

Ecosystems

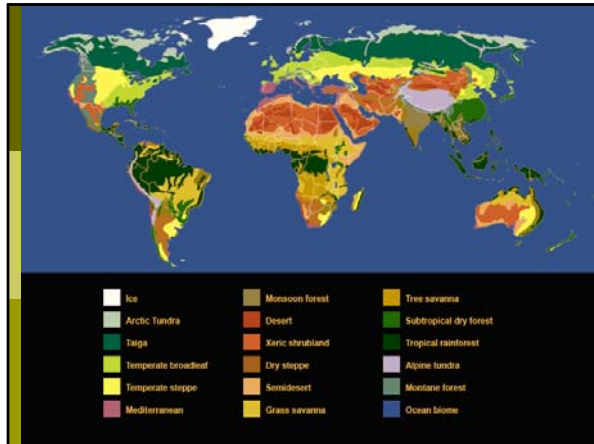
Master Naturalist Program
March 13, 2009

Ecosystems (Ecological Systems)

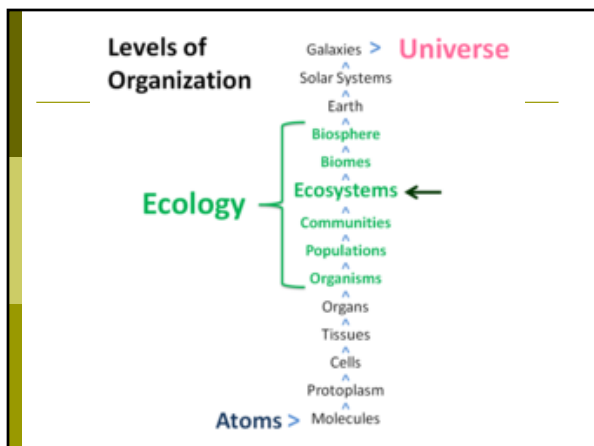
- ❑ **Ecosystems** are the interactions between the living things and the nonliving things in a place. In an ecosystem, the plants, animals, and other organisms rely on each other and on the physical environment – the soil, water, and nutrients, for example.
- ❑ Or a dynamic complex of plant, animal, and micro-organism communities and their non-living environment interacting as a functional unit.

Biomes

- ❑ A climatically and geographically defined area of ecologically similar climatic conditions such as communities of plants, animals, and soil organisms, often referred to as ecosystems.







Types

- ❑ Wetlands
- ❑ Desert
- ❑ Longleaf pine ecosystem
- ❑ Wiregrass ecosystem
- ❑ Estuaries
- ❑ Prairie
- ❑ Tropical rain forest
- ❑ Coral reef
- ❑ ...



Longleaf/wiregrass ecosystem



Types

- ❑ Terrestrial
- ❑ Tundra
- ❑ Urban ecosystem
- ❑ Greater Yellowstone
- ❑ Farm pond
- ❑ My Terrarium
- ❑ Etc...



Ecosystem Classification

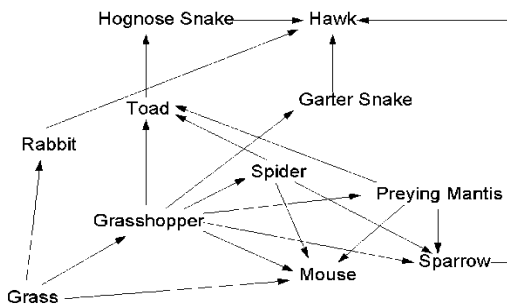
- Can be recognizable in the field as well as on satellite imagery
 - Structure and seasonality of vegetation
 - Elevation
 - Humidity
 - Drainage
 - Animal, fungi, bacteria, and plants

Ecosystem productivity

In an ecosystem, the connections between species are generally related to food and their role in the food chain. There are three categories of organisms:

- Producers** – usually plants which are capable of photosynthesis but could be other organisms such as bacteria around ocean vents that are capable of chemosynthesis.
- Consumers** – animals, which can be primary consumers (herbivorous), or secondary or tertiary consumers (carnivorous).
- Decomposers** – bacteria, mushrooms which degrade organic matter of all categories, and restore minerals to the environment.

Food chain



Ecosystem Services



Function

- ❑ Ecosystem services are the benefits people receive from ecosystems. We derive basically four kinds of services:
 - Provisioning services are things like food, timber, and water
 - Regulating services regulate things like climate, floods, and disease
 - Supporting services support geochemical and biological processes on Earth, for example, the nutrient cycle and pollination
 - Cultural services make a difference for our souls, physical and aesthetic enjoyment, and our communities

Ecosystem services

- ❑ moderate weather extremes and their impacts
- ❑ disperse seeds
- ❑ mitigate drought and floods
- ❑ protect people from the sun's harmful ultraviolet rays
- ❑ cycle and move nutrients
- ❑ protect stream and river channels and coastal shores from erosion
- ❑ detoxify and decompose wastes
- ❑ control agricultural pests
- ❑ maintain biodiversity
- ❑ generate and preserve soils and renew their fertility
- ❑ contribute to climate stability
- ❑ purify the air and water
- ❑ regulate disease carrying organisms
- ❑ pollinate crops and natural vegetation
- ❑ Ecotourism
- ❑ Employment

What are Ecosystem Services worth?

