Gardening to Improve Water Quality
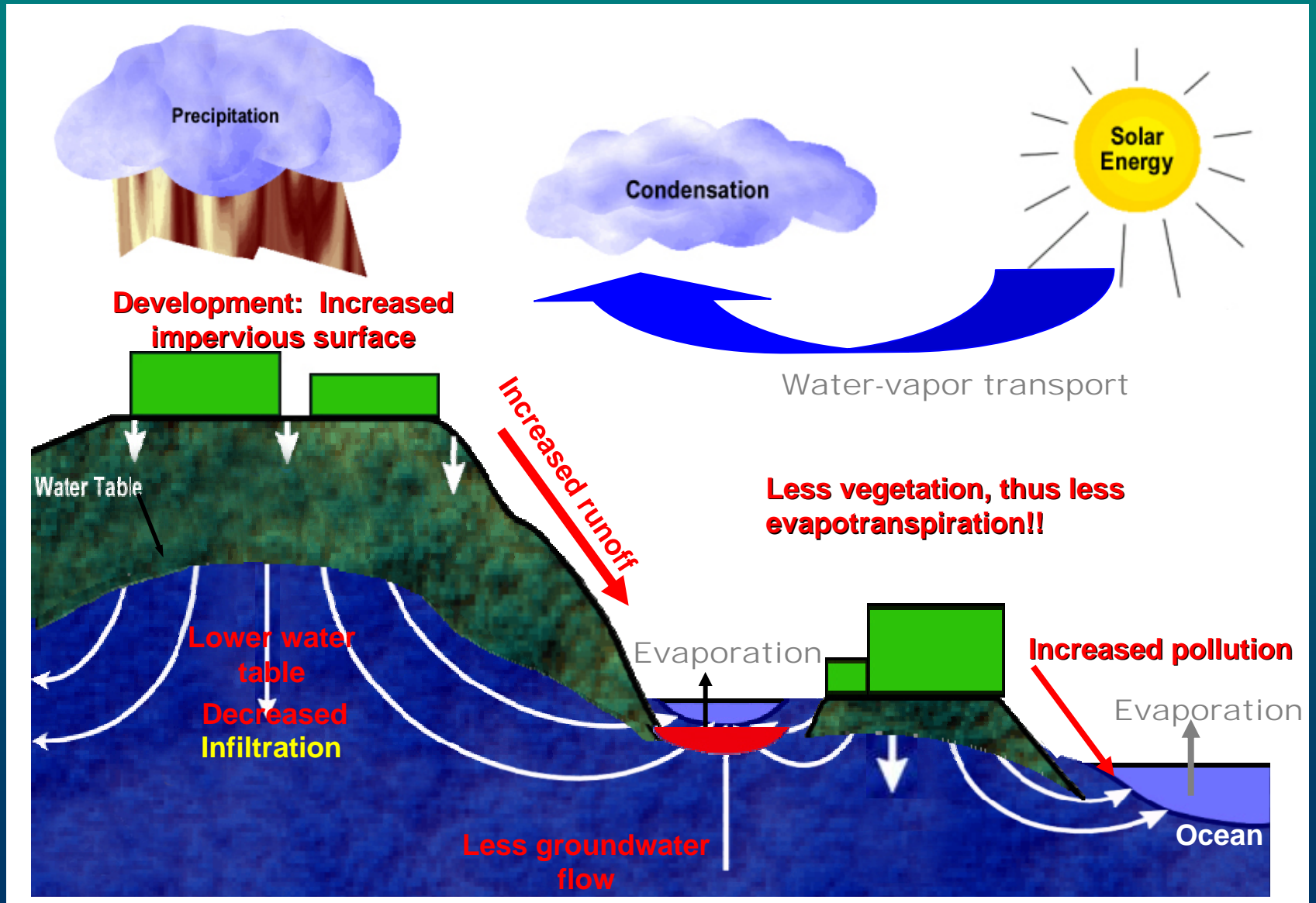
Landscaping with Native Plants

