Issue Four: Maintaining High Quality Soil and Water Resources

In a nutshell: Trees and forests, when managed properly, are highly effective at conserving soil and water resources. Forest vegetation and leaf litter help protect soil from forces that cause erosion. Riparian forests help hold stream-banks in place and filter out pesticides, nutrients and sediments before they can reach streams. Through filtration, interception and evapo-transpiration, trees and forests reduce storm water runoff problems and moderate stream-flow rates and volumes. In these and other ways, forested landscapes produce much of our cleanest and most cost effective and reliable drinking water. In order to enhance soil and water resources for today and ensure that they will be available into the future, existing trees and forests need to be carefully managed and strategic areas should be re-forested.

Desired Future Conditions:

1. Forests provide high quality, cost effective drinking water.
2. Aquatic ecosystems, and the plants and animals they support, are maintained and enhanced by forests[6].
3. Soil and water resources are protected through the widespread use of riparian forest buffers and best management practices[2].
4. Soil productivity is maintained through sustainable forest management practices.
5. Urban storm-water runoff is minimized through the use of trees and forests.
6. Forests maintain and enhance water related recreation opportunities (canoeing/boating, fishing, hunting, wildlife viewing and aesthetics, etc.)

[6] These DFC's may not apply to some grassland dominated landscapes.

A. The Role of Trees and Forests in Maintaining Soil and Water Resources

All forested areas help maintain soil and water resources. Leaf litter and forest vegetation protects soil from forces that cause erosion so well that erosion from forests is virtually non-existent compared to erosion from crop fields. Figure 4.1 shows estimated soil loss rates for three land-use types on the same soil type and percent slope. While actual soil loss rates can vary considerably by soil type, percent slope and management practices, this example helps illustrate the effectiveness of forests in protecting soil resources and the waters in which eroded soils are ultimately deposited.

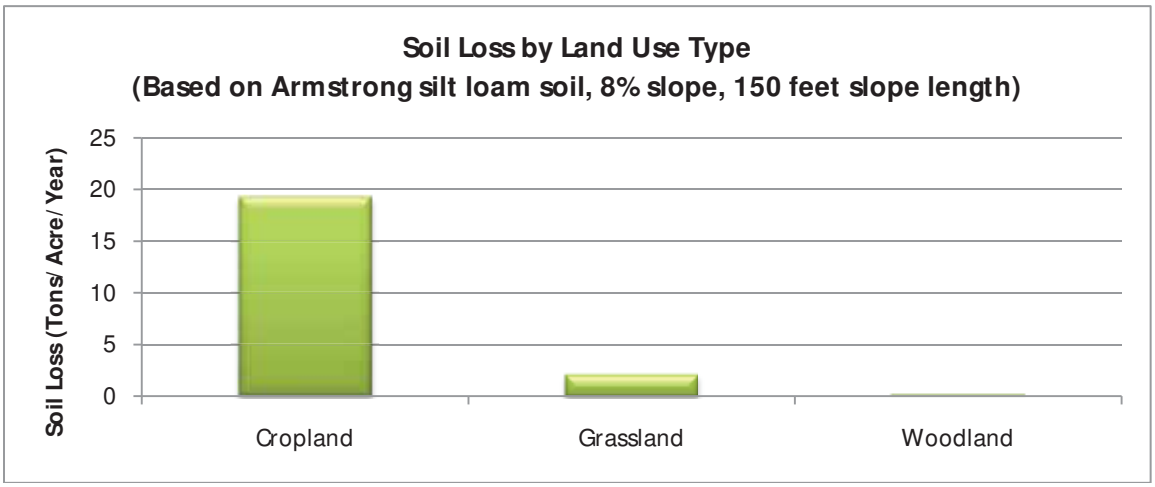


Figure 4.1 Soil Loss by Land Use Type[7]
(Source: USDA Natural Resources Conservation Service[3])

