Developing Successful Watershed Projects: Lessons from the Pond Creek and Oostanaula Creek Watershed Projects

Forbes Walker and Lena Beth Reynolds
University of Tennessee Extension

Water Quality in TN (2006)*

- Agriculture = 41% of water quality impairments
- Sources in Assessed Streams and Rivers
  - Grazing in riparian 60 %
  - Crop related 33 %
  - Unrestricted cattle access 4%
  - Intensive Animal Operations 3 %

* TN 305 (b) Report 2006

Cleaning up the Water

- Monitoring – do we meet TN standards?
- Where is the pollutant coming from?
  - Models (TMDLs, IPSI, SWAT)
  - Source tracking (sediment, pathogens)
- What BMPs should we use
  - Cost?
  - Management?
  - Does it impact agricultural production?
  - How do we get BMPs implemented?

2004 & '06: Tennessee List of Impaired Streams (TDEC)

- 7.2 miles of Mud Creek
- 7.3 miles Greasy Branch
- 21.1 miles Pond Creek

Impaired for:

- Nitrates
- *E. coli*
- Habitat alterations

Primary causes: Pasture Grazing, Livestock in Stream, Animal Feeding Operations

Pond Creek: Total P (2001)
(Ecoregion level = 0.05 mg/L)

Total Phosphorus in mg/L

Site	June	July	Augus	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
PC1	0.02	0.16	0.19	0.30	0.02	0.00	0.18	0.48	0.00	0.08	0.24	0.09
PC2	0.01	0.13	0.17	0.28	0.04	0.00	0.23	0.59	0.00	0.07	0.11	0.26
PC3	0.00	0.10	0.25	0.33	0.00	0.00	0.17	0.55	0.01	0.08	0.19	0.03
PC4	0.00	0.21	0.38	0.26	0.00	0.00	0.17	1.74	0.07	0.05	0.21	0.08
PC5	0.04	0.13	0.33	0.24	0.00	0.00	0.19	0.74	0.09	0.05	0.25	0.20
PC6	0.00	0.10	0.27	0.47	0.00	0.00	0.43	0.96	0.00	0.06	0.17	0.09
GS	0.02	0.26	0.27	0.55	0.00	0.02	0.18	nd	0.03	0.11	0.29	0.58
MC	0.67	0.74	0.34	0.26	0.22	0.71	0.22	1.53	0.01	0.07	0.13	nd

Pond Creek (2001)

- Linked to rainfall data
- The numbers are "high!"; critical = 126 cfu per 100 mL

E. Coli (cfu per 100 mL)

Site	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May
PC1	99	860	816	33	34	10760	20350	387	1553	92080	816
PC2	1553	2780	2183	411	1986	32550	14450	435	3450	19040	1046
PC3	1046	2500	2419	805	1986	41060	2595	980	2419	86640	2419
PC4	2160	2620	1986	520	1120	35075	173290	517	1733	111990	1414
PC5	12230	3110	1414	3090	1700	20350	38730	980	3130	72700	1460
PC6	11870	1400	727	1580	1986	7940	6690	160	1553	41060	579
GS	17820	2280	34480	300	1580	241920	nd	1643	1420	57940	740
MC	27550	980	2419	200	8260	19350	43520	1300	1203	23820	nd

Land Use

- Pasture based beef and dairy operations
- Total 23,579 acres
  - Pasture = 55%; 12,880 acres
  - Row crops = 7%; 1,558 acres
  - Forest = 26%; 6,135 acres

Project Milestones

- June 2001 to June 2002: Water Quality Monitoring
- April 2003: Lena Beth Carmichael Reynolds hired as watershed coordinator
- July 2003: Land-use inventory completed
- August 2003: monitoring
- Feb. to July 2006: Watershed restoration plan and website developed