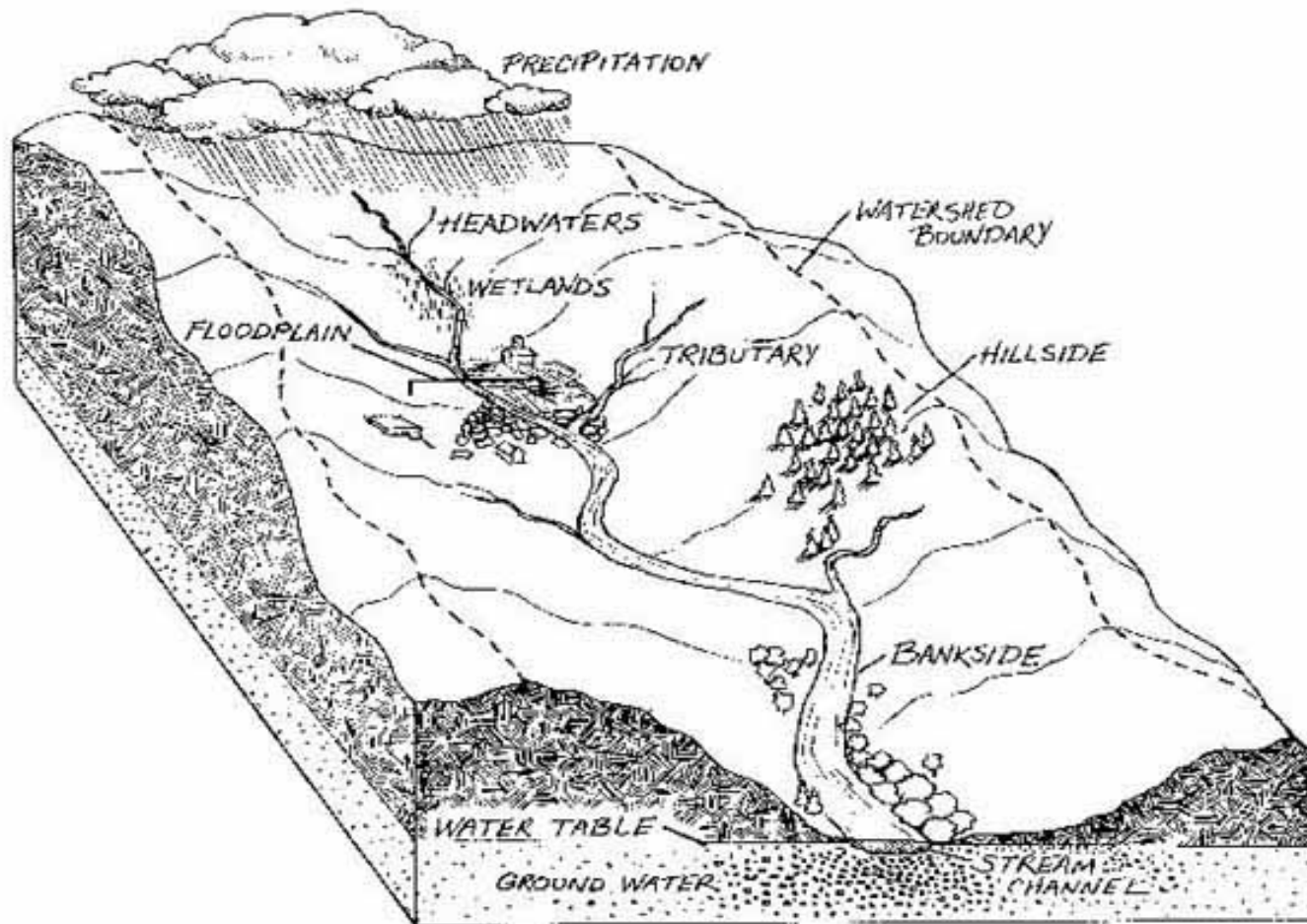**David O'Brien**

NOAA Fisheries Service

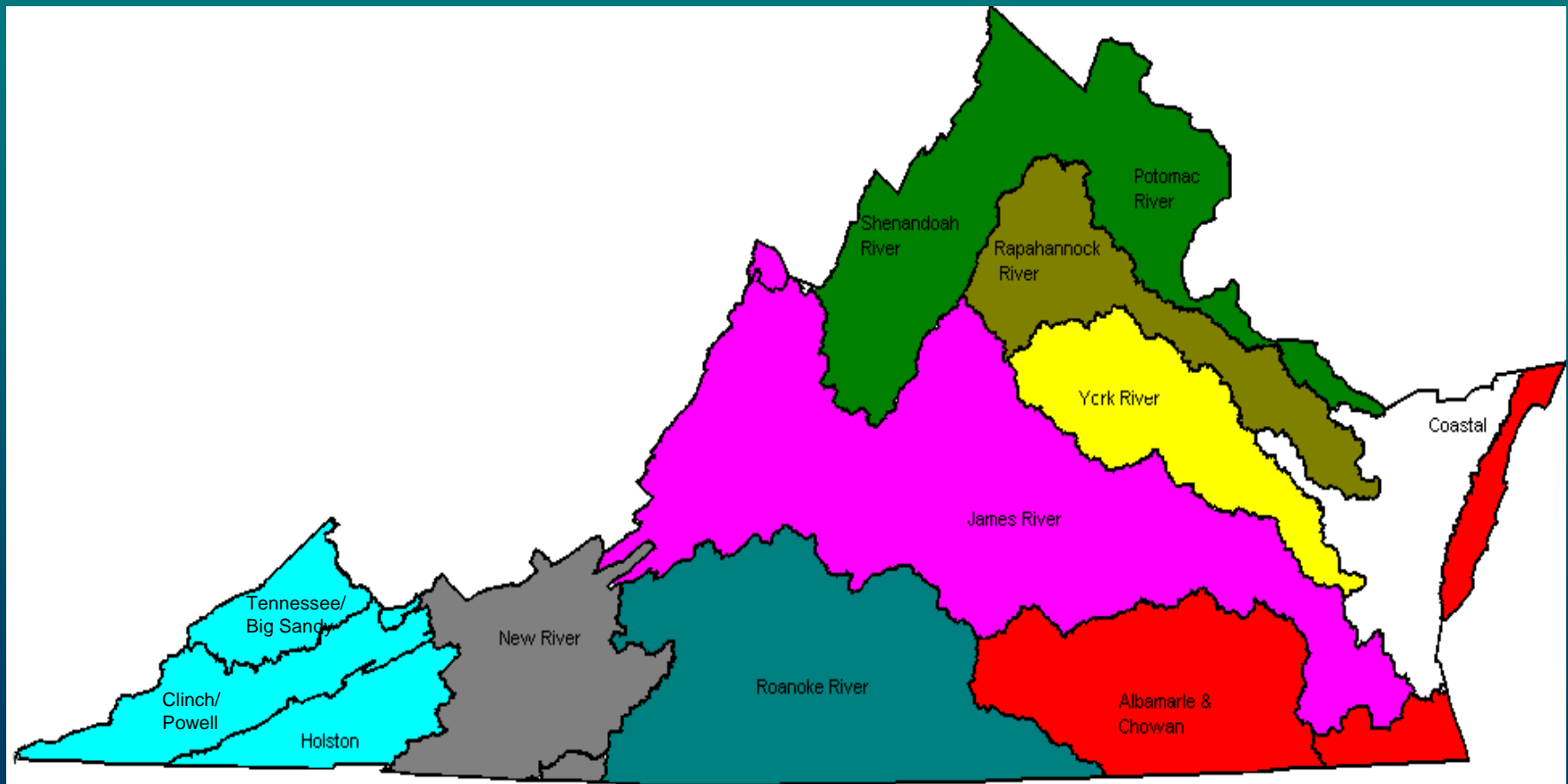**Gloucester Point, VA**

The Water Cycle

What Is a Watershed?

Virginia's Watersheds

Chesapeake Bay

The nation's largest estuary

Nation's most biologically diverse estuary; >3600 species of plants and animals

Nearly 16 million people live in the watershed

Sources of Pollutants to the Bay

Point Sources
- Industry
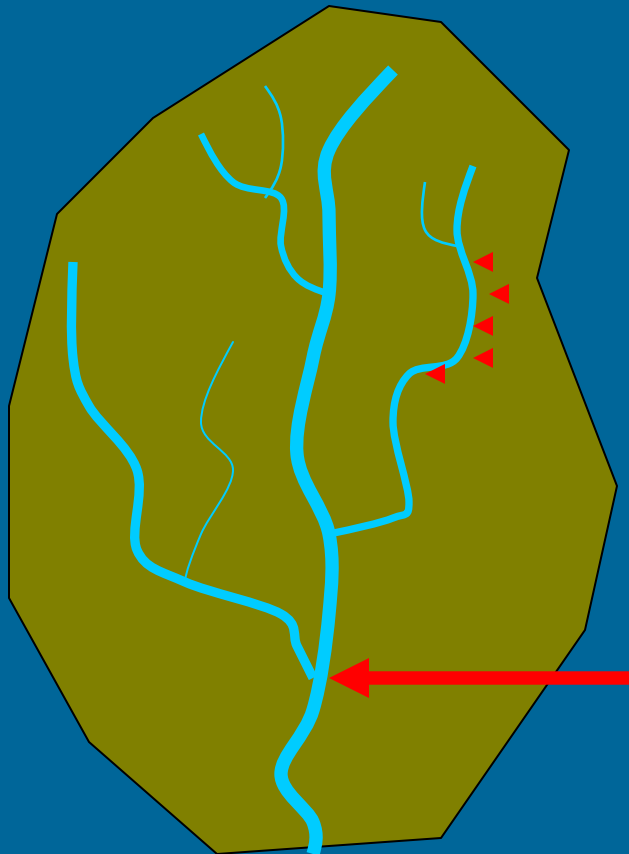- Wastewater Treatment Plants

Nonpt. Sources
- Run-off from farmland
- Run-off from lawns and paved areas

Nature of Contaminant Inputs

Watershed or Drainage Basin

Natural unit of land bounded by its drainage divide and subject to surface and subsurface drainage to a common outlet region.

Nonpoint Source

Origin of discharge is diffuse

Discharge may be transient in time

Runoff from cropland
Effluent from septic systems
Highway de-icing salts

Point Source

Inputs with well defined point of discharge

Discharge is usually continuous

Leakage from landfills and storage tanks
Wastewater treatment facilities
Industrial inputs
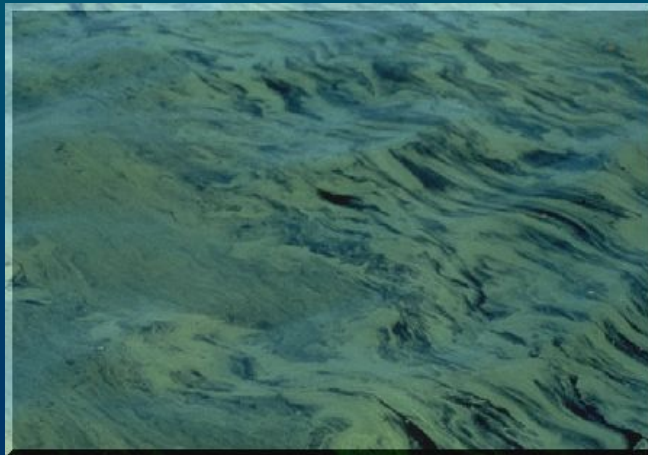
Non-point Source Pollution

