LAND USE AND CLEAN WATER

AN INTERACTIVE WORKSHOP DESIGNED FOR LOCAL COMMUNITY LEADERS

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Eleanor Burkett
Extension Educator
Objectives

To learn about and discuss the following:

• How what we do on the land impacts lakes and rivers
• The benefits of clean water to you
• How local leaders can make a difference and keep the Mississippi River Headwaters clean
• Learn about resources to help

And to network with leaders from the watershed
Finite fresh water

Only 2.5% is freshwater

< 1% of the world's freshwater is accessible for direct human uses

Illustration by Jack Cook at Woods Hole Oceanographic Institution
A watershed is ... an area of land that drains to a common body of water.

Any land within the watershed may contribute runoff and associated pollutants to that lake, river, stream, or wetland.
Minnesota’s waters flow outward in three directions; north to Hudson Bay in Canada; east to the Atlantic Ocean; and south to the Gulf of Mexico.
Ten Major River Basins

- Red River of the North
- Rainy River
- Lake Superior
- Upper Mississippi River
- St. Croix River
- Cedar River
- Lower Mississippi River
- Minnesota River
- Missouri River
- Des Moines River
10 Major Basins

81 Major Watersheds
The Mississippi River Headwaters Watershed
ABOUT THE MRH WATERSHED

- Consists of 1,255,105 acres or 1,961 sq miles
- Itasca State Park: headwaters 2,320 miles to the Gulf of Mexico
- Counties: Becker, Beltrami, Cass, Clearwater, Hubbard and Itasca
ABOUT THE MRH WATERSHED

- River miles: 685.05
  - Mississippi, Deer, Leech Lake River, Schoolcraft, Third, Turtle and Vermillion

- Lakes: over 1,000
  - Lake Itasca, Ball Club, Cass, Deer, Lake Bemidji, Lake Winnibigoshish, Pokegama
ABOUT THE MRH WATERSHED

- Land ownership
  - 44% private landownership
  - County or federal public land
  - Tribal land owners

- Largely forested and many wetlands

- Agriculture accounts for about 10% of the acreage
MAJOR THREATS TO THE WATERSHED:

- Loss of shoreline and aquatic habitat due to development.
  - Many of the prime lakeshore properties have been developed
  - the focus of development turning toward more marginal shoreland and/or shoreland along smaller natural environmental water resources.

- Increased sedimentation due to forest management practices.

- Increased nutrient, contaminant, and sedimentation loading from stormwater runoff from development and other non-point sources.

- Loss of biodiversity due to competition from invasive species.
Benefits of a healthy watershed

- Recreational opportunities
- Strong agriculture systems
- Drinking water protection
- Protect property values
- Flood minimization
- Provide valuable fish and wildlife habitat
- Sense of place
Improved recreational opportunities

• People are willing to pay more for recreation as the quality of environmental amenities increases.

• Willingness to pay is shown via both hypothetical and actual measurement methods.
Strong agricultural systems

- In healthy watersheds, soil, water, and nutrients are available when they are needed, where they are needed.
- Soil erosion, excessive runoff, too much or too little precipitation or soil moisture .... All affect the bottom line for farmers.
Drinking water protection

In Minnesota:
• 961 community systems (2010)

• Some contaminated with:
  • Pesticides
  • Fecal coliform bacteria
  • Nitrates

• 1M Minnesotans use private drinking water wells

• Nitrate contamination is first sign of reduced groundwater quality
Property values

- People prefer to live near positive environmental amenities (clean water, recreation, natural spaces)
- Buyers are willing to pay more for property with desirable amenities and devalue those with environmental “degradation”
Flood minimization

• Healthy watersheds can handle floods with no or little damage

• Floods are the #1 hazard in Minnesota in terms of frequency of occurrence and total damages.

• Granted Presidential Disaster Declarations **36 times** 1965-2010 due to flooding
  • 10 of these were 2001-2010
Valuable fish and wildlife habitat

Healthy watersheds provide:

• Consistent, diverse habitat
• Resilient ecosystems
• Stable physical parameters such as temperature and $O_2$
• Intact food web (invertebrates, small fish, bigger fish, small mammals, large mammals, etc.)
• Adequate shelter for all life stages
Sense of place

"A sense of place is the sixth sense, an internal compass and map made by memory and spatial perception together."

—Rebecca Solnit, Orion magazine, August 25, 2011
35% evapotranspiration

3 X the runoff of natural ground cover

20% shallow infiltration

30% runoff

15% deep infiltration

35%-50% Impervious Surface
Natural runoff patterns
Altered runoff patterns
Traditional Stormwater Runoff Management

Centralize

Concentrate

Convey

Collect
Polluted runoff is the #1 water quality problem in the U.S.
Remove Forest Cover

Remove Storage

Add Impervious Surfaces
What is the big deal with forest cover removal?

Depending on size and species, a tree’s leaves and bark may store 100 gallons or more until it reaches saturation (one to two inches of rainfall).

Litter adds even more to storage capacity.
What’s the big deal with impervious surfaces?

