Current Issue for MS Envirotthon

Water Resource Management: Local Control and Local Solutions
Water Resource Management
Typical Issues/Concerns

1) Runoff/flooding
2) Drinking water (groundwater/surface water)
3) Recreational water use (boating, swimming, fishing)
4) Pollutants in waters
5) Natural areas and Wildlife use of waters
6) Erosion related to water bodies
7) Others that you identify
Key Topics

#1: Understanding how groundwater and surface water systems function.

#2: Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem.

#3: Understanding a variety of water quality indicators in different landscapes

#4: Understanding a variety of water quantity indicators in different landscapes

#5: Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife

#6: Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources

#7: Understanding the social, economic, political impacts of natural resources management and decision making.
Ecosystem Services

- Pollination
- Pest and disease management
- Fresh water, food, fibre, habitat and genetic resources
- Recreation and tourism
- Spiritual health, cultural identity

Human beings benefit from ecosystems in many ways.

- Erosion prevention
- Protection from natural disasters
- Carbon sequestration and storage
- Air and water pollution control
- Nutrient cycling and soil fertility
Water Quality Factors

- TEMPERATURE
- TURBIDITY
- DISSOLVED OXYGEN (DO)
- PHOSPHATES
- BIO-INDICATORS
- pH
- NITROGEN
Step 1  
**BMP Opportunity Assessment**  
User identifies BMPs that are potentially applicable

Step 2  
**BMP Prioritization**  
User prioritizes BMPs with the greatest potential for reducing the environmental footprint

Step 3  
**BMP Selection**  
User evaluates BMPs from prioritized lists, selects those that will be applied, and provides rationale for those not to be implemented

Step 4  
**BMP Implementation**  
User implements the selected BMPs and documents BMPs not implemented due to new information or field conditions

Step 5  
**BMP Documentation**  
User documents BMPs implemented and rationale for any BMPs not retained during selection or implementation
Figure 6. Chesapeake Bay Program Components, Members, and Responsibilities

CHESAPEAKE EXECUTIVE COUNCIL
Members: Watershed state governors, mayor of DC, Chair of Chesapeake Bay Commission, and Administrator of EPA.
- Sets policy direction
- Accountable for progress made under agreement

PRINCIPALS’ STAFF COMMITTEE
Members: State and federal officials with environment and natural resource responsibilities and the Chesapeake Bay Commission executive director. Led by EPA representative.
- Policy advisers to the EC, set policy and implementation actions (management strategies), and determine EC meeting agendas
- Seek and receive counsel from the Advisory Committees

MANAGEMENT BOARD
Members: State and federal agency representatives. Led by Director of the EPA CBP Office.
- Oversee and provide strategic planning, priority setting, and operational guidance to implement Management Strategies
- Create and dissolve Goal Implementation Teams and Action Teams

ACTION TEAMS
- Set up by the Management Board to meet short-term explicit needs, products, or issues outside the scope of a GIT

GOAL IMPLEMENTATION TEAMS
Members: Determined by the GIT itself. Led by designee of Management Board.
- Develop and implement Management Strategies to reach agreement goals
- Identify monitoring, modeling, metric development, and information management needs for Science, Technical Analysis, and Reporting group development

SCIENCE, TECHNICAL ANALYSIS, AND REPORTING
Members: Jurisdiction representatives from CBP office, federal and state agencies, NGOs and universities.
- Provide assessment, data management, modeling, monitoring, technical analysis, and website support
- Manage CBP monitoring networks and coordinate with science partners

EPA CBP OFFICE
- Implement and coordinate science and research, among other activities to support the CBP
- Develop and share information about the environmental quality and living resources of the Bay
- Assist the EC members in development and implementation of action plans
- Coordinate EPA actions with other federal, state, and local authorities
- Implement outreach programs to foster Bay stewardship

Application of theories, methods and analysis to understand...

- Markets
- Governance
- Politics & Power
- Culture & Worldview
- Policy & Law
- Norms
- Ideas & Narratives
- Demographics
- Socio-Economics
- Social Organization
- Decision Making
- Educating
- Communicating & Marketing
- Development
- Management
- Values & Beliefs
- Knowledge
- Perceptions & Preferences
- Behaviors
- Ethics
Determines What is Appropriate or Effective

Enables or Undermines

Shapes

**Context**
- **Contextual Factors:** Social, Economic, Political, Cultural and Environmental
- **Nature of Change:** Complexity, Rapidity, Type, Number and Severity of Stressors

**Actors**
- **Level:** Individuals, Collectives and Networks
- **Allocations:** Rights, Roles and Responsibilities
- **Characteristics:** Memberships (NGOs, Govt., Consumers), Resource Dependence, Socio-economic status, etc.