Sediment

Toxic Substances

Nutrients

Pathogens

Healthy vs. Unhealthy Water Quality

Sunlight

Minimal nutrient and sediment inputs

Excessive nutrient and sediment inputs

Sunlight

Balanced Algae Growth

Healthy Bay Grasses

Healthy Habitat

Healthy Oyster Reef

Adequate Oxygen

Benthic Community

Algal Bloom

Reduced Bay Grasses

Unhealthy Habitat

Algae Die-off

Algae Decomposition

No Oxygen

Barren Oyster Reef

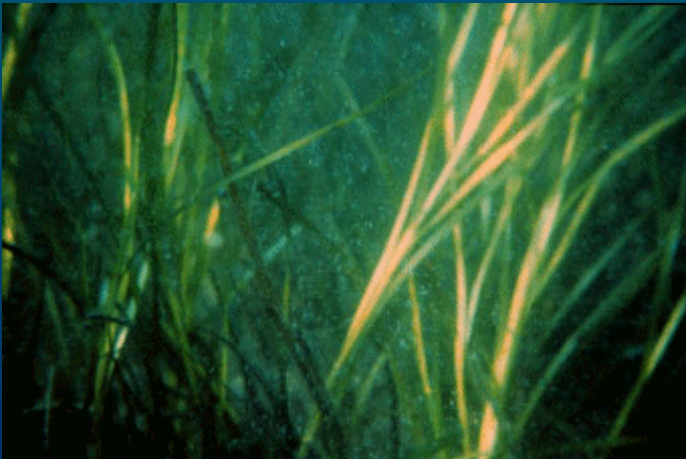No Benthic Community
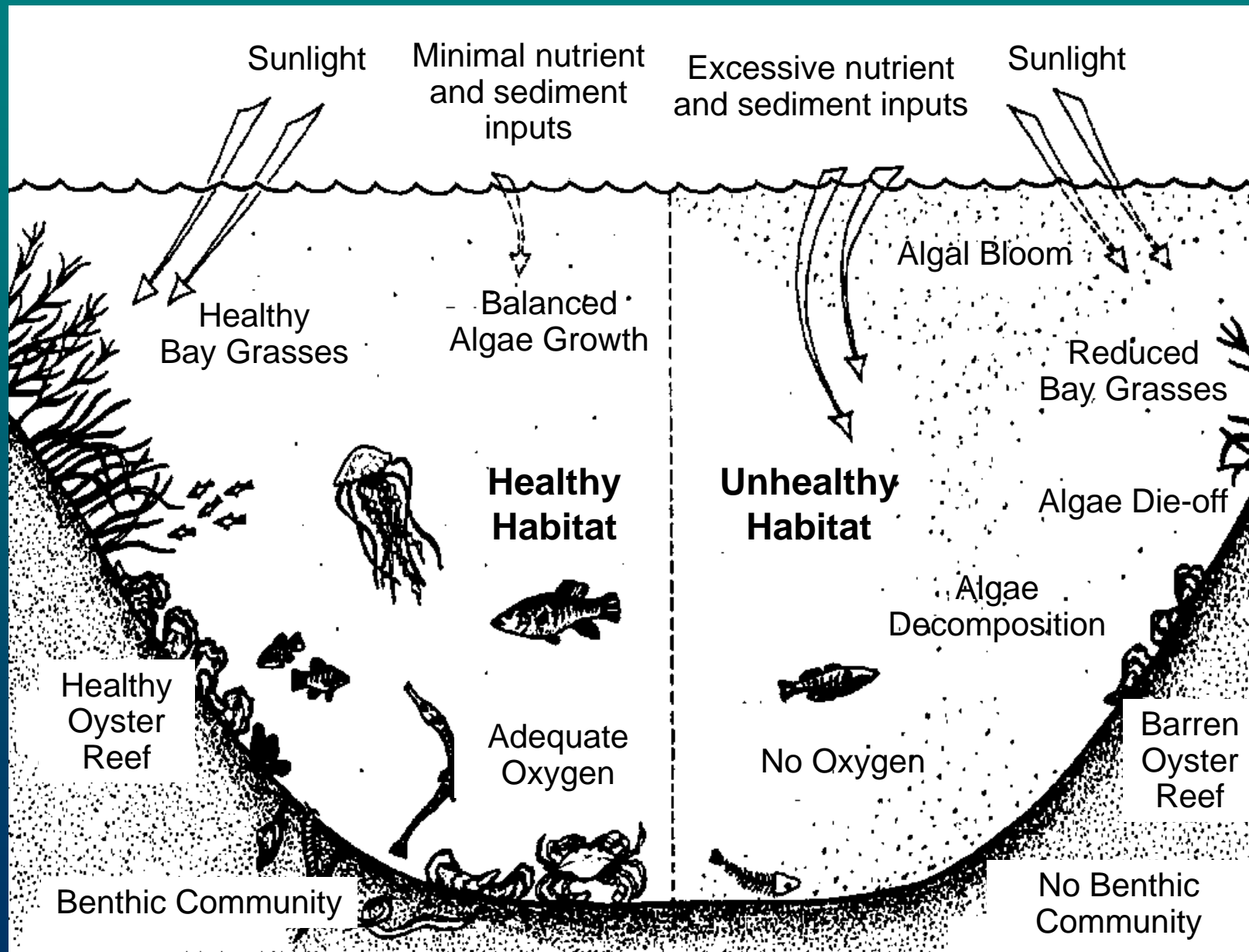
Water Quality Problems

Algae blooms and depleted oxygen levels are caused by excessive nutrients

When the algae die and decompose, they use up oxygen needed by other plants and animals living in the Bay's waters.

Poor water clarity is caused by algae blooms and suspended sediments

Algae blooms and sediment cloud the water and block sunlight, causing underwater bay grasses to die.

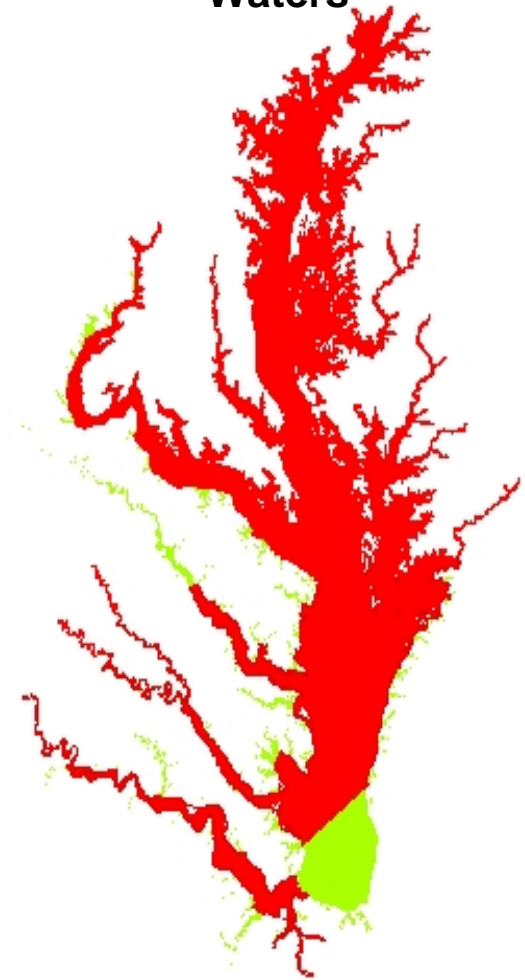# Chesapeake Bay:

How is it Doing???

Impaired Waters List

Nutrient and/or Sediment Impaired Waters

Portions of the Chesapeake Bay and its tidal rivers are listed under the Clean Water Act as "impaired waters" largely because of low dissolved oxygen levels and other problems related to nutrient pollution.

This "listing" requires the development of a clean-up plan for the Bay by 2011.

Note: Representation of 303(d) listed waters for nutrient and/or sediment water quality impairments for illustrative purposes only. For exact 303(d) listings contact EPA (http://www.epa.gov/owow/tmdl/).

