Riparian Science Technical Committee (RSTC)

- 1999-2004 - Public and peer review comments recommended guideline revisions.
- 2004-2007 - RSTC work on the science.
- 2007-2008 - Economic evaluation of RSTC outcomes.
- Future - Revisions to guidelines (science and economics).

RSTC Members

Scientists selected by the MFRC for their area of expertise

RSTC Member	Affiliation	Employment
Daniel Gilmore	silviculture	University of Minnesota, North Central Research & Outreach Center
Dave Grigal	forest soils	Emeritus Professor – University of Minnesota, Department of Soil, Water, and Climate
JoAnn Hanowski	wildlife	Natural Resources Research Institute
Mark Hanson	wetland biology	MN Department of Natural Resources, Wildlife Research
George Ice	forest hydrology	National Council Air and Stream Improvement, Inc
Lucinda Johnson	aquatic ecology	Natural Resources Research Institute
Randy Kolka	aquatic ecosystems	USDA Forest Service – North Central Research Station
Brian Palik	forest ecology, wetlands	USDA Forest Service – North Central Research Station
Sandy Verry*	fisheries	Ellen River Partners, LLC

* Replaced Charles Anderson, MDNR fisheries as of October 2005

RSTC Charge

Provide unbiased scientific information about riparian areas and timber management practices necessary to protect riparian areas on the site level.

RSTC's Role to the MFRC

- Does NOT make recommendations.
  - Provide information on the science.
- Scope of work addresses physical, chemical, and biological components.
  - NOT social, aesthetic, political, economical issues.
- Utilize peer-reviewed scientific literature
  - Identify relationship between indicators of functions and RMZ width and basal area.
- Provide judgments (professional) on strength of the science (high, medium, low, no opinion).

RSTC Definition of Riparian Area

"Zone of interaction between aquatic and terrestrial ecosystems along streams, lakes, wetlands, and other water bodies. Riparian areas both influence water bodies and are influenced by them. They perform important ecological functions that link aquatic and terrestrial ecosystems".

Methodology

- MFRC's Questions/Topics/Issues
  - focus for evaluating scientific findings and providing professional judgment
- First, identified overarching functions for evaluation
  - Hydrology
  - Geochemistry
  - Habitat

Methodology

- Second, identified indicators within these functions to focus literature search.
  - Articles/published studies related to the management of riparian forests identified
- Graphical relationships were developed from data points derived from scientific research.
  - Where the science was not definitive, graphed their best professional judgment as to the response trends for these indicators.

Habitat Indicators

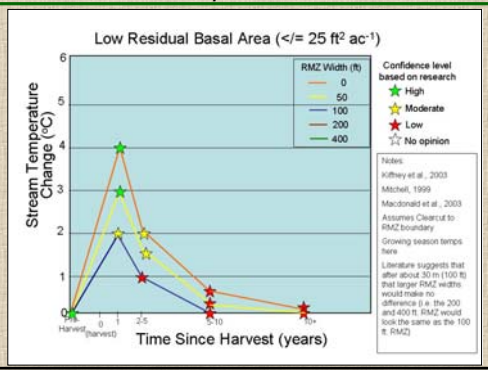
Beaver interactions	Interior forest birds
Bird productivity	Invasive plants
Canopy cover	Large wood (as it relates to herpetofauna)
Emergent (herbaceous) macrophytes	Macroinvertebrates (shredders, collectors, gatherers)
Forest amphibians	Macroinvertebrates (fairy shrimp, water boatman)
Forest area sensitive plants (interior forest)	Primary production (periphyton)
Forest vegetation (age, size, structure, distribution)	Riparian dependent birds
General disturbance associated plants	Snags

Hydrology/Geochemistry Indicators

Air Temperature	Methyl mercury
Dissolved Oxygen	Overhead canopy
Dissolved organic carbon	Soil moisture
Embeddedness	Soil redox, nitrates, and denitrification
Large wood	Turbidity and total suspended solids
Light	Water temperature (stream, lake, and wetlands)
Litter decomposition	Windthrow

Example of Graphics

Stream Temperature Indicator

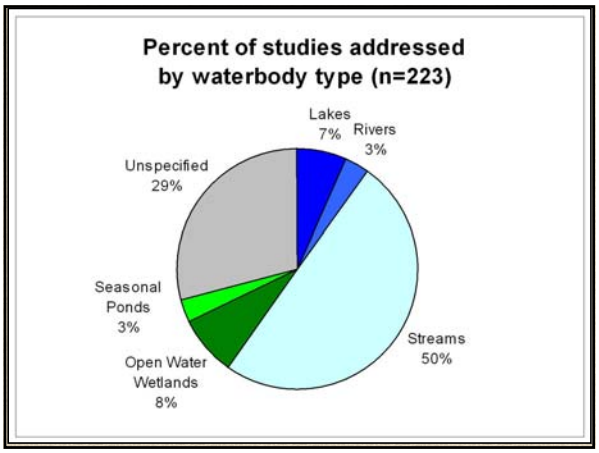


Which waterbody types require RMZs?