All forested areas in Missouri also provide hydrologic benefits. Compared to cropland, pasture, turf and urban developed areas, trees and forests are highly effective at intercepting precipitation and releasing it slowly into the atmosphere, groundwater and streams. In this way, trees and forests help reduce storm water runoff, and therefore reduce the threat of flooding and the amount of stormwater needing to be handled by local governments. By releasing precipitation slowly into groundwater and streams, trees and forests also help moderate stream flow and volume - providing a more consistent and reliable source of water for public drinking purposes as well as for aquatic habitat. Although non-forested areas often produce a larger volume of water, this volume often comes in rapid pulses which typically does more harm than good.

Riparian Forests and Forested Wetlands:

Although all wooded areas provide significant soil and water benefits, riparian forests and forested wetlands are especially important.

[7] These figures were generated by Doug Wallace, former State Forester of Missouri Natural Resource Conservation Service, using the Universal Soil Loss Equation. All figures were based on an Armstrong silt loam soil, 8% slope, 150 feet slope length. Cropland = minimum tillage (30% cover after planting), corn-soybean (drilled) rotation, up and down tillage; Grassland = 80% ground cover, grass with some weeds and brush, continuously grazed; Woodland = no grazing, low management, 90% duff cover; 90% canopy cover.

Riparian forests are forests found adjacent to streams. Riparian forests help armor stream-banks to keep them from eroding into streams. They filter out pesticides, nutrients and sediments before they can reach the stream. They provide shade which is important for maintaining water temperatures conducive to healthy aquatic ecosystem functioning. Vegetation from riparian forests helps provide the food base and habitat needed by many aquatic organisms. Riparian forests also provide important wildlife travel corridors and can be highly productive for forest products. **Of Missouri's 3,238,536 acres of potential riparian forest buffer, approximately 1,782,368 acres or 55% are currently forested[8].** Reforesting much of these currently unforested riparian areas would significantly benefit soil and water resources. (Note: Although some Missouri streams were historically prairie streams and are best suited for prairie cover, a significant majority of stream riparian zones are best suited for forest cover.)

Similar to riparian forests, forested wetlands filter out sediments, nutrients, fertilizers and pesticides from adjacent fields before they reach streams. They also help moderate stream flow and minimize flooding potential. Forested wetlands have terrific wildlife value and can be highly productive for forest products. Throughout the 19th and 20th century, most of Missouri's historically forested wetlands have been drained and converted to agriculture. A prime example is Missouri's Bootheel which was historically dominated by forested wetlands and is now dominated by agriculture. Although most of Missouri's forested wetlands have been lost, Missouri does still have some quality forested wetlands as well as many areas that have good restoration potential.

B. Forests and Drinking Water: The USFS Forests, Water and People Assessment

For reasons mentioned above, forested landscapes produce our cleanest and most cost effective drinking water. In order to determine the most important forested watersheds for protecting and enhancing public drinking water supplies, public health and aquatic ecosystems, the US Forest Service recently completed a "Forest, Water and People Assessment" (Barnes 2009). This assessment was based on the following four factors:

1) The ability of watersheds to produce clean water
   (Greater ability = higher priority)
2) Total water consumers served by surface water supplies in each watershed
   (Greater number of consumers = higher priority)
3) The percentage of unprotected private forest land in each watershed
   (Greater percentage of unprotected private forest land = higher priority)
4) Areas of greatest development pressure
   (Greater development pressure = higher priority)

[8] These figures were generated by Mike Morris of the Missouri Department of Conservation using National Land Cover Data – 2001 and the following two parameters for riparian areas: 200 feet wide on either side of permanent streams, and 100 feet wide on either side of intermittent streams.