■ Impaired Water ■ Unimpaired Water

Threats to the Chesapeake Bay

NUTRIENTS

SEDIMENTS

TOXIC CHEMICALS

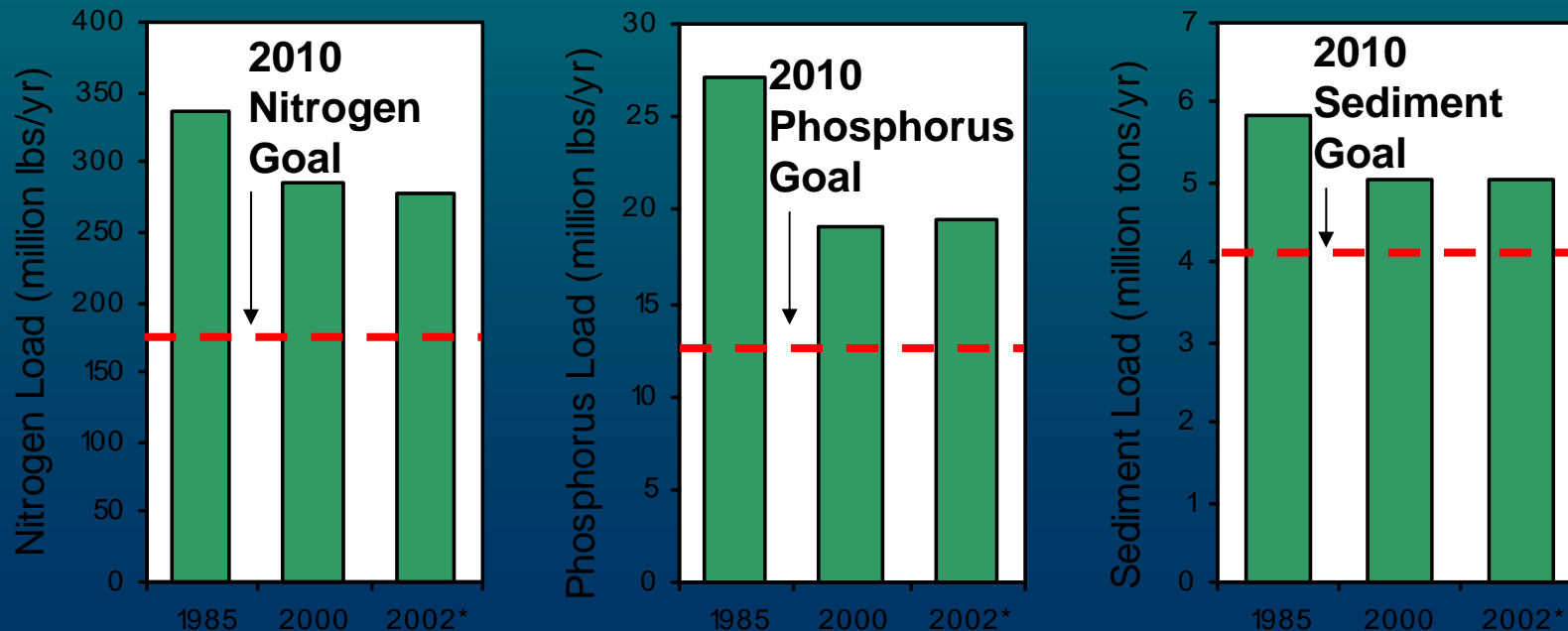**H**ABITAT LOSS

OVERFISHING

Nutrient and Sediment Load Reduction Goals

The 2010 pollutant reduction goals are:

Nitrogen - Reduce annual loads to no more than 175 million pounds.

Phosphorus - Reduce annual loads to no more than 12.8 million pounds.

Land-based Sediment - Reduce annual loads to no more than 4.15 million tons.

Chemical Releases

Millions of lbs/yr

Year 2000 Measurement of Progress

1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998
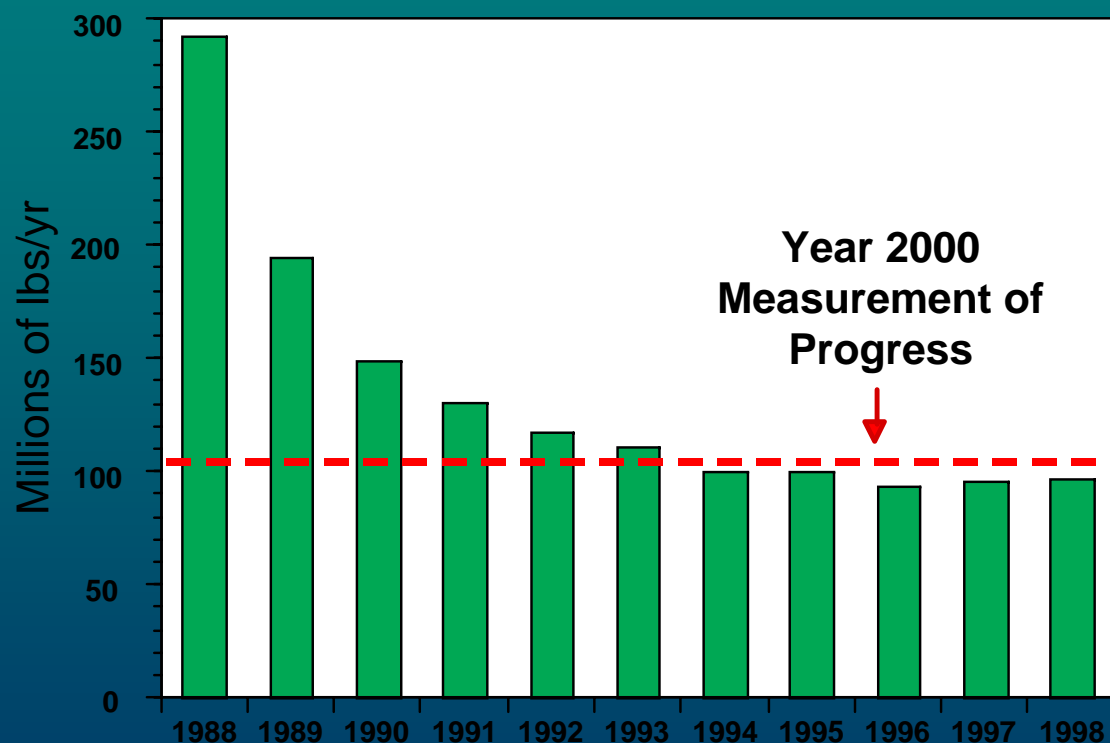
Industries have achieved their voluntary goal of reducing releases and transfers of chemical contaminants 65% between 1988 and 2000.

Since the year 2000 goal has been achieved, the Chesapeake Bay Program has consulted with industry to set new targets.