- Streams & Lakes
  - trout and warm water
- Open water wetlands
  - Cowardin types 3, 4, 5, & seasonal ponds

Excluded Waterbodies

Excluded waterbodies	Sufficiency of current guidelines	Science availability	RSTC professional judgment
Dry washes	RSTC is unable to improve current guidelines which include: 1) selective cutting within 25 ft. 2) maintaining root structure	Science is not definitive to support recommendation for an RMZ. However, "deductive science" based on professional judgment and knowledge supports retaining the current guidelines.	Current guidelines are sufficient.
Intermittent drainages *Ephemeral drainages with a defined bed and bank only*	RSTC is unable to improve current guidelines which include: 1) proper crossings for all drainages 2) RMZs on drainages greater than 3 ft	Science is not definitive to support recommendation for an RMZ. However, with the revised guidelines that require protecting the banks of intermittent streams, there is no need for RMZs on intermittent drainages.	Delete requirement for RMZs adjacent to intermittent streams > 3 ft. wide.
Seeps and springs	Current BMPs are appropriate and necessary	Science is not definitive to support recommendation for an RMZ.	Current guidelines are sufficient.
Wetland types 1,2,6,7,8	Current BMPs are appropriate and necessary	Science is not definitive to support recommendation for an RMZ.	Current guidelines are sufficient.



Fixed-width RMZs are appropriate

- Variable-width is strongly supported scientifically, but it is not easy to define or implement.
- Level of complexity increases in defining a variable-width for groups of indicators versus single indicators.

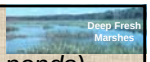
Trout Streams and Lakes

- Fixed-width RMZ of 50 m (165 ft) and a residual BA of 75 ft^2/ac for all sizes.
  - Average of the range supported by the science.
- Eliminate even- and uneven-age management.
  - Unless management plan exists documenting other "desired future conditions"

Warm Water Streams greater than 1 m (3 ft) wide and Lakes

- Fixed-width RMZ of 34 m (110 ft) and a residual BA of 75 ft^2/ac
- Eliminate even-and uneven-age management.
  - Unless a management plan exists documenting other "desired future conditions".
- 3 m (10 ft) wide stringer along the banks.
  - No cut zone to help provide shade and woody debris inputs.
- Agreement not reached
  - Extent of stream width criteria where RMZs and/or residual BAs might possibly change.

Open Water Wetlands



(Circ 39 types 3, 4, 5, & seasonal ponds)

- Waterbodies <u>greater than or equal to one acre</u> should be treated similar to lakes.
- Provide waterbodies <u>less than one acre or seasonal ponds</u> with a minimum RMZ of 15 m (50 ft) wide and minimum BA of 75 ft^2/ac.

Seasonal Pond RMZs

- Agreement not reached.
- Uncertainty in the literature regarding RMZ width and BA.
- Science supports the recommended RMZ and BA given in the RSTC report.

Classification of open water wetlands and seasonal ponds

- Agreement not reached on a deminimus RMZ width
- Agreement
  - waterbodies <u>less than one acre</u> should be classified as seasonal ponds
  - waterbodies <u>greater than or equal to one acre</u> should be generally classified as open water wetlands.
- Key factor is the hydrologic regime not size.

Relationship between indicators evaluated & RMZ widths

- Indicators evaluated first and foremost upon scientific literature and second upon professional judgment.
- Goal was to provide a minimum RMZ and residual BA for each of the riparian indicators.
  - Literature was not conclusive on all fronts.
  - Synthesis reports were written for habitat and hydrologic/geochemical functions to summarize the data.

Habitat Indicators

Terrestrial Habitat	*Aquatic Habitat*	*Forest Dependent*
Interior forest birds	Stream primary production	Wood frog abundance
Bird productivity	Stream large wood	
Riparian dependent birds	Stream macroinvertebrate (abundance)	
Forest area sensitive plants (species richness, recruitment)	Stream macroinvertebrate (community structure)	
Disturbance associated plants (generalist, aspen regneration)	Wetland macroinvertebrate (community structure)	
Snags	Wetland sedge production	
Canopy cover		

Terrestrial Habitat Summary

- High proportion of indicators exceed their normal reference (mature forest) range after harvest, at low RMZ width and BA.
- Limited recovery of these indicators within 10 yrs after harvest (RMZ width <200 ft BA <125ft^2/ac).
  - Does not provide optimal terrestrial habitat, relative to a mature forest reference condition.

Aquatic Habitat Summary

- To reduce potential for changes to values outside the normal reference range.
  - Minimum RMZ of 100 ft.
  - Maintain moderate to high BA.
- Some aquatic variables may recover to normal range values by 10 yrs post harvest.
- Data is lacking
  - Consider conservative guidelines to protect against potential impacts.

Forest Dependent Indicators (Amphibians)

- Wood frogs
  - High priority indicator
  - Biphasic life history: terrestrial and aquatic
- Minimum RMZ of 100 ft with high BA, **if the majority of surrounding landscape is forested** within a minimum 0.6 miles radius around the wetland or stream.
  - RMZs should exceed 300 ft with high BA where recent timber harvesting has occurred or will occur within 0.6 miles.