In this assessment, Missouri had the two highest scoring watersheds in the seven state Midwest Region (Fig. 1). The Meramec watershed, which provides surface drinking water to 586,750 people, received the highest score; and the Lower Missouri watershed, which provides surface drinking water to 588,819 people, received the second highest score. In addition to these two watersheds, Missouri's Big River, Cahokia-Joachim River, and North Fork-White River Watersheds also scored in the top 20. Composite results of the Forests, Water and People Assessment in the Midwest are shown below. This analysis is incorporated into our Forest Opportunity Model described in Chapter 4.

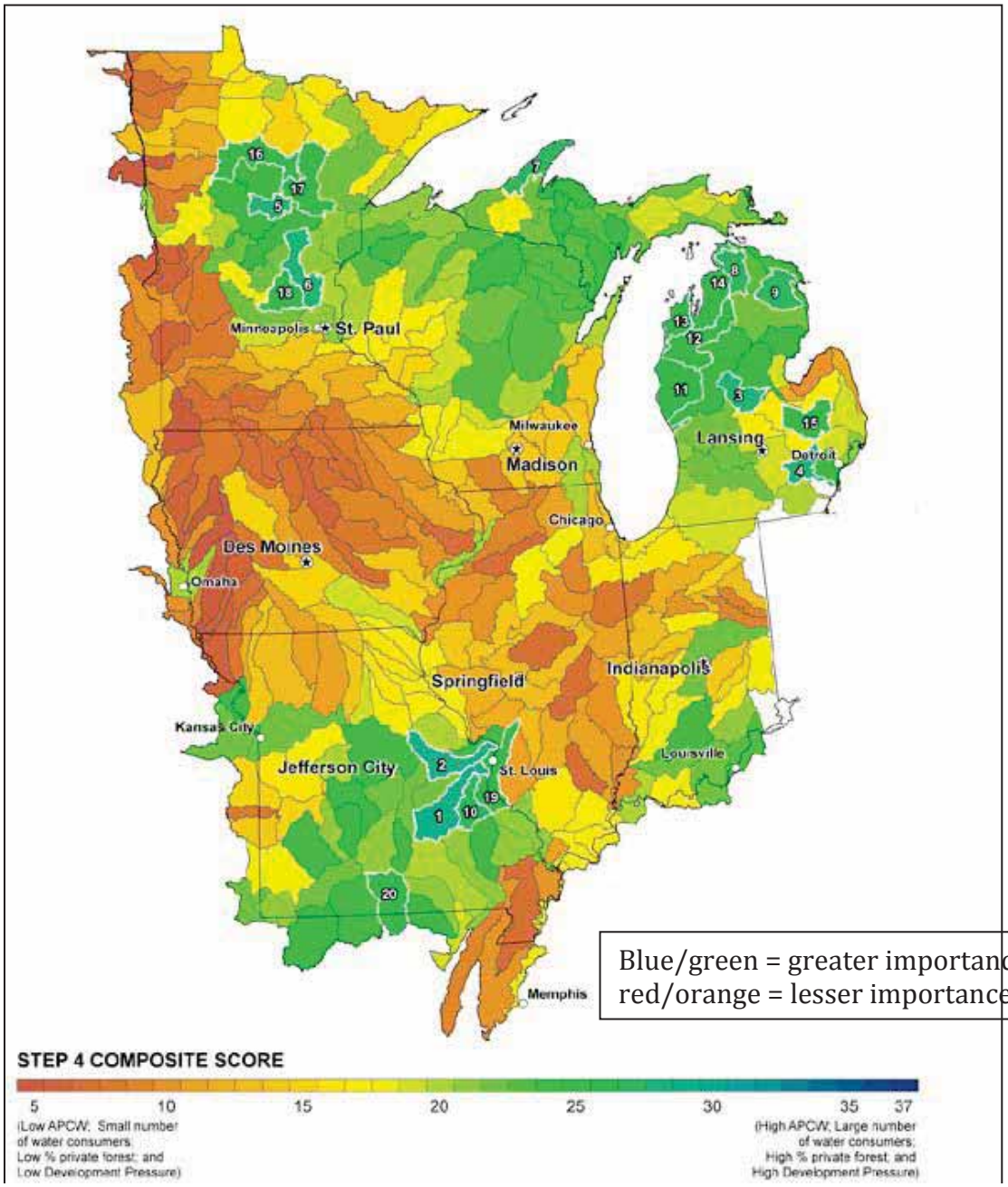


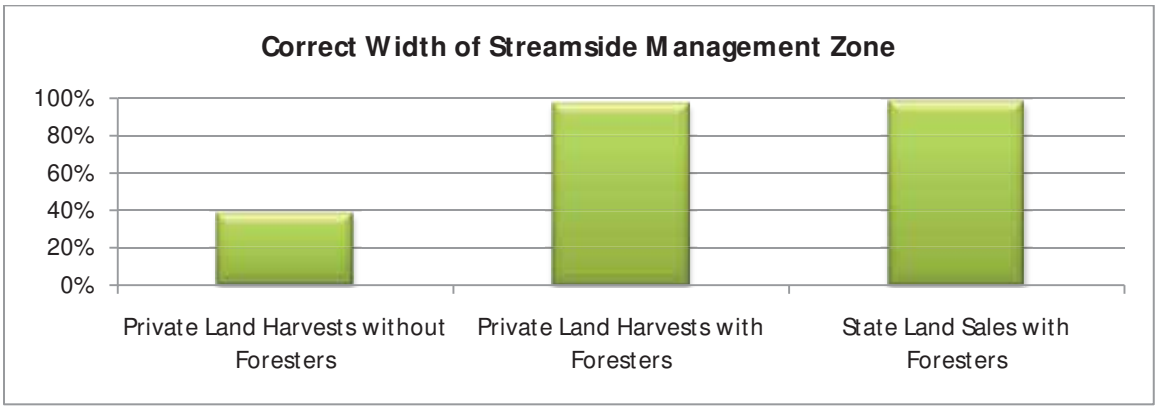
Figure 4.2. Important Forest Watersheds for Maintaining Drinking Water Supplies.