Forest Acreage Declining

Percentage of Watershed Forested

Early Colonies	Land cleared for agriculture and timber

Land abandoned after Civil War and Depression

Development

1650 1700 1750 1800 1850 1900 1950 2000
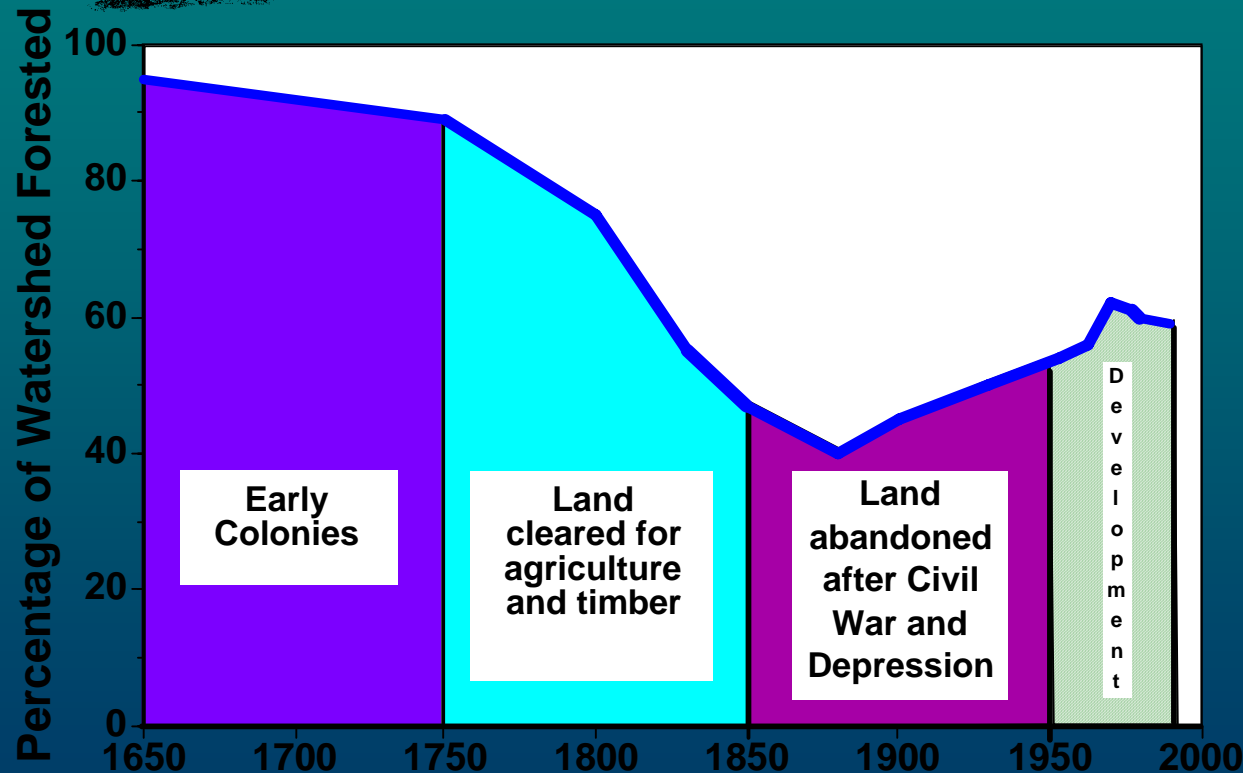
Forests provide critical habitat and help prevent pollutants and sediment from reaching the Bay and rivers.

About 59% of the Bay basin is currently forested.

The forest that regrew from the 19th to the mid-20th centuries is steadily declining. Current losses represent permanent conversions.

Wetlands Being Restored
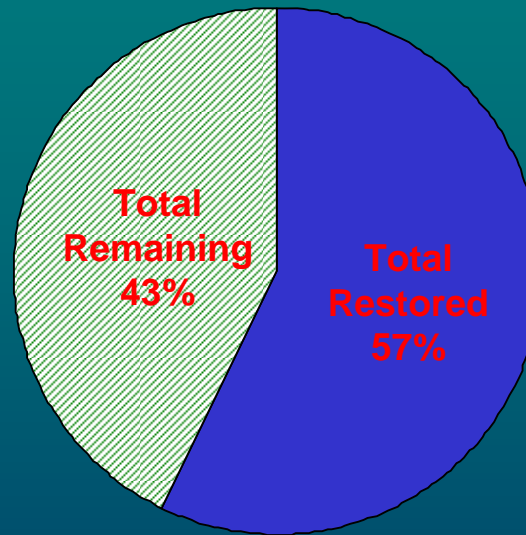
Wetlands Restoration Program Achievement

PA Goal: 4,000 acres
Restored: 930 acres
Percent Achievement: 23%

MD Goal: 15,000 acres
Restored: 12,593 acres
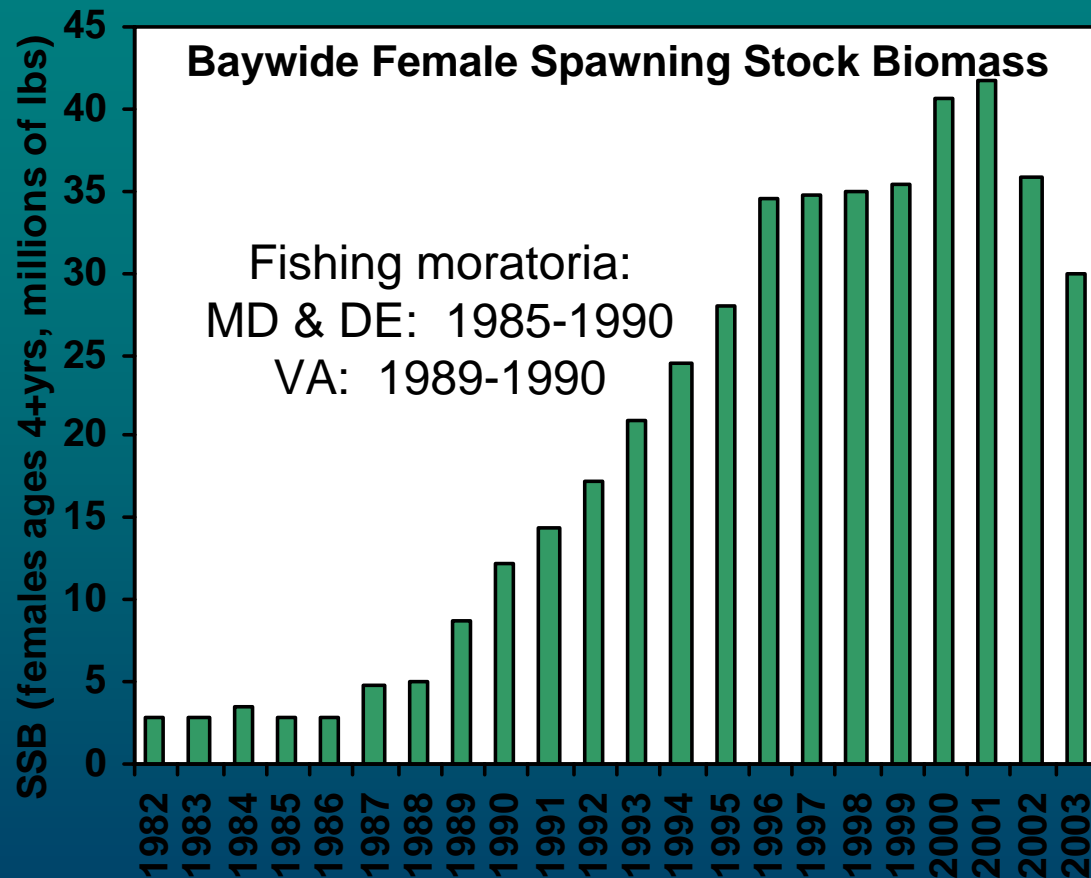Percent Achievement: 84%

VA Goal: 6,000 acres
Restored: 794 acres
Percent Achievement: 13%

Total Remaining 43%

Total Restored 57%

Wetlands are being restored throughout the watershed, but remain at risk due to development pressures.

Rockfish Population Stable

Baywide Female Spawning Stock Biomass

SSB (females ages 4+yrs, millions of lbs)