Examples

- ❑ Flood protection services-Mississippi River Valley
 - Altering wetlands and channels caused property damages ~ \$12 billion
- ❑ Medicinal products
 - 78% of the top medicines in the US
- ❑ Pollination services
 - ~\$4-6 billion per year



Changes

- ❑ ecosystems of the world have changed more rapidly in the last 50 years than at any other point before human history.
- ❑ an estimated 25 percent of the terrestrial continental surface of the planet is currently under some type of cultivation system. In cultivated ecosystems, increased agriculture and the greater use of a few modern varieties of crops have reduced the genetic diversity of domesticated plants and animals.

Biodiversity (Biological Diversity)

Biodiversity is the variation of life forms within a given ecosystem, biome, or the entire Earth.

So far, about 1.75 million species have been officially classified.



Geographic Regions of Georgia

Ecoregions



Georgia

- ❑ area of 59,441 square miles
- ❑ 1,016 square miles of inland water
- ❑ 48 square miles of coastal waters over which the state has jurisdiction
- ❑ largest state east of the Mississippi River



How Diverse is Georgia?

- ❑ Georgia is home to 69 terrestrial animals
- ❑ 370 species of birds that live in Georgia at some point during their lifetimes
- ❑ 163 species of reptiles and amphibians
- ❑ more than 219 different native species of fish
- ❑ nearly 4,200 different species of aquatic insects
- ❑ 98 species of mollusks
- ❑ more than 3,600 species of native wild plants

Georgia Biodiversity

- ❑ Second- amphibians
- ❑ Third- freshwater fishes
- ❑ Third- Crayfishes
- ❑ Seventh- reptiles
- ❑ Seventh- vascular plants
- ❑ Sixth- overall species diversity!

Home to more than 4400 species of native or naturalized plants and vertebrates

Georgia is home to some 88 endemic species.

Threatened and Endangered Species



Threatened and Endangered Species (Georgia- 71)

- ❑ Animals- 49
 - 35 Endangered
 - 14 Threatened
- ❑ Plants- 22
 - 15 Endangered
 - 7 Threatened



Georgia's Endangered Species

- ❑ Loggerhead sea turtle- *Caretta caretta*



Georgia's Endangered Species

- ❑ Eastern Indigo Snake- *Drymarchon corais couperi*



Georgia's Endangered Species

- ❑ Red Cockaded Woodpecker- *Picoides borealis*



Georgia's Endangered Species

- Blue Shiner- *Cyprinella caerulea*



Keystone Species

- Vital species that are indicators of ecosystem health. A sizeable change in these species can cause a cascade of direct and indirect effects on the ecosystem.
 - Top predators (foxes, owls...)
 - Engineers (beavers, woodpeckers)
 - Resource providers (mycorrhizae fungi...)
 - Mutualists (pollinators, flowering plants, seed eating birds)

Keystone Species- examples

- Bumblebee- *Bombus spp*
- Longleaf Pine- *Pinus palustris*
- Beaver- *Castor canadensis*
- Gopher tortoise- *Gopherus polyphemus*



Biodiversity Loss

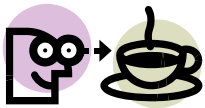
- ❑ Habitat loss and fragmentation
- ❑ Invasive species
- ❑ Pollution
- ❑ Climate change



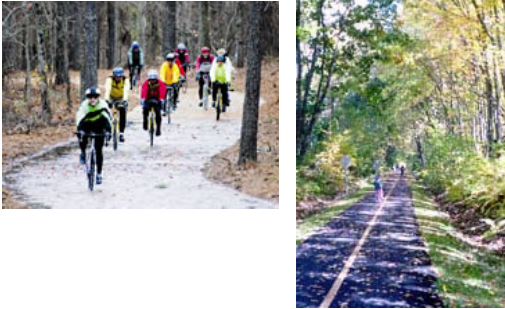
Biodiversity and our Food Supply



BREAK



Greenspace





Greenspace



Greenspace- what is it?

- Protected lands (permanent or temporary)
- Public access vs private property
- Scenic enjoyment/quality of life
- Historic preservation
- Public uses
 - Recreation
 - Tourism
 - Connected areas
- Natural resource protection
 - Watershed management
 - water quality
 - Air quality
 - Wetland protection
 - Habitat restoration
 - Flood plains
 - Wildlife corridors
 - Etc.
- Economics



Green infrastructure is our nation's natural life support system - an interconnected network of waterways, wetlands, woodlands, wildlife habitats, and other natural areas: greenways, parks and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America's communities.