(Source: Barnes 2009)

C. Best Management Practices (BMP's)

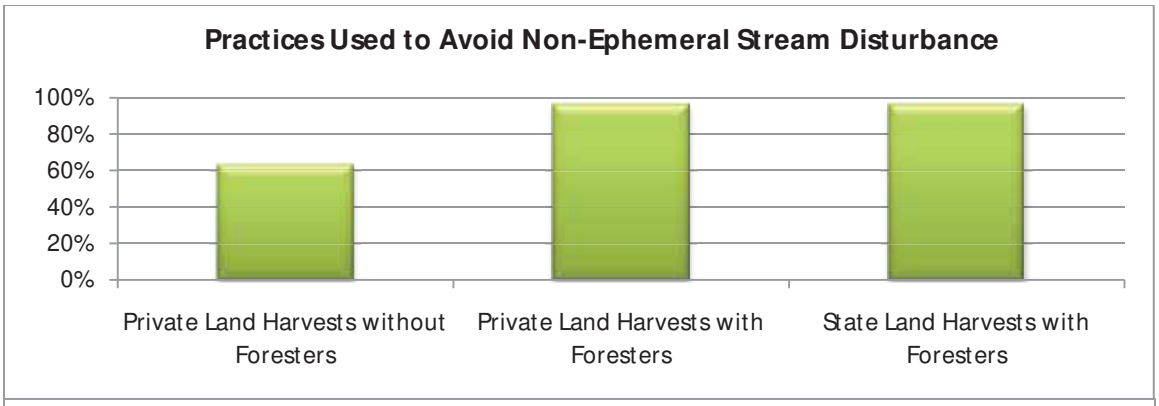
When done correctly, forest management (harvesting, prescribed fire, forest stand improvement) has minimal impact on soil erosion or water quality. Unfortunately, forest management is not always done correctly. To promote soil and water quality during management operations, MDC and various partners have established two sets of voluntary Best Management Practices - "Missouri Watershed Protection Practices" and "BMP's for Harvesting Woody Biomass". These BMP's describe procedures for how and where to construct, use and retire logging roads, how to avoid over-harvesting biomass to the detriment of soil productivity, things to consider when conducting a prescribed burn or applying herbicide, and much more.