**Motivations**
- **Intrinsic:** Ethics, morals, values and beliefs, Self-determination and self-actualization
- **Extrinsic:** Perceived direct costs and benefits from nature, External rewards and sanctions (economic, social, legal)

**Capacity**
- **Local Assets:** Social capital, Financial capital, Physical capital, Cultural capital, Human capital, Institutional capital, Institutional capital
- **Institutions:** Laws & policies, Organizations & networks, Decision-making Processes, Structures of power & politics

**Actions**
- **Type:** Approaches, activities, behaviors and technologies
- **Purpose:** Preservation, restoration or sustainable use
- **Complexity:** Species, habitats or ecosystem level protections
- **Scales:** Local, national, regional, global

**Outcomes**
- **Ecological:** Species Abund., Habitat Quality, Area Coverage, Ecosystem Productivity, Sustainability
- **Social:** Wealth/Poverty, Livelihoods, Employment, Wellbeing, Food security

*Monitoring & Adapting

*Leverage Points.*
The Nine-Step Conservation Planning Process

Phase I: Collection and Analysis
- Determine Objectives
- Inventory Resources
- Identify Problems
- Analyze Resource Data

Phase II: Decision Support
- Formulate Alternatives
- Evaluate Alternatives
- Make Decisions

Phase III: Application & Evaluation
- Implement the Plan
- Evaluate the Plan
Water Resource Management: Local Control and Local Solutions

Defining Watersheds

Solutions

Land Uses

Impacts

Links

Links & Interactions

Dr. Mark LaSalle, MSU Coastal Research and Extension Center
What is a Watershed?

... an area of land from which water drains to a given point
What is a Watershed?

... an area of land from which water drains to a given point
Boundaries

The watershed where you work may drain through the watershed you live in to the watershed you fish and swim in.

Dr. Mark LaSalle, MSU Coastal Research and Extension Center
What is a Watershed?

... an area of land from which water drains to a given point

... an area of land where we live, work, play, raise our children, breathe the air, drink the water, enjoy the outdoors and wildlife, fish, swim, ski, etc., etc., etc.

... an area of land where we depend upon clean, safe, abundant quantities of air, water, and wildlife
To understand your watershed’s ecological health, you must ask two important questions.

1. How is water used in my watershed?

2. How is land used in my watershed?
Survey Your Watershed:

... determine the activities in your watershed and their affect on the quality of the environment.
How might the presence of this construction site in your watershed affect your stream's water quality?
You should look for:

- Land use activities
- Land cover
- Manmade discharges

Question to ask:

*How are the activities in my watershed related to the water quality of my stream?*
Sources of Water:

- Groundwater
- Manmade discharges (Point Source Discharges)
- Runoff from rainfall (Nonpoint Source Discharges)
MANMADE DISCHARGES

Point Source Wastewater Discharge

... a discharge of wastewater from a specific source such as a municipal, industrial, or commercial discharge pipe.
POINT SOURCE DISCHARGE

- a pipe

- the foaming is not necessarily bad.
Assuring Adequate Treatment

... the National Pollutant Discharge Elimination System (NPDES) permit.

Agency: EPA, MS Dept of Environmental Quality, local(?)
The NPDES permit gives:

- permission to discharge
- allowable pollutant quantities, ppm
- allowable discharge flow, cfs
- monitoring requirements (what, when)
- reporting requirements (timing, spills)
Wastewater Sources

Industries:
- Natural Resources Mining
- Furniture manufacturers
- Power Production
- Clothing/Textile Mills
- Raw Chemicals
- Paper Mills
- Electroplating
- Food Processors

Municipalities:
- Sanitary Waste
- Pretreated Industrial Waste

Commercial Establishments:
- Trailer parks
- Sub-divisions
- Car/Truck Washes
- Schools
Wastewater Pollutants

Nutrients:
- Nitrogen
- Phosphorous

Solids:
- Floating
- Suspended
- Dissolved

Color
- Temperature
- Heavy Metals

Oxygen Demand
- Organic Chemicals

Bacteria
- Oil and Grease
Permits contain appropriate limits, however occasionally:

- treatment plants malfunction
  - power outage, computer glitch

- accidental spills occur
  - operator error, pipe breaks

- inadequate treatment is present
  - facility expansion

- unpermitted discharging occurs
  - facility construction re-routes materials
Municipal Wastewater Treatment Facility - has a discharge to stream.
Wastewater Treatment for Pollutant Removal

... a Best Management Practice (BMP).
Sources of Water:

- Groundwater (USGS, MDEQ)
- Manmade discharges (Point Source Discharges) (EPA, MDEQ)
- Runoff from rainfall (Nonpoint Source Discharges)
Runoff From Rainfall

NONPOINT SOURCE (NPS) Discharge

Excessive amounts of runoff, sediment, nutrients, or chemicals in runoff is NPS pollution.

