RIVER MANAGEMENT AND
Protection in New Hampshire

Jo Beth Mullens
Keene State College

ABSTRACT

Increasing and competing demands for river-related resources led New Hampshire to adopt the Rivers Management and Protection Program (RMPP) in 1988. A major component of this state river protection program was a provision intended to assist and encourage citizens to nominate local rivers for program designation and to then develop integrated river corridor management plans for these rivers. New Hampshire's approach followed national trends toward increased state involvement in river protection, and emphasis on locally-led, integrated resource planning efforts. In the twenty years since its enactment, only sixteen rivers, or river segments, have been entered into the program. This article examines New Hampshire's approach to river protection by highlighting strengths of and challenges to the RMPP which have surfaced over the past two decades. This state program exhibits several strengths including the furthering of integrated resource planning, emphasis on local stakeholder participation, and adoption of specific state-level river protection measures. Notable program limitations include inadequate state funding, limited river enrollment, and implementation difficulties. The article concludes by identifying areas of needed improvement in order to fully achieve the goals of New Hampshire's river protection program. *Keywords: integrated river planning, river protection, local participation, state river program, New Hampshire.*

Introduction

In 1988, New Hampshire's legislature passed the Rivers Management and Protection Act (RSA 483) to increase planning for and protection of the state's rivers. In adopting this new statute, policy-makers acknowledged rivers as one of New Hampshire's most valuable but also most vulnerable resources. The documentation of water quality problems, rapid riverfront development, and increased threats to river and riparian species provided evidence that the state's existing river protection policies were insufficient. The legislative response to these concerns was to create a two-tiered program which relied upon both state and local efforts for increased river protection. The adoption and structure of this new program reflected three inter-related-but-distinct national trends in river protection and management: (1) greater dependence on state-level programs and (subsequently) less dependence on federal initiatives; (2) dedication to local stakeholder participation in river planning and protection; and (3) commitment to inte-

grated river planning and management, which takes into account the multiple demands placed upon rivers. New Hampshire's new program surfaced at a time when these national trends were emerging.

New Hampshire was not alone in crafting state-level river protection legislation, the first of the above-mentioned national trends. Responding to their own river management needs, states across the country joined New Hampshire by establishing their own river protection policies (Wilson 1994). While these state programs varied substantially in their scope and approach, by 1995 thirty-three states, including all six New England states, had developed some form of a state-level river protection program (Pettit and Schoolmaster 1995). To establish a context for the emergence of New Hampshire's and other states' programs, one needs to note passage of the 1968 National Wild and Scenic Rivers Act (P.L. 90-542), the primary national legislation for protecting undeveloped qualities of the nation's rivers.

The purpose of the National Wild and Scenic Rivers Act was to protect free-flowing rivers that had been identified as possessing unique natural qualities that could be threatened by development. While this early federal program was well-intended, fewer than 11,000 miles in 166 rivers within thirty-eight states have been protected in the forty years since the act was implemented (National Wild and Scenic Rivers 2010). This represents little more than one-quarter of 1 percent of the nation's rivers. When New Hampshire's river protection legislation was first being debated, no rivers in the state were protected by the National Wild and Scenic Rivers Act. Currently, only portions of two New Hampshire rivers (14.5 miles of Wildcat Brook and 23.5 miles of Lamprey River) receive protection under this federal program. In part due to the limited number of rivers protected by this federal-level Act, a number of state-crafted river protection programs were established around the country in the 1980s (Watanabe 1988). New Hampshire's program was one of these.

The national trend toward increased state-level initiatives was accompanied by a closely-related second national trend which involved the localization of river planning. Historically, river protection planning and management fell to outside experts, representing a "top-down" approach. However, as state-level programs emerged in the 1980s, river governance shifted toward the local level. New planning and management efforts increasingly relied on local knowledge and vision and encouraged participation from a wider range of stakeholders (Weber 2000; Durham et al. 2008). Over time, socially-acceptable planning solutions required the use of a "bottom-up" or "place-based" approach in which local citizen groups identified their own community-based, river-related concerns (National Research Council 1999). While state-facilitated, New Hampshire's program has exemplified this "place based" approach since its inception, consistently depending upon local-level, multiple-stakeholder involvement