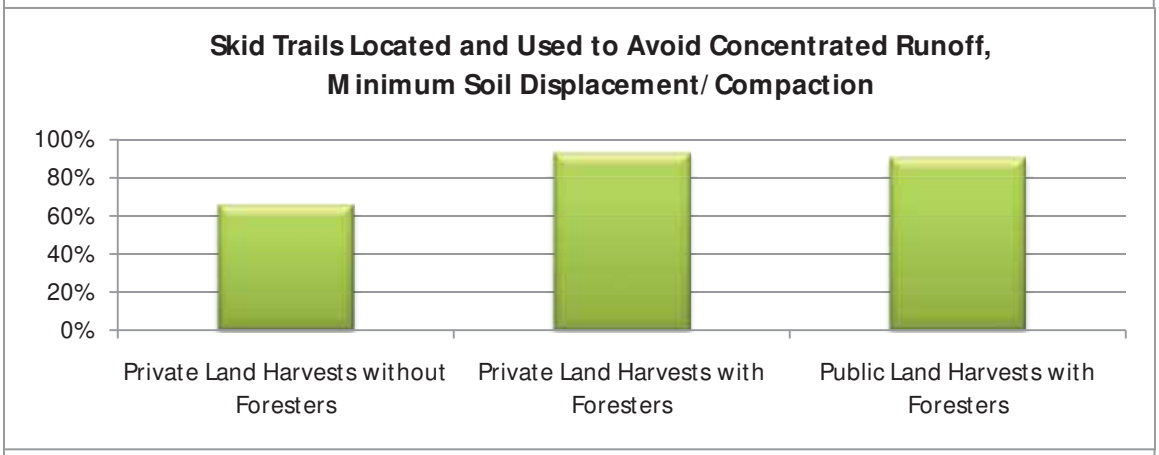
A good way to help ensure that BMP's are followed and used properly is to utilize the services of trained loggers and foresters. Loggers who have attended Missouri Forest Product Association's Professional Timber Harvester Training have been trained in using and installing BMP's. Most state and federally employed foresters, and some private consultant foresters have been trained in inspecting harvests for compliance with BMP's. The advantages of using forester expertise when conducting a timber harvest are clearly demonstrated below. In all cases, the presence of consulting or management foresters improved compliance with the voluntary guidelines and resulted in less potential for erosion, sedimentation, and stream disturbance.

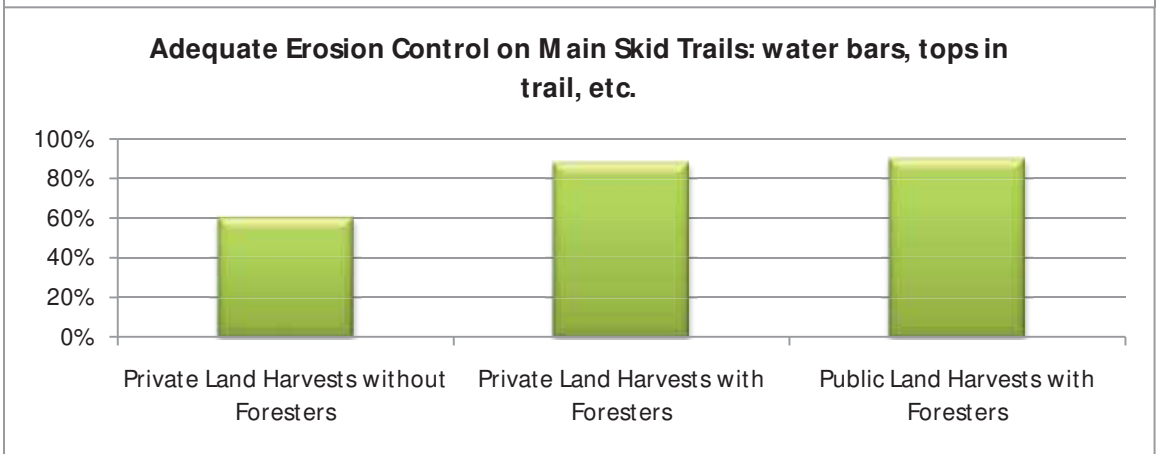
Use and Effectiveness of BMP's in Missouri - 2001 to Present[9]