Fishing moratoria:
MD & DE: 1985-1990
VA: 1989-1990

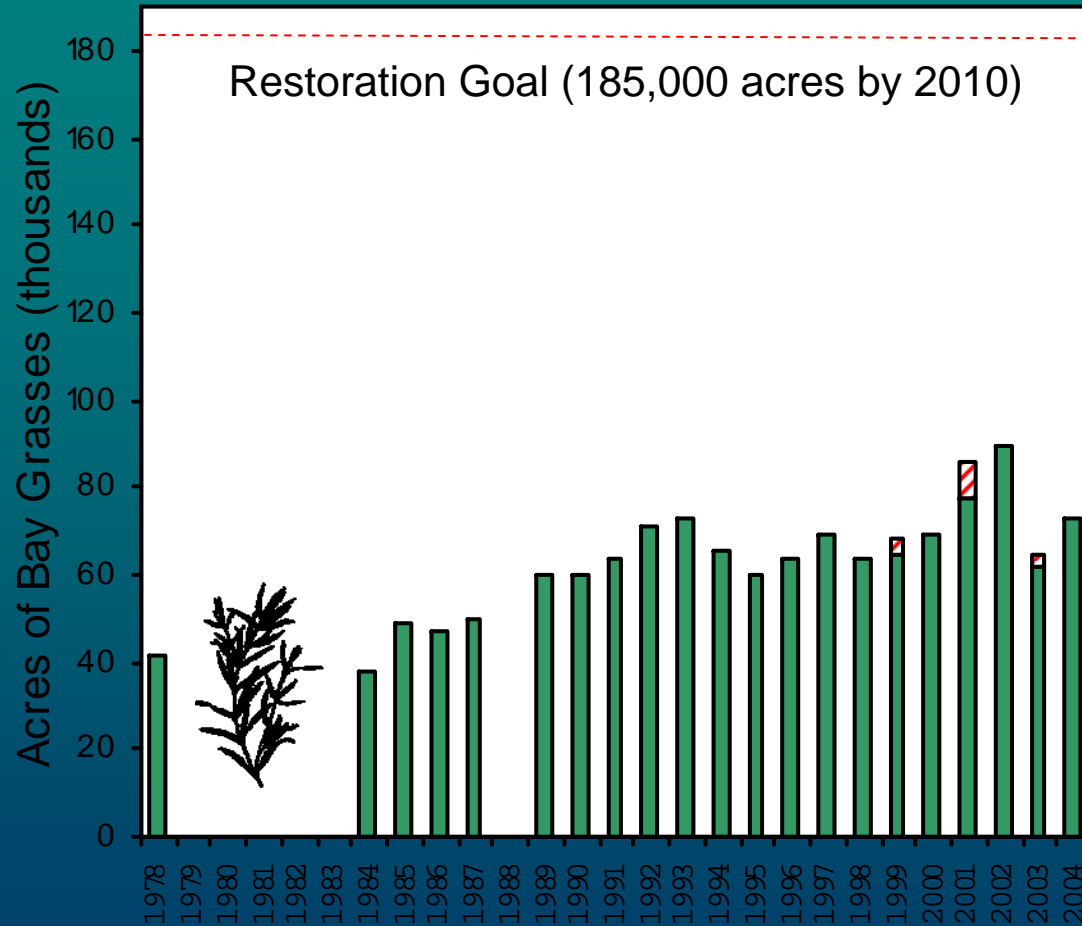1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003

Rockfish have rebounded to levels not seen since the 1950's, but concerns remain over disease, sufficient sources of food and availability of spawning habitat.

Bay Grasses Show Annual Variation

Restoration Goal (185,000 acres by 2010)

Acres of Bay Grasses (thousands)

y-axis: 0, 20, 40, 60, 80, 100, 120, 140, 160, 180

x-axis: 1978, 1979, 1980, 1981, 1982, 1983, 1984, 1985, 1986, 1987, 1988, 1989, 1990, 1991, 1992, 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004

Underwater bay grasses are slowly improving, but further reductions in the pollutants flowing into the Bay are needed to help them flourish.
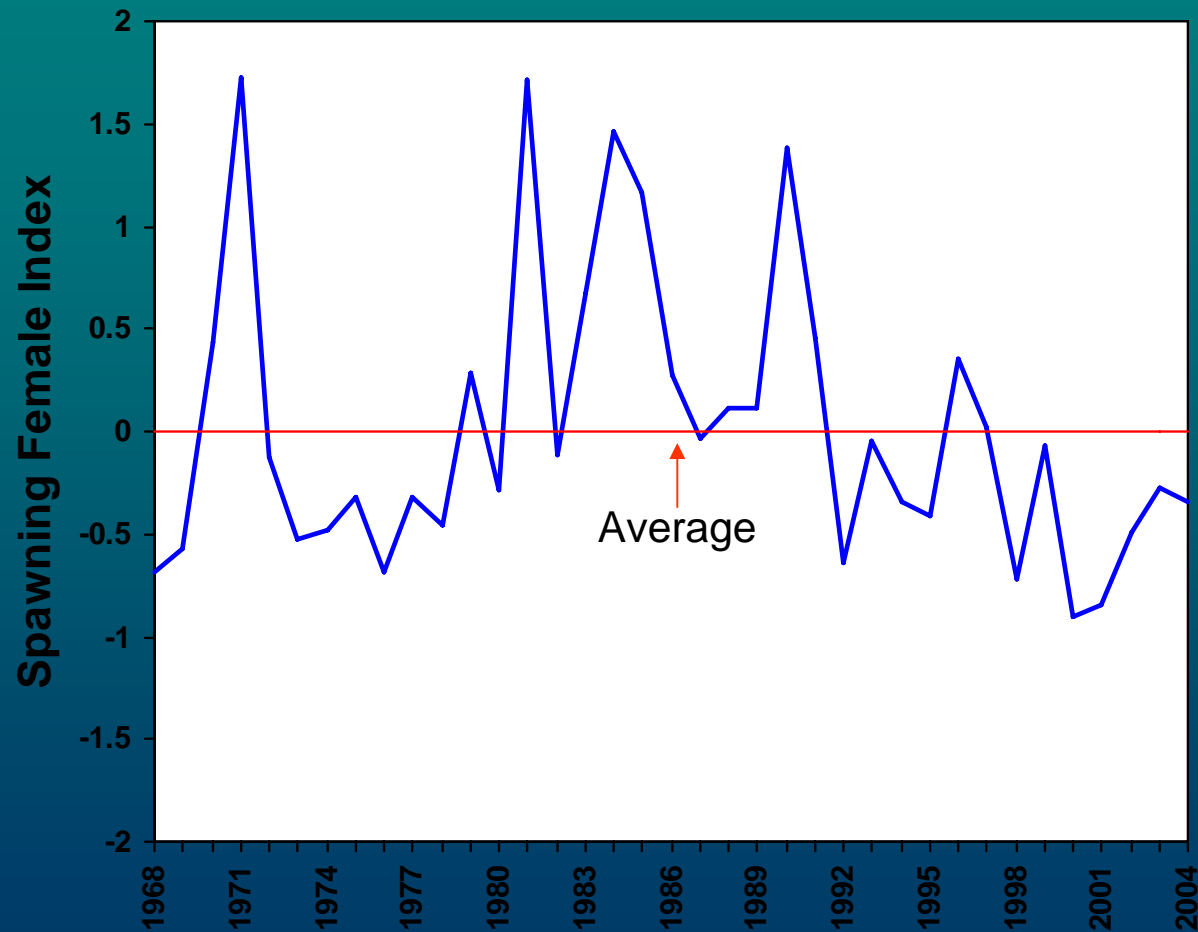
Annual variations in bay grasses show the sensitivity of the Bay ecosystem.

*Note – Hatched area of bar includes estimated additional acreage. No Baywide surveys 1979-83 and 1988
Source: Chesapeake Bay Program.

Blue Crabs At Risk

Mature Female Blue Crabs

Chart: Spawning Female Index (y-axis, from -2 to 2) vs. years (x-axis, 1968 to 2004), showing mature female blue crab data with a red "Average" line at 0.

Blue Crab populations have stabilized at below-average levels.

Improved water quality and habitat restoration efforts along with proper management of the crab harvest are needed to restore the Bay's blue crab populations.