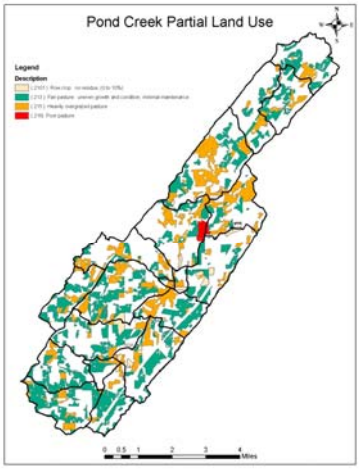
http://pondcreek.ag.utk.edu/

Restoration Goals

- Reduce the amount of bacteria (sediments and nutrients) entering the creek
  - Infrastructure improvements
    - Manage livestock access to creek
    - Improve septic and manure systems
    - Improve stream bank protection
  - Modify Practices
    - Reduce erosion
    - Intercept or reduce losses through runoff
    - Improve septic and manure management

Suggested Target Areas

- **Fair, poor and over-grazed pasture**: 40% all land use and 52% of soil loss
- **Plowed fields:** 1.6% all land use and 11% of soil loss
- **Eroding stream banks:** 22% or 27 miles



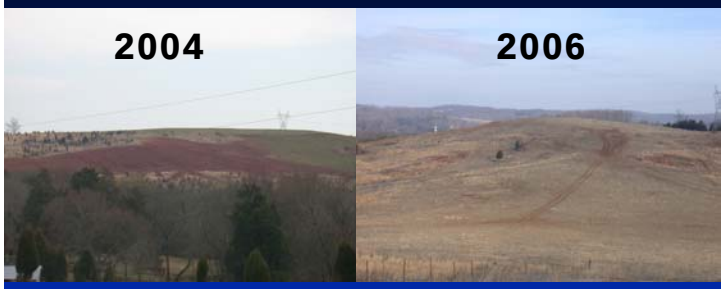
Stakeholder Meetings & Education

- Meetings: UT Extension, agencies, farmers
- One-on-one discussions with project coordinator
- BMP Calendars
- Newsletters: mailed to 600 households, updates on developments, future meetings, BMPs
- Demonstrations: visible locations