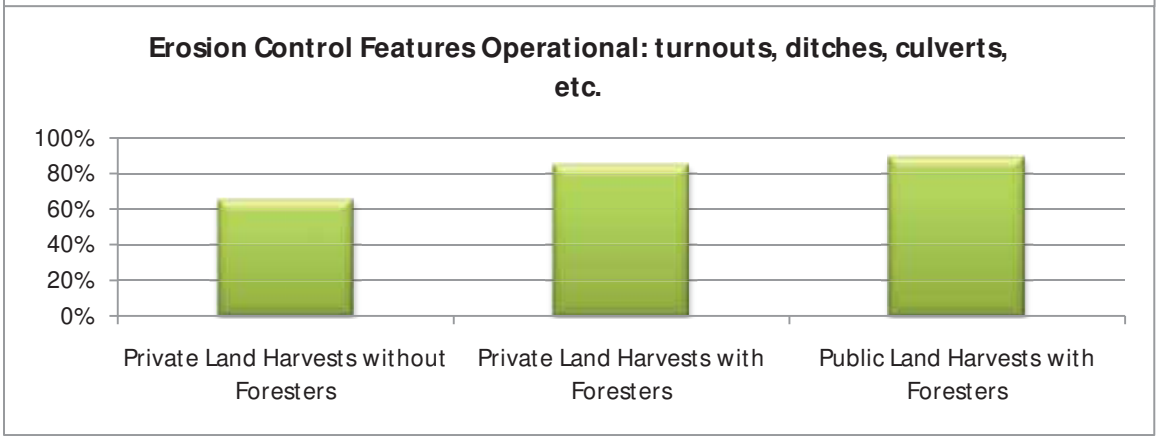


[9] Since 2001/2002, MDC and the Missouri Forest Products Association have conducted BMP monitoring on three types of harvests: 1) State land harvests (which always incorporate BMP's), 2) Private land harvests which used a forester (which typically incorporate BMP's), and 3) Private land harvests which did not use a forester (which often do not incorporate BMP's). These figures include the following acres monitored by MDC and Missouri Forest Products Association: Private Land Harvests without Foresters: 610; Private Land Harvests with Foresters: 1,482; State Land Harvests with Foresters: 14,894. Admittedly, the sample size is small for private land harvests without foresters. This is a reflection of the limited access we have to such harvests.


Practices Used to Avoid Non-Ephemeral Stream Disturbance
100%
80%
60%
40%
20%
0%
Private Land Harvests without Foresters
Private Land Harvests with Foresters
State Land Harvests with Foresters


Skid Trails Located and Used to Avoid Concentrated Runoff, Minimum Soil Displacement/ Compaction
100%
80%
60%
40%
20%
0%
Private Land Harvests without Foresters
Private Land Harvests with Foresters
Public Land Harvests with Foresters


Adequate Erosion Control on Main Skid Trails: water bars, tops in trail, etc.
100%
80%
60%
40%
20%
0%
Private Land Harvests without Foresters
Private Land Harvests with Foresters
Public Land Harvests with Foresters


Erosion Control Features Operational: turnouts, ditches, culverts, etc.
100%
80%
60%
40%
20%
0%
Private Land Harvests without Foresters
Private Land Harvests with Foresters
Public Land Harvests with Foresters