Oysters at Historic Lows
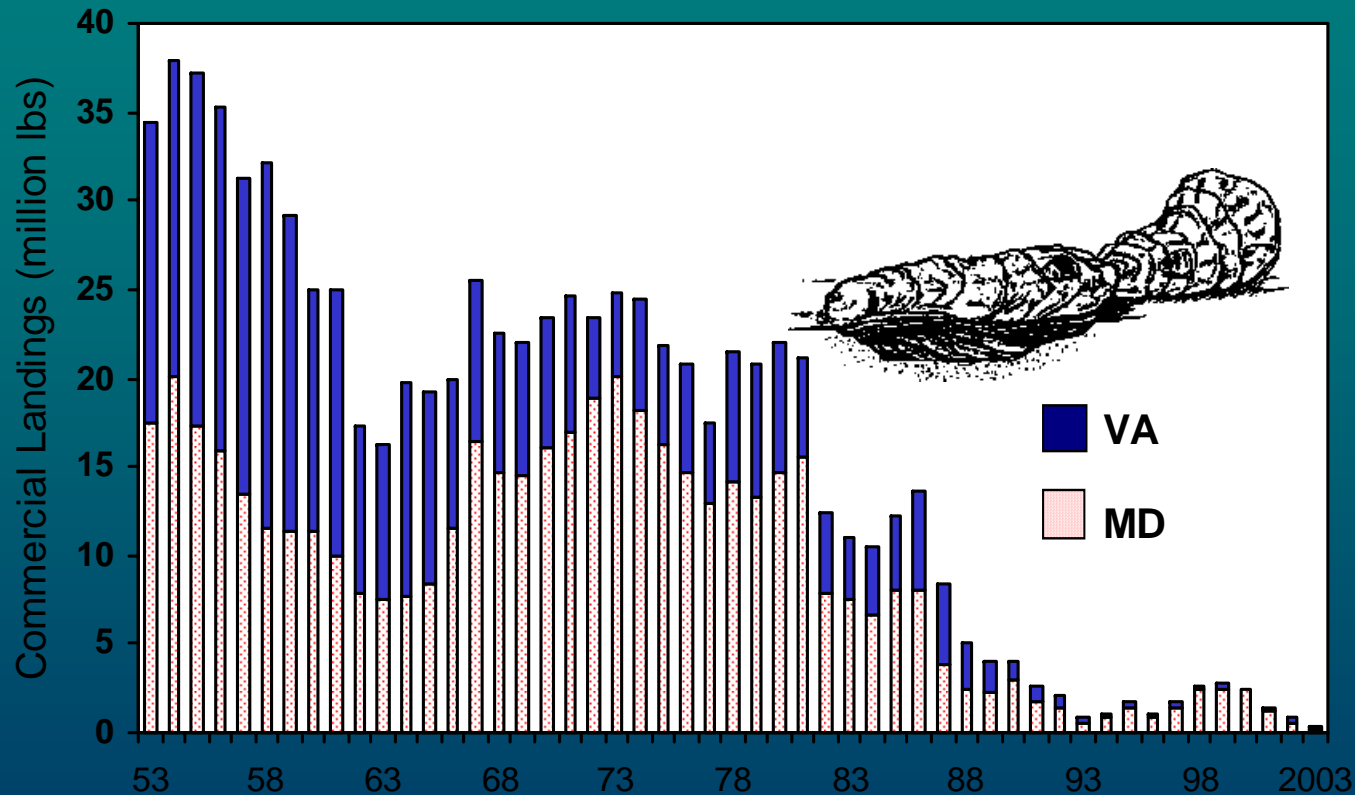
Oyster populations in the Chesapeake are at historic lows due to disease, intense harvest pressure and poor water quality.

How Can We Help Restore Water Quality at Home?

Environmental Implications of Tradition Landscapes

The hidden impacts of gardens… why things need to change

Did You Know ???

30 - 60 % all potable water used for lawns

Mowing lawn 1 hour = driving 20 miles

87 million pounds pesticides

100 million tons fertilizer

Each year!

25 - 40 % landfill space used for grass clippings

Traditional Landscape Challenges

URBANIZED

- INTENSE CARE
- MONOCULTURE
- SINGLE AGE
- SOLITARY
- NO FOREST FLOOR

NATURAL

- SELF SUSTAINING
- BIODIVERSITY
- MULTI-AGE
- MULTI-STRATA
- FOREST FLOOR

Goals of a Sustainable Landscape

- Prevent nutrient and sediment runoff

- Conserve natural resources

- Maximize ecological function

- Look attractive

Water Pollution- Fertilizers

- 40-60% of nitrogen applied ends up in the surface and groundwater
- Nitrogen and phosphorus are main nutrients polluting Chesapeake Bay

Water Pollution- Pesticides

- Homeowners overuse and misuse
- 67 million lbs. applied yearly in lawn care
- 66% improperly disposed
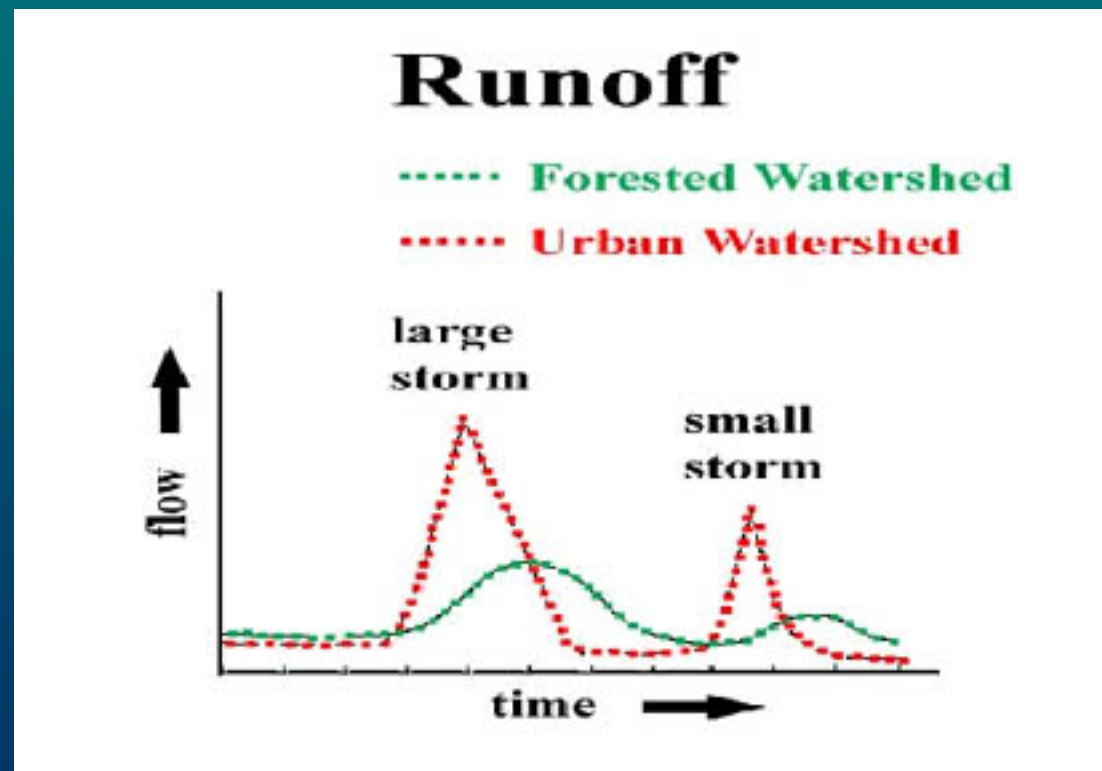- 5-10% wells detectable limits

Water Pollution- Sediment Surface Water Runoff

- Lawns absorb much less stormwater than forests or meadows
- Turf has shallow root system
- Runoff results in erosion, impacts to aquatic system, property damage

Surface Water Runoff

When lawns replace forest - flooding more severe

Consumption of Natural Resources

- Lawns use 30% water in East; 60% in West
- Droughts, water restrictions
- Mowers use 58 million gallons gas/yr.
- Minerals –fertilizers, soil amendments
- Organic matter-leaves, grass clippings filling landfills

Impacts to Public Health/Safety

Photo: Britt Slattery, USFWS

Poisoning

- 50-74% don't store pesticides safely
- 50% don't read, follow pesticide labels
- 110,000 sickened by pesticides/yr. (U.S.), 3 million world-wide

Accidents

- 75,000/yr. require ER treatment for mower injuries

Expensive to Maintain

- $25 billion/year spent on lawn care

- 1 acre lawn costs $400-700/year to maintain

- Average homeowner mows 40 hours/year

IS THERE AN ALTERNATIVE ??

BAYSCAPING
Environmentally sound landscape management

- **Imitate natural habitats**

- **Reduce water, chemical & fertilizer use**

- **Create natural buffers that help protect the Bay from pollution**

BAYSCAPING
Basic Principles

Landscape Design

Beneficial Plants

Water Conservation

Integrated Pest Management

Elements of a Natural Landscape Design

Conserve Native Vegetation

Provide Habitat Diversity

Create Patches & Edges

Provide Corridors

Low Maintenance

Conserve Native Vegetation

Habitat Diversity

Spatial
Forests - Hedges - Meadows - Wetlands

Vertical

Canopy

Understory

Shrub

🐦 Most important for migratory birds!