Least regulated: EPA, MDEQ, city/county ordinances/permits

Some land uses exempted
Land Use Activities and Best Management Practices
Dr. Mark LaSalle, MSU Coastal Research and Extension Center

Water Resource Management: Local Control and Local Solutions

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Links & Interactions
Land Use in Mississippi

Forestry  50%

Agriculture  34%
  Cropland  21%
  Pasture  13%

Urban  15%

Surface Water  1%
Land Use Activities used in A-A-S

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
Land Use Activities: are not inherently good or bad. It all depends on how we manage them.

1. Forestry (MS Forestry Commission, MS Forestry Association)
2. Agriculture (USDA, NRCS, MSWCC, SWCD, Extension)
3. Urban and Commercial (EPA, MDEQ, city and county)
4. Construction (EPA, MDEQ, city/county)
5. Surface Mining (EPA, MDEQ, MSWCC, SWCD)
6. Household Wastewater Disposal (MS Dept of Health)
Best Management Practices (BMPs)
.... are practices that are used to prevent or minimize pollution from land use activities.

BMPs may be vegetative or structural, temporary or permanent.

Example: Straw (a temporary, vegetative BMP) is applied to a bare soil surface created in road construction (Land Use) to prevent erosion and sedimentation (Pollutant).
FORESTRY

Contaminants may include sediment, woody debris, and chemicals from silviculture and timber harvesting activities.
Logging operations can cause significant land cover disturbance.
Reforested area after a harvest. Pine plantation.
Mississippi Forestry Commission - members agree to follow BMPs
Private Sector
RIPARIAN ZONE

The vegetated area along the banks of a water body. Stabilizes banks, filters runoff, provides shading of stream.

A.K.A.
Buffer Zone, Streamside Management Zone
SMZ Guidelines for Perennial Streams

<table>
<thead>
<tr>
<th>Allowed</th>
<th>Not Allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Select Harvest: Must leave 50 square feet of basal area per acre within the SMZ in the absence of an understory.</td>
<td>• Roads (except perpendicular stream crossings)</td>
</tr>
<tr>
<td>• Excessive rutting</td>
<td>• Damage to stream bank</td>
</tr>
<tr>
<td>• Any chemical application</td>
<td>• Any fertilizer application</td>
</tr>
<tr>
<td>• Mechanical site preparation</td>
<td>• Prescribed burning</td>
</tr>
<tr>
<td>• Log decks or landings</td>
<td></td>
</tr>
</tbody>
</table>

Perennial Stream SMZ Width by Slope

The perennial stream SMZ will have a minimum width of 30 feet extending from both sides of the stream measured from the banks. As the slope of the land increases, the SMZ width will increase.

<table>
<thead>
<tr>
<th>Percent Slope</th>
<th>SMZ Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% - 5%</td>
<td>30 feet</td>
</tr>
<tr>
<td>6% - 20%</td>
<td>40 feet</td>
</tr>
<tr>
<td>21% - 40%</td>
<td>50 feet</td>
</tr>
<tr>
<td>Over 40%</td>
<td>60 feet</td>
</tr>
</tbody>
</table>

Water Bars

A water bar is a mound of soil designed to divert runoff water away from the road.

• Water bars should cross roads at a 30 degree angle.

• Shallow water bars may be constructed prior to and during logging use and should be considered a temporary structure.

• Deep water bars are utilized when use of the road is finished and are considered a permanent structure.

• Water bars may be constructed by hand or by bulldozer.

Water Bar Spacing

<table>
<thead>
<tr>
<th>Grade of Road (percent)</th>
<th>Approximate Distance (feet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>250</td>
</tr>
<tr>
<td>5</td>
<td>135</td>
</tr>
<tr>
<td>10</td>
<td>80</td>
</tr>
<tr>
<td>15</td>
<td>60</td>
</tr>
<tr>
<td>20</td>
<td>45</td>
</tr>
<tr>
<td>25</td>
<td>40</td>
</tr>
<tr>
<td>30</td>
<td>35</td>
</tr>
<tr>
<td>40</td>
<td>30</td>
</tr>
</tbody>
</table>

Outslopes

• Design the outslopes to effectively move water away from the center of a road.