Hydrologic and Geochemical Synthesis

- Hydrology
  - Peakflow and water yield
- Microclimate
  - Air temperature, light, soil moisture
- Water Quality
  - Nitrogen [nitrate], phosphorus, methyl mercury, and DO; sediment (TSS, turbidity, and embeddedness); water temperature
- Two Key Risk Factors
  - Windthrow and beaver

Hydrology Summary

- Overall watershed (landscape) conditions, NOT riparian forest conditions, determine runoff patterns.
  - Land use changes in subwatersheds increase channel-forming bankfull flows that destabilize channels before a new sediment/water transport equilibrium is reached.
- The smallest waterbodies are likely to experience the largest changes.
  - probably not unlike experiences due to annual variations in weather or natural disturbance events.

Microclimate Summary

- Data scarce in this region.
- **Soil Moisture** expected to increase with harvesting, but response related more to overall watershed condition.
- **Air Temperature** and **Relative Humidity** may be moderated by water.
- **Light** will increase but recover rapidly.
  - More literature here, but little guidance on significance of changes.

Nitrate, Phosphorus, Methyl Mercury, Dissolved Oxygen Summary

- Short-term influences occur on concentrations of these components by timber harvesting.
- RMZ width and BA had minimal impacts on stream water nitrate, phosphorous and methyl mercury.
- DO best controlled through stream temperature and slash management .

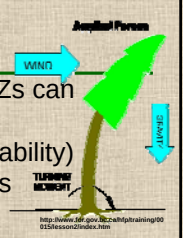
Sediment is an important indicator

- Current filter strip recommendations are consistent with national literature on controlling sediment.
- RMZs serve as filter strips and help avoid channel disturbance.
  - Effective RMZ width depends on site variables, particularly slope.
- Breakthrough points of concentrated flow or poor road crossings can be detrimental without appropriate BMPs.

Temperature is an important indicator

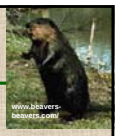
- Most shade functions can be provided for with 50 to 75 ft RMZ if shade is dense.
  - Soil type and slope matter
  - Risks and recovery rates influence decisions about appropriate filter strips and streamside criteria.
- Stream water temperature increase of 2- 4º C can be avoided with forested RMZ widths of 15-30 m (50-100 ft), depending on BA.

Windthrow Summary



- Excessive blowdown within RMZs can impact some riparian functions (e.g., shade production, bank stability) but may enhance other functions (e.g., large wood recruitment).
- Outside 25 ft edge most vulnerable.
  - Hardwood stand data lacking.
- Agreement not reached on whether stringer of trees along small stream edges is an effective equipment deterrent or an invite for blowdown/timber value loss.

Beaver Summary



- Create risk to riparian functions.
  - Agreement not reached on how to depict these risks.
- Riparian forests should be managed for mid- to late-successional species in northern MN as an option to control beaver impacts. RMZs between 50 m (165 ft) and 91 m (300 ft) are needed to discourage excessive beaver colonization on coldwater streams.

Landscape/watershed Considerations

- Primary area of consideration.
  - investment in watershed research to resolve management/water quality issues in this region is lacking.
- Difficult to separate site level considerations from the landscape context.

Research Needs

- Develop monitoring programs to:
  - Better identify & assess natural variability in indicators.
  - Assess effectiveness of guideline influences on water quantity/quality, aquatic habitat & biotic communities.
- Research seasonal pond habitats for sustainability.
  - Collect long-term recovery data of seasonal pond species following disturbance.
  - Use digital elevation models to better identify seasonal ponds & provide maps.

Research Needs

- Develop tools to define and apply a variable-width RMZ.
- Research cavity nesting birds/habitat requirements.
- Research linkage between ephemeral & intermittent drainages.
- Research tendency toward low basal areas around streams (e.g., blowdown, poor soils).

Key Concluding Considerations

- Waterbodies supported by the scientific literature as needing RMZs
  - streams, lakes, rivers, and open water wetlands.
- Consider the landscape issues related to both hydrology and habitat indicators as they affect overall watershed conditions.
- Existing filter strip recommendations are consistent with national literature on controlling sediment.

Key Concluding Considerations

- RMZ width and residual BA had minimal impacts on many of the geochemical indicators (e.g., nitrate, phosphorus, methyl mercury, dissolved oxygen, litter decomposition).
- Most shade functions are protected with moderate RMZ widths (e.g., 15-23 meters (m) [50-75 feet (ft)]) and dense shade.
- RSTC suggests excluding early succession forests on streams where the impact is critical (e.g., cold water trout streams).

Key Concluding Considerations

- All terrestrial indicators **exceeded** their reference condition (>25% change) at low BA for all RMZ widths. A wide RMZ (>61m [200 ft]) coupled with high residual BA has the greatest likelihood of maintaining most terrestrial indicators within these reference conditions.
- At low residual BA, most of the terrestrial habitat indicators may not recover (in 10 years), regardless of RMZ width. Potential for recovery within 10 years is maximized with high residual BA and wide RMZs (>61 m [200 ft]).