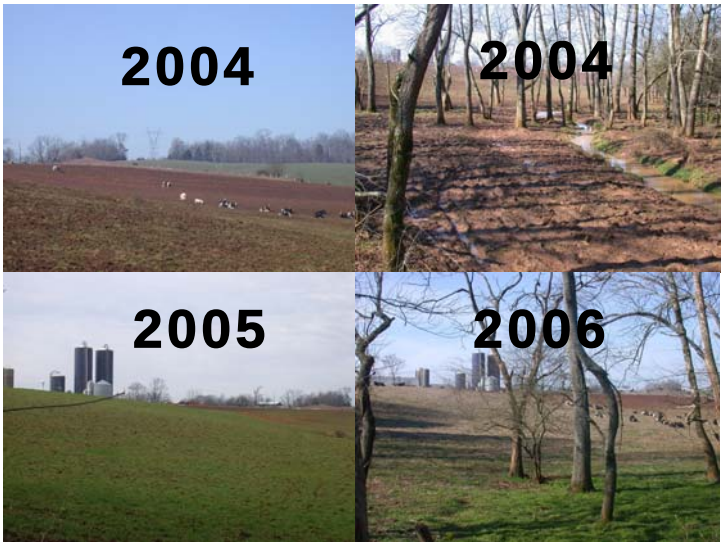
Implementation / demonstrations

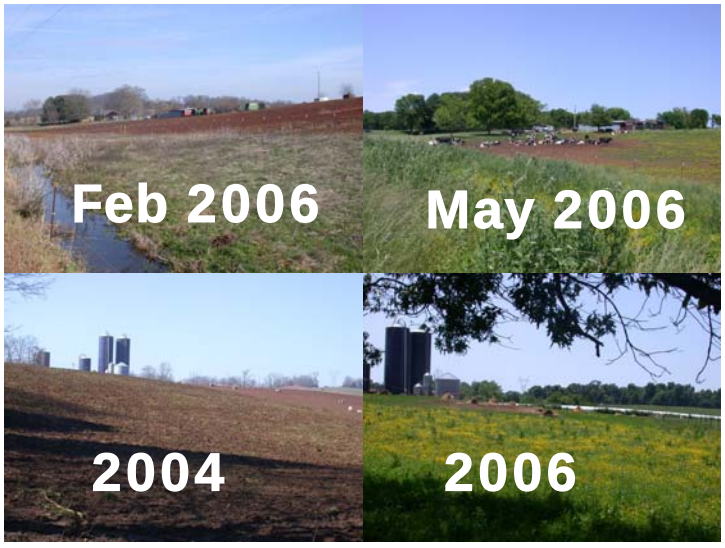
- "Free" Soil tests: lower fertilizer / manure rates
- Weed management: 500+ acres improved pasture stands
- Re-seeding of overgrazed pastures
- Work with other agencies on "engineered" BMPs (>1,750 feet fencing, manure storage, 7 watering systems and >1,700 feet pipes, heavy use areas)

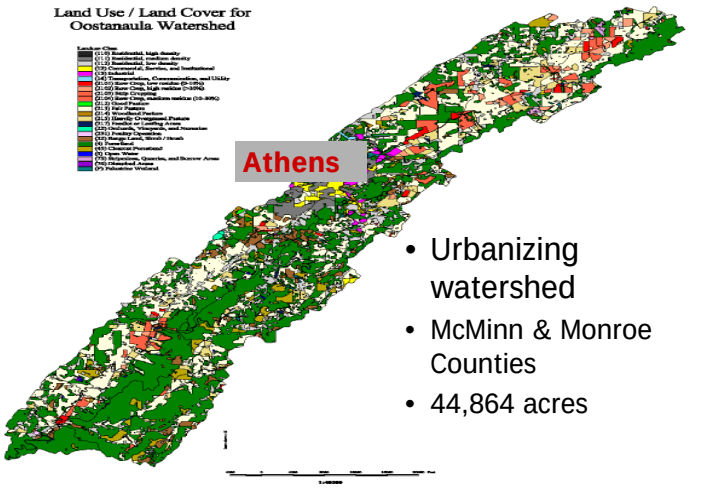
Re-vegetation of Disturbed Soils



- **Practices**: dozer work, soil testing, fertilizer, seed etc.







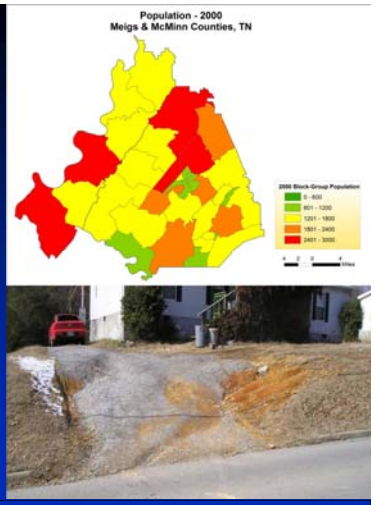
- Urbanizing watershed
- McMinn & Monroe Counties
- 44,864 acres

2006 303(d) list

- Impaired for:
  - *E. coli* ~ 48.9 miles
  - Phosphates and siltation causing loss of biological integrity ~ 7.4 miles
- Causes:
  - Surface erosion
  - Pasture grazing
  - Livestock in stream
  - Non-point sources of pollution
  - Municipal point source discharges

Population Growth & Development

- McMinn County
  - 1990 42,383
  - 2000 49,015
  - 2025 58,629
- Planning for Growth
  - Smart Growth
  - Community involvement
  - Standard zoning rules
  - Education



Oostanaula Watershed Project Partnership

- City of Athens
- Athens Utility Board (AUB)
- McMinn and Monroe counties
- Natural Resource Conservation Service (NRCS)
- Tennessee Department of Agriculture (TDA)
- Tennessee Dept. of Environment and Conservation (TDEC)
- Tennessee Wildlife Resources Agency (TWRA)
- Tennessee Department of Health (TDH)
- University of Tennessee
- University of Tennessee Extension (UT)
- Tennessee Valley Authority (TVA)
- Environmental Protection Agency (EPA)

Activities (2002 to 2005)