Ground Cover

Patches

Clusters of different species, sizes & shapes

Brush piles, shrub & vine tangles

Edges

Intersections of different habitat types

Corridors

Connections between & through habitats & patches

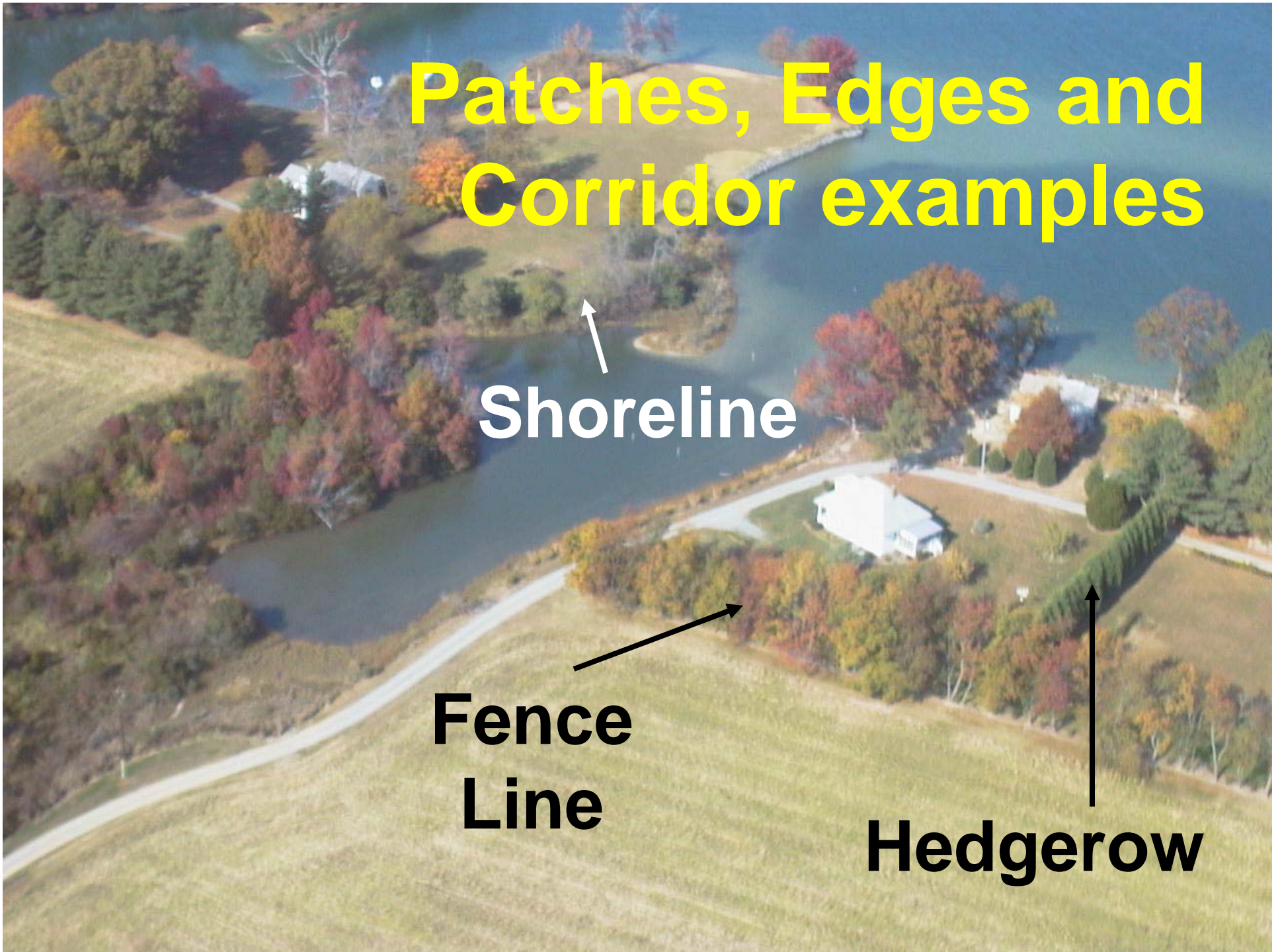**Hedgerows - at least 10 feet wide**

Shorelines, Property Lines, Fences, Driveways, Gardens & Flower Beds

Patches, Edges and Corridor examples

Shoreline

Fence Line

Hedgerow

Natural Design

- Less maintenance
- Less environmental harm
- Benefits wildlife
- Greater seasonal interest

Location, location, location !!!

Location??????

Remember !!!
Right Plant – Right Place

By W.S. Justice

Sun: Swamp milkweed

Shade: Foam flower

By W.S. Justice

By W.S. Justice

Wet: Cardinal flower

Beneficial Plants
Waterfront Setting

Native to local community

Salt tolerant

Wind tolerant

Erosion resistant

Tolerant of tidal flooding

Native Plants

- Best adapted to local conditions / thrive with least care
- Great variety of species for all conditions
- Won't invade natural areas
- Habitat value
- Natural setting

Native Plants & Drought

Photo: Pat Armstrong, Prairie Sun Consultants

Plant for the Long Term

- Use Perennials
- Long living cultivars
- Plan for growth over time
- Separate / transplant

Diversity and Density

A diversity of plants provides:

- More seasonal interest
- Less noticeable damage from pests and disease
- More wildlife habitat

Densely planted, layered sites:

- Better water retention
- Greater air quality benefits
- More cooling ability

Energy Conservation / Cooling

Use trees to shade buildings & pavement

Can lower energy bills by 25%
- A/C bills - 15-50%
- Heating bills - 25-40%

Air temperature up to 25% cooler under tree

Stormwater Retention

Reduce runoff

Groundwater recharge

- Rain gardens
- Green roofs
- Rain barrels
- Pervious surfaces

Rain Gardens

Absorb stormwater, recharge groundwater

Wildlife Habitat

Wildlife need:
- Food
- Shelter
- Water

Wildlife Benefits

Trees - evergreen & deciduous

Shrubs - year round flowers & fruit

Wildflowers - perennials

Ornamental Grasses - seeds

Vines - fruit & tangles

Wildlife Benefits - Fruit Production

Summer	Fall	Winter
Highbush blueberry	Dogwood	Myrtles
Brambles (blackberry, raspberry, dewberry, etc.)	Inkberry	Sumacs
	Juniper	Chokeberry
	Alders	Pyracantha
Elderberry	Winterberry	Viburnums
Serviceberries		
Huckleberries		

Landscape Maintenance
Go for Low !!!

- Nutrient application
- Water conservation
- Energy conservation
- Control invasives
- Compost / mulch
- Integrated pest mgmt.

Low Maintenance

Natural forest floor

allow leaf and twigs to remain

Minimize mowing

allow seed production

Control Invasive Plants

- Learn to identify invasive plants
- Remove invasive plants on your property
- Monitor property to prevent new introductions

Fertilizer Application

- Test soil to determine requirements
- Use organics and slow-release N
- Apply rate according to directions
- Apply at correct time of year
- Little if any needed for natives

Water Conservation

Use less

- Assess need
- Use water saving devices
- Water early in the day
- Use drought tolerant plants

Save more

- Use mulch
- Rain barrels & gardens

Composting / Mulching

- Compost organic matter on-site
- Save disposal fees, landfill space, transportation impacts
- Create soil amendment
- Hey its, Free!

Native Landscapes
Summary of Design Principles

- **Natural Design**
- **Native Plants**
- **Right Plant - Right Place**
- **Plant for the Long Term**
- **Diversity and Density**
- **Resource Conservation / Cooling**
- **Storm Water Retention**
- **Wildlife Value**
- **Low maintenance**

Result - an aesthetic and environmentally sustainable landscape

Special thanks to:

Karen Duhring, VIMS Wetlands Program

Mik Lestyan, City of Chesapeake

Jim Orband, York Co. Coop. Extension

Thanks for your interest !