• Outslope the entire width of the road to reduce the number of drainage structures needed.

• A recommended slope is 1/4" per foot of road width.

• Outsloping is not recommended for highly erodible soils.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
Runoff may contain sediment, pesticides (herbicides, insecticides, fungicides, etc.), fertilizers (nitrogen, phosphorous), and animal wastes (nutrients, pathogens).
Cattle destroy vegetation on stream banks with hooves and grazing. Destroy in-stream habitat. Waste products directly in stream.
Fencing allows restoration and preservation of riparian zone. Direct access to stream denied. In-stream habitat preserved.
Liquids and sludge land applied as irrigation and fertilizer to fields.

Aerobic lagoon - holds liquids.

Anaerobic lagoon - traps solids.

Confined animal feeding operations have no discharge waste water systems.
What is this?

In this instance, fertilizer (like you put on your lawn or garden) is being applied to a rice field.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
URBAN AND COMMERCIAL

Runoff contains truck and automobile fluids (oil, gas, antifreeze, grease), lawn and garden chemicals, and other pollutants from city streets, parking lots, and industrial lots.
Water flows from parking lot, through grass median, to drain. This allows vegetation to filter runoff and to provide infiltration time.
Manuals exist to assist in the planning, selection and design of BMPS.
IMPACT OF LAND CONVERSION

Increased runoff rates and volumes result from changing grass or forested areas to impervious areas (rooftops, parking lots, roads)

Flooding, erosion, and stream degradation (bank sloughing) can result
IMPACT OF LAND CONVERSION ON STREAMS DRAINING WATERSHED

An increase of 20% impervious area in a watershed will cause the stream draining the watershed to degrade to seek a new equilibrium.

This degradation can be prevented by mitigating the land cover change with runoff detention basins (pre- and post-runoff equal).
## Impacts of Land Conversion on Runoff

<table>
<thead>
<tr>
<th>Landuse</th>
<th>Rainfall 2-yr, 24 hr (inches)</th>
<th>Runoff volumes (gallons)</th>
<th>Runoff rates (gpm)</th>
<th>Increase over Forest</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 acre</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forest</td>
<td>4.4</td>
<td>119,470</td>
<td>3150</td>
<td>Vol Rate</td>
</tr>
<tr>
<td>Pasture</td>
<td>4.4</td>
<td>19,000</td>
<td>450</td>
<td>-</td>
</tr>
<tr>
<td>Lawn</td>
<td>4.4</td>
<td>27,150</td>
<td>450</td>
<td>43% 0%</td>
</tr>
<tr>
<td>Cropland</td>
<td>4.4</td>
<td>40,730</td>
<td>900</td>
<td>114% 100%</td>
</tr>
<tr>
<td>Roof/Parking lot</td>
<td>4.4</td>
<td>43,440</td>
<td>900</td>
<td>129% 100%</td>
</tr>
<tr>
<td>100% Runoff</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Pond to prevent downstream flooding and water quality problems.
Waterfall provides aesthetics as well as aeration in detention pond system
Detention pond in Madison sub-division. Waterfall of previous picture is to left and behind camera.
Picture of Commercial Detention

- Extreme event overflow
- Design Detention
- Normal rains, drawdown
Road ditch turnout

1. Prevents water from going entire slope-length, top of hill to bottom of hill. That would cause excessive erosion.

2. Turnouts put water out into vegetative areas.

Note: Kudzu is ineffective as a groundcover for erosion control.

Bermuda grass is very good.

Forests are excellent.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
Runoff contains sediment from land clearing and grading activities.