- TDA and TVA
  - stakeholder meetings; coordination and development of educational projects and events
- TDEC
  - Development of TMDLs (2002 and 2005)
  - Fecal coliform (2002); Siltation and Habitat Alteration (2005)
- TDA allocated federal funds (319-grants)
  - Installing and implementing on-the-ground BMPs for water quality improvements
- TVA
  - Integrated Pollutant Source Identification (IPSI) model

BMP Implementation (2004)

- Funds from NRCS (EQIP); TVA and TDA (319)
  - 4 x Stream crossing
  - 10,985 feet fencing to protect streambanks
  - 6,235 feet cross-fencing for rotational grazing
  - 9,520 feet manure transfer system (pipeline)
  - 6,512 feet pump and pipeline
  - 8 watering tanks
  - 7 heavy use area protection
  - 25 acres cropland conversion
  - 565 feet travel lane for livestock
- Total = $127,955
- What impact? Are they targeted in best places?

Public Outreach

- McMinn Farm-City Day, Athens, May 9, 2006. Approx. 660 attendees
- Athens Fishing Derby, Athens, April 22, 2006. Approx. 100 attendees
- Media stories color brochure insert into Daily Post Athenian (2006 circulation of 12,148)
- Brochures; schools and city and county offices, and county commissioners.

Growth Readiness Workshops (2008)

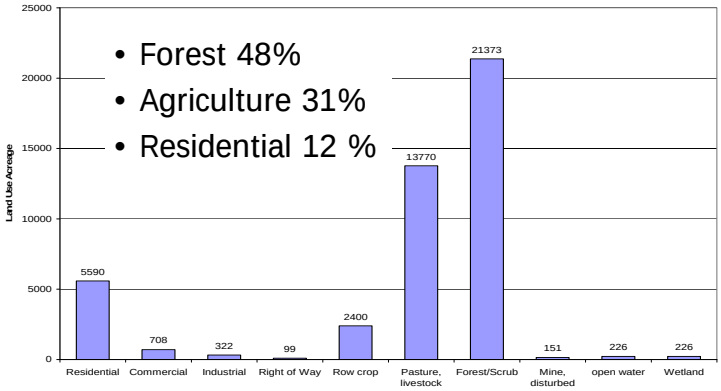
- Facilitated by TVA, Southeast Watershed Forum and City of Athens
- Recommendations for 22 Model Principles for Better Site Design
  - Residential Streets and Parking Lots
  - Lot Development
  - Natural Areas
- Report
- Demonstration projects (YMCA parking lot; Athens Regional Park)

Restoration Plan Development (2005 to 2007)

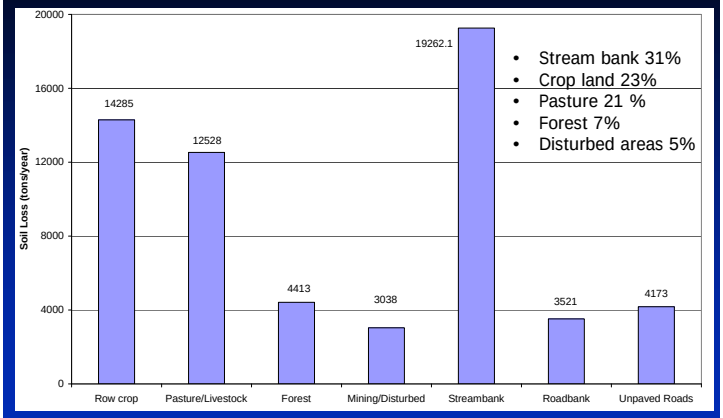
- TMDL
  - Reduce E. coli 72.2%; phosphorus of 79.2% and a reduction of sediment and siltation by 59.4%.
- UT Extension lead
  - Stakeholder and partner meetings
  - What information sources?
  - Are assumptions correct?
  - Possible solutions?
- TDA 319 funding
- Based on TVA's IPSI
- Plan and website

Land Use (IPSI model)

