers → aquatic ecosystem decline). • Students comparing/contrasting the environmental and economic advantages and disadvantages of different forest management techniques **COMMON MISCONCEPTIONS 🚩 (Historical/widespread misunderstandings)**	**TEACHER CONTENT BACKGROUND RESOURCES** • Smedes - Clearcutting • Smedes – Sustainable Forestry • NC Forestry Association – Forestry Management Basics • Rainforest Alliance – Sustainable Forestry • Forest Stewardship Council

Lesson	Objective(s) and Standard(s)	Instructional Notes	Resources
		• Forests regrow quickly after clearcutting (in reality, full ecosystem recovery can take many decades or even centuries, especially to reach late succession (old growth) forests. • Clear cutting is only a problem in tropical rainforests. It can affect Deciduous and Coniferous forests too. **Making Connections** • Like many other environmental problems, the advantages of clearcutting are almost entirely economic, and the disadvantages are almost entirely environmental. • Clearcutting is the practice of harvesting timber resources by cutting down all or nearly all the trees in an area and the area is left to ecological succession afterwards. Trees are also entirely removed from an area to make way for human use (agriculture, urbanization, roads, etc.) but when this happens it is called deforestation because there is no way for the area to move through ecological succession because of human development. • Slash and Burn is not really a forestry technique because it does not harvest trees for lumber or paper but cuts them down just to clear the land (most often for agriculture or to build human developments) • Preserving the MANY ecosystem services of forests is one of the top priorities of sustainable forestry: water retention and purification, oxygen creation, climate stabilization, habitat for species, etc. • Conservation of forests is a key strategy to help combat climate change as forests pull CO_2 out of the atmosphere • Sustainable forestry is like IPM in the sense that compared to each's conventional alternative they require much more knowledge, practice, and specific techniques for each specific situation, which often makes them more difficult and more expensive/ less profitable	
Semester Exam Window – TX_SCI_APEnvironmentalScience_F25_SE			

VERTICAL STANDARDS

This section details the **progression** of key student expectations/standards** in the courses **before** and **after** this course. This will help you understand what **prior knowledge skills to build upon** and guide you in knowing what **skills you are preparing your students** for in the subsequent course.

BEFORE AP Environmental Science

Grade 6 - 8
Pre-AP Biology (Grade 8 or 9)
Pre-AP Chemistry (Grade 9 or 10)

AP Human Geography

Unit 2: Population and Migration Patterns and Processes

- **Topic 2.3: Population Composition -** Understanding where and how people live is essential to understanding global cultural, political, and economic patterns.
  - Describe elements of population composition used by geographers.
    - Patterns of age structure and sex ratio vary across different regions and may be mapped and analyzed at different scales.
  - Explain ways that geographers depict and analyze population composition.
    - Population pyramids are used to assess population growth and decline and to predict markets for goods and services.
- **Topic 2.4: Population Dynamics -** Changes in population are due to mortality, fertility, and migration, which are influenced by the interplay of environmental, economic, cultural, and political factors.
  - Explain factors that account for contemporary and historical trends in population growth and decline.
    - Demographic factors that determine a population's growth and decline are fertility, mortality, and migration.
    - Geographers use the rate of natural increase and population-doubling time to explain population growth and decline
    - Social, cultural, political, and economic factors influence fertility, mortality, and migration rates.
- **Topic 2.4: The Demographic Transition Model -** Changes in population are due to mortality, fertility, and migration, which are influenced by the interplay of environmental, economic, cultural, and political factors.
  - Explain theories of population growth and decline.
    - The demographic transition model can be used to explain population change over time.
    - The epidemiological transition explains causes of changing death rates.
- **Topic 2.6: Malthusian Theory -** Changes in population are due to mortality, fertility, and migration, which are influenced by the interplay of environmental, economic, cultural, and political factors.
  - Explain theories of population growth and decline.
    - Malthusian theory and its critiques are used to analyze population change and its consequences.
- **Topic 2.8: women and Demographic Change -** Changes in population have long- and short-term effects on a place's economy, culture, and politics.

- Explain how the changing role of females has demographic consequences in different parts of the world
  - Changing social values and access to education, employment, health care, and contraception have reduced fertility rates in most parts of the world.
  - Changing social, economic, and political roles for females have influenced patterns of fertility, mortality, and migration, as illustrated by Ravenstein's laws of migration.

After AP Environmental Science

AP Biology (Grade 10, 11 or 12)

AP Chemistry

VOCABULARY GLOSSARY

Domain-specific words and definitions for this unit.

Key Content Vocabulary
Forestry - the science and craft of creating, managing, planting, using, conserving and repairing forests, woodlands, and associated resources for human and environmental benefits.[1] Forestry is practiced in plantations and natural stands.[2] The science of forestry has elements that belong to the biological, physical, social, political and managerial sciences.[3] Forest management play essential role of creation and modification of habitats and affect ecosystem services provisioning. **Clear Cutting –** a forestry/logging practice in which most or all trees in an area are uniformly cut down. **Selection Cutting –** **Seed Tree Cutting –** A forest management technique in which most trees in an area are cut, and a few are left to provide seeds for the regeneration of the cut area. **Prescribed (Controlled) burn -** a fire set intentionally for purposes of forest management, farming, prairie restoration or greenhouse gas abatement. **Shelterwood cutting -** progression of forest cuttings leading to the establishment of a new generation of seedlings of a particular species or group of species without planting. **Old Growth Forest** - a forest that has attained great age without significant disturbance and thereby exhibits unique ecological features and might be classified as a climax community. **Surface Mining –** a broad category of mining in which soil and rock overlying the mineral deposit (the overburden) are removed, including **strip mining**, open-pit mining and mountaintop removal mining, is in contrast to underground mining, in which the overlying rock is left in place, and the mineral is removed through shafts or tunnels. **Underground (Sub-surface) Mining –** Sub-surface mining consists of digging tunnels or shafts into the earth to reach buried ore deposits. Ore, for processing, and waste rock, for disposal, are brought to the surface through the tunnels and shafts. Sub-surface mining can be classified by the type of access shafts used, and the extraction method or the technique used to reach the mineral deposit. **Overburden –** (also called **waste** or **spoil**) is the material that lies above an area that lends itself to economical exploitation, such as the rock, soil, and ecosystem that lies above a coal seam or ore body. **Ore –** natural rock or sediment that contains one or more valuable minerals, typically containing metals, that can be mined, treated and sold at a profit.[1][2] Ore is extracted from the earth through mining and treated or refined, often via smelting, to extract the valuable metals or minerals.[3] **(Ore) Grade -** The *grade* of ore refers to the concentration of the desired material it contains. The value of the metals or minerals a rock contains must be weighed against the cost of extraction to determine whether it is of sufficiently high grade to be worth mining, and is therefore considered an ore. **Tailings – (**also called gangue) the materials left over after the process of separating the valuable fraction from the uneconomic fraction (gangue) of an ore.

Mine Reclamation – the process of modifying land that has been mined to ecologically functional or economically usable state. **Acid Mine Drainage -** the outflow of acidic water from metal mines or coal mines. **Sulfide minerals** - a class of minerals containing sulfide (S^{2-}) or disulfide (S_2^{2-}) as the major anion.			
Related Vocabulary			
Urban sprawl Urban Heat Island	Urban sprawl Urban Heat Island	Urban sprawl Urban Heat Island	Urban sprawl Urban Heat Island