- inhibits groundwater recharge
- provides a surface for accumulation of pollutants
- prevents natural processing of pollutants in soil, plants
- provides an express route for pollutants to waterways
- Changes runoff characteristics and stream dynamics
Rainfall event over time

Streams of “impacted” landscapes

Streams of “natural” landscapes

Flow (cfs)

Rain (inches)

Time (hr)
Problems of excessive runoff:

Quantity (too much)

Quality (degradation)

http://minnesota.publicradio.org/display/web/2012/06/20/disaster/duluth-flood-photos#4
Impacts of altered hydrology on water *quantity*

- Habitat Loss
- Nutrient & Contaminant Loading
- Erosion
- High Turbidity & Sedimentation
Impacts of altered hydrology on water **quality**

- Nutrients
- Debris
- Sediment
- Pathogens
- Toxic Contaminants

Quantity = Quality

- Thermal Stress
Polluted runoff is possible from:
Polluted runoff from Natural areas

Nutrients: Animal waste
Pathogens: Animal waste
Sediment: Natural stream bank and shoreland erosion
Toxic:
Debris:
Thermal: Loss of streamside vegetation (fire, windstorm, etc.)
Polluted runoff from Residential areas

Nutrients: lawn fertilizers & septic system effluent
Pathogens: septic systems, pet waste
Sediment: construction, road sand, erosion from lawns & gardens
Toxic: household products, pesticides
Debris: litter & illegal dumping
Thermal: heated runoff, removal of streamside vegetation
Polluted runoff from Commercial and Industrial areas

Nutrients: acid rain and car exhaust
Pathogens: malfunctioning or overloaded septic systems & lagoons
Sediment: construction, road sand, roadside erosion
Toxic: auto emissions, industrial pollutants
Debris: litter & illegal dumping
Thermal: heated runoff, removal of streamside vegetation, impoundments
Polluted runoff from **Rural** areas

**Nutrients:** septic system effluent, farm field fertilizer, animal waste

**Pathogens:** animal and human waste

**Sediment:** farm fields, construction, road sand, gravel roads

**Toxic:** pesticides, herbicides, household products

**Debris:** litter and illegal dumping, farm fields

**Thermal:** removal of streamside vegetation
Runoff Volume/Infiltration

Phosphorus Inputs

Sediment Inputs

Adapted From: Wisconsin DNR

University of Minnesota Extension
Impacts of development on lakes
Impacts of development on streams
INTENSITY OF LAND USE

AMOUNT OF IMPERVIOUS SURFACE OR ARTIFICIAL DRAINAGE

POTENTIAL WATER QUANTITY & QUALITY PROBLEMS
Can we make this... 

... function hydrologically MORE like this?
What can we do?

Plans

Policies

Practices
• Plans are blueprints
• Establish vision
• Set broad goals and priorities
• Provide you direction
What are examples of PLANS?

- Comprehensive Plan
- Land Use Plan
- County Water Plan
- Stormwater Plan
- Watershed Plan
- TMDL Plans
Is there a new planning ethic that can be followed to protect water resources?

Development in the past has often been haphazard, with little coordinated planning, even at the local level.

Consequences of haphazard urban and agricultural development:

- **Loss of Free Natural Resource Services** such as flood control, stormwater management and pollution filtration; costs communities billions in mitigation and disaster relief efforts.

- **Degradation of Water Resources** by developing wetlands and riparian zones reduces their capacity to control floods, trap sediments, filter out toxins and excess nutrients, and support wildlife and plant species. Benedict, M.A. and E. T. McMahon, (2002)

> It is often easier and cheaper to plan and install runoff control measures pre-development vs. post-development retrofit to meet required mitigation measures.

What to preserve dictates where to develop.
What can we do?

Plans

Policies

Practices
POLICIES

- **Ordinances**
  a piece of legislation (law) enacted by a LUG (county, municipality, township)

- **Regulations**
  a rule or directive made and maintained by an executive authority (i.e. planning dept.) to meet requirements of ordinances
Clear Policies, Ordinances, and REGULATIONS

Policies balance interests of the community versus individuals

Ordinances treat everyone the same

Regulations clearly tell people what is expected of them

If followed these should help meet clean water goals
What types of ‘clean water’ provisions are covered in a local ordinances?

- **Zoning** (Floodplain, subdivision, building codes, soils protection, impervious surface standards)
  
  - **Vegetation** (**Trees**, landscaping, streetscaping, critical areas preservation, **buffers**, riparian management)
  
  - **Design** (Site planning, dimensional standards, clearing & grading, engineering, hardscaping, stormwater)

(now we’ll take a look at two of these, trees and buffers highlighted above)
Goals of Tree Ordinances

- Protection & preservation
- Replacement and additional plantings
- Maintenance

We talked about the benefits of tree cover earlier
Goals of Buffer Strips Ordinances

- Provide permanent vegetative cover
- Potentially reduces land loss
- Reduce sediment loading
- Reduce contaminants and nutrients
- Provide terrestrial habitat
- Improve aquatic habitat
Best Management PRACTICES (BMPS) for Healthy Watersheds
What are Best Management Practices (BMPs) for Healthy Watersheds?
Best Management Practices

“Creative Techniques to Treat, Use, Store, Retain, Detain, and Recharge”

- Bio-retention/rain gardens
- Strategic grading
- Site finger printing
- Resource conservation
- Flatter, wider swales
- Conservation tillage
- Long flow paths
- Tree/shrub depression
- Turf depression
- Landscape island storage
- Rooftop detention/retention
- Roof leader disconnection
- Parking lot/street storage
- Smaller culverts, pipes & inlets

- Conservation drainage
- Perennial cover crops
- Smart irrigation systems
- Grassed waterways
- Minimize application of herbicides and pesticides
- Vegetative swales, buffers & strips
- Infiltration swales & trenches
- Eliminate curb and gutter
- Shoulder vegetation
- Maximize sheet flow
- Maintain drainage patterns
- Reforestation
- Pollution prevention ..............
Nonstructural Practices

Education & Outreach

Audience segmentation

- Citizen & general homeowners
- Local elected & appointed officials and community leaders
- Businesses & industry
• Clean water is important
• Having enough water is important
• Thinking long-term is important

• Make the water ‘walk’
• Keep pollutants out of the water
Discover more at extension.umn.edu/water

Questions?

Eleanor Burkett
Extension Educator
218-828-2326
burke044@umn.edu