- Forest 48%
- Agriculture 31%
- Residential 12 %



Estimated Soil Losses



- Stream bank 31%
- Crop land 23%
- Pasture 21 %
- Forest 7%
- Disturbed areas 5%

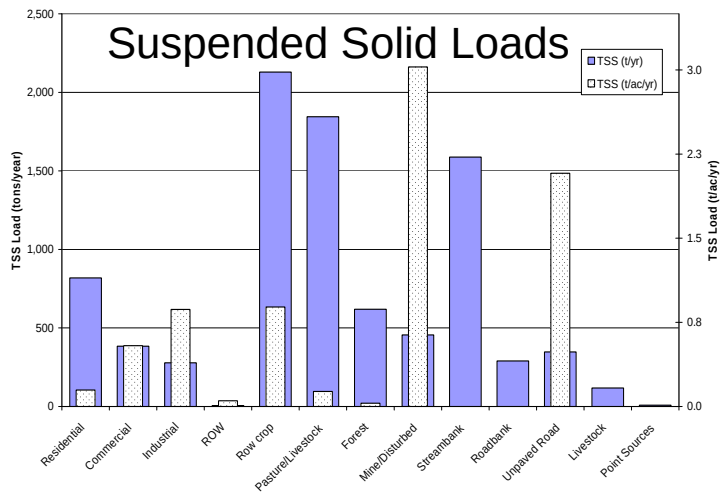
Stream Banks

- Restoration possible if no buildings!
- Convincing landowners a challenge

Agriculture (2007)

- 3,770 beef cattle on approx. 150 farms, most < 50 head
- 1,135 dairy cows on 11 farms
- 200,000 chickens (140,000 broilers and 60,000 layers); 3 operations
- Others (horses, donkeys, hogs and llamas)

Suspended Solid Loads



Oostanaula Restoration Phases

Phase 1 (2007 to 2012):

- Minimal cost BMPs (education and outreach programs, soil testing, collection and adoption of baseline standards, and development of community goals, among others.

Phase 2 (2011 to 2015)

- Implement BMPs that require significant planning and development, design specifications, and/or additional funding ("structural" BMPs; site-specific vegetative BMPs).
- Develop and implement zoning, ordinance and regulation materials

Phase 3 (2015 to 2022):

- Larger structural BMPs (streambank restoration projects, pilot projects or demonstration sites)

Funding: 2001 to 2015

- Almost $2 million funded
  - Pond Creek: $600k – EPA, TDA, TVA
  - Oostanaula Creek
  - TDA: $175 k
    - Plan development; BMP implementation
  - USDA: $652 (2009) + $633k (2012)
    - Support of Watershed coordinator
    - Monitoring
    - BMP implementation study
    - Modeling - SWAT
    - Bacteroides – fecal source tracking
    - Sediment – chemical source tracking, sediment budget
- Indirect funding
  - USDA NRCS: EQIP contracts

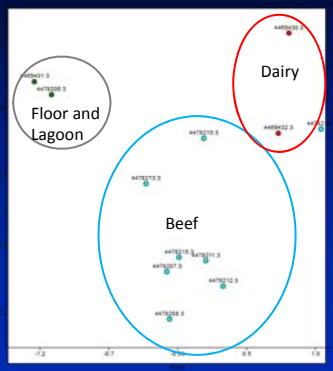
BMP adoption patterns

Practice	Adopters (% of total cattle operations)	Total Units of practice adopted	Total average cost ($)*
Stream crossing	23 (16%)	1,302 ft²	3,147
Rotational grazing	62 (42%)	3,456 ac	69,120
Pasture improvement	100 (68%)	4,694 ac	743,217
Waterer	61 (41%)	171 troughs	163,875

*Based on implementation schedule of the survey

437 responses (30% response rate)
143 beef cattle operations (34% of responses)
13,962 pasture acres represented

Fecal Contamination – Alice Layton



- Best approach for differentiating sources of fecal contamination may be by comparing all species types.

Improving Water Quality in Tennessee Agriculture

- Do not over-apply nutrients
- Control erosion
- Keep manure away from water
- Intercept runoff