-- The Green Infrastructure Work Group

Tools for Greenspace Protection

- Donations
- Fee simple purchases
- Conservation easements
- Conservation subdivisions
- Buffers
- Transfer of Development Rights
- Differential tax
- Comprehensive Land Use Plans

Farmland Protection





Benefits of Farmland

A diverse & stable local economy

Conserving soil, water & air quality, wildlife habitat

Community Quality of Life

Rural heritage & Community character

Provides Local Foods

States with Differential Assessment Programs, 1997



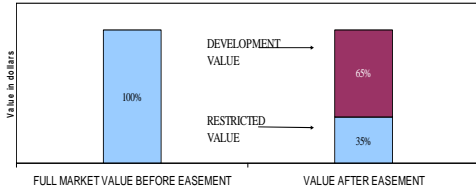
Agricultural District Laws

- Allow farmers to form areas where commercial ag is encouraged
- Authorized by state legislatures and implemented locally
- Partnership between farmers, commissioners, and planners
- Ag district programs in 16 states

Agricultural Conservation Easements

- Voluntary
- Protect the agricultural value and productivity of the land
- Limit or restrict non-farm development and subdivision
- Allow farms to adapt to changing economic conditions
- Place few limits on agricultural development or activities
- Financial incentives

Valuation of Agricultural Conservation Easements



Why Place an Easement on Your Property?

- Desire to protect long-term conservation and agricultural values of the land for future generations
- Can be donated for estate and income tax benefits
- Can be sold for cash in some places

Purchase of Agricultural Conservation Easements (PACE)

- Pay property owners to restrict future development on farm
- Landowners sell agricultural conservation easements to a government agency or private conservation organization.
- Voluntary
- Also called Purchase of Development Rights (PDR)

Agricultural Economic Development

- Planning for ag viability
- Recruitment of input and output businesses
- Individual business plans
- Farmers Markets/Community Supported Agriculture
- Agri-tourism/recreation
- Purchase of Development Rights

Economics of Land Preservation/Greenspace

Cost of Community Studies

- ❑ Developed by the **American Farmland Trust**, a private, national conservation organization
- ❑ A way to determine a community's bottom line by apportioning the direct costs of public services to specific land uses
- ❑ Analyzes the revenue collection and expenditure burden by class of development.

Why Do a COCS Study?

- Different categories of development provide different levels of local revenue and require varying levels of local government services
- It is important to examine the impact of these differences and learn how much working lands contribute to the local tax base
- Gives local officials an incentive to conserve farm and forest land
- It is inexpensive and relatively easy

Common Claims

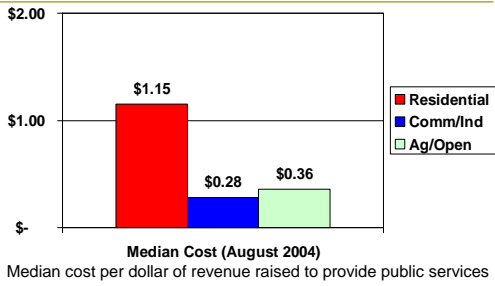
- ❑ Residential development will lower property taxes by increasing the tax base
- ❑ Farmland gets an unfair tax break when it is assessed at its actual use instead of its potential use for development
- ❑ Open lands, including productive farms and forests, are interim uses awaiting conversion to their “highest and best use”

Costs of Community Services

(tax dollars at work)

- ❑ Although residential development increases the local tax base, it does not pay for itself.
- ❑ Towns pay more on residential services than they receive from residential revenues
- ❑ While farm and forest land do not raise nearly as much gross income as developed land uses, their need for services is so modest that the net effect on the tax base is a surplus.
- ❑ In general, residential development is an economic drain while commercial/industrial and farmland/forestland/open space more than pay their own way.

Cost of Community Services Studies



Georgia Results – Rev/Expend.

Development Class	Cherokee Co	Carroll Co
Residential	\$1.60	\$1.29
Commercial/Ind.	\$0.19	\$0.37
Farm/Forest/Open	\$0.19	\$0.55

Expenditures per \$1 in Revenue by Land Use
These results include school revenues or expenditures.

Agricultural lands and open space provides a surplus in tax revenue based upon expenses as compared to residential land uses which is a financial drain on the local tax base.

Sustainable Agriculture as a Land Protection Tool



- Marketing
- Agritourism
- Value-Added Farming
- Local Markets



"If today is a typical day on planet Earth, we will lose 116 square miles of rainforest, or about an acre a second. We will lose another 72 square miles to encroaching deserts, as a result of human mismanagement and overpopulation. We will lose 40 to 100 species, and no one knows whether the number is 40 or 100. Today the human population will increase by 250,000. And today we will add 2,700 tons of chlorofluorocarbons to the atmosphere and 15 million tons of carbon. Tonight the Earth will be a little hotter, its waters more acidic, and the fabric of life more threadbare.... What is education for?"

David Orr (1991)