During construction, sediment loss from a site should be restricted to 15% above the natural condition before construction.
Highway construction is largest land disturbing construction activity in state. Streams crossed are susceptible to sediment inflows.
Highway construction with visible BMPs: mulching, seeding, rock check dams.
House Site: Avoid, minimize disturbance; restore groundcover as quickly as possible (mulch, grasses). Not followed on this site.
2-tons per acre of straw mulch over grass seed and fertilizer will stabilize slopes up to 3:1 until vegetation grows. Steeper slopes need erosion control blankets. No run-on water allowed to flow down slopes.
Diversion keeps water off slopes

Lack of slope drain for concentrated water

Flow direction

Hydraulic mulch applies seed, fertilizer and mulch in one step. Green color is added for aesthetics only.
Slope drains carries runoff down slope without contacting the slope, preventing slope erosion.
Improperly designed and installed check dam. Water concentrated and flowed around, increasing velocity, erosive power, resulting in bank erosion. Water is meant to flow over check dam in center of drainageway.
Check dams are the most misapplied construction BMP in Mississippi. Check dams can be built from: vegetation, gravel, silt fence, and straw bales.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
SURFACE MINING
Sand and Gravel, Lignite

Runoff from sand, gravel, dirt, or mineral mining may contain heavy sediment loads and alter surface terrain affecting runoff.

During mining, sediment loss from a site should be restricted to 15% above the natural condition before mining.
Many of MS sand and gravel mines are pits with no surface runoff. Groundwater contamination from fuel spills would be of most concern.
A sediment trap removes sediment from runoff out of a surface mine before it enters a stream. Works by reducing runoff velocity, allowing soil particles to settle in trap, which must be cleaned out after events.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
4. Construction
5. Surface Mining
6. Household Wastewater Disposal
Surface and groundwater may become contaminated by bacteria and nutrients from improperly designed or unmaintained systems.
Standing sewage. Poor system and/or soils. Bacteria and nutrients possible pollutants. Breeding ground for mosquitoes.
A properly designed and maintained individual wastewater treatment system can be a positive presence on a home lot. Rock-Reed gravel system.
Land Use Activities To Look For In Your Watershed

1. Forestry
2. Agriculture
3. Urban and Commercial
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6. Household Wastewater Disposal
Water Resource Management: Local Control and Local Solutions

Solutions that meet ecological and growth goals

Defining Watersheds

Planned Land Uses

Impacts Mitigated by BMPs

Recognize watershed responses to change
Individual citizens must accept that they are the only cause of and solution to pollution.
WHAT CAN YOU DO?

1. Conduct runoff survey around your own home, business, or workplace.

2. Support Local Building/Zoning Codes for Stormwater Runoff/Greenspace requirements/etc.

3. Educate others about Runoff.

Solutions

**Conservation**: most economical means of ensuring the future supply of the resources. Reduces production of by-products. (Reduce usage of lights, water, gasoline, oil, etc.)

**Recycling**: maximum utilization of resource, conserves energy (oil, paper, aluminum, metal recycling)

**Responsible Consumption of**:
- recycled products
- resource conscientious products
Typical Ordinances:

- pre- and post-stormwater runoff control
- first flush runoff treatment
- Individual household wastewater treatment
- greenspace
- greywater reuse

Typical Zoning:

- floodplain
- Individual vs. central wastewater treatment or lot size
- stream corridors
- traffic corridors
- residential (single, multi), commercial, industrial
Want to Learn More?

Explore Agency Websites

1) Environmental Protection Agency (EPA)
2) Mississippi Department of Environmental Quality (MDEQ)
3) United States Geological Survey (USGS)
4) Natural Resources Conservation Service (NRCS)
5) Mississippi Soil and Water Conservation Commission (MSWCC)
6) Madison County (good example of local planning, leadership)
7) MS Forestry Commission
8) MS Department of Agriculture
MS Erosion and Sediment Control Manual


Sustainable Communities
https://www.mafes.msstate.edu/research/areas.asp?id=5
Water Resource Management: Local Control and Local Solutions

1) What is your watershed/aquifer of concern
2) Identify history, present conditions, future planning and actions
3) What local organizations can guide and assist (SWCD)
4) What local action can be taken to meet your future goals (ordinances, permits, economic incentives)
5) How will you organize and coordinate various interest groups.
6) How will you coordinate local groups with state and federal agencies
7) What is the benefit of Local Control and Local Solutions
8) How will plan be funded (taxes, prices of good and services)
Key Topics

#1: Understanding how groundwater and surface water systems function.

#2: Understanding the importance of water quality and quantity as a foundation in a healthy ecosystem.

#3: Understanding a variety of water quality indicators in different landscapes

#4: Understanding a variety of water quantity indicators in different landscapes

#5: Understanding how sustainable and best management practices enhance and protect water quality and quantity for humans and wildlife

#6: Understanding the differences of local, regional, and national systems that manage natural resources and the importance of each in water resources

#7: Understanding the social, economic, political impacts of natural resources management and decision making.
We must never forget that PEOPLE are our most important resource.

So THANK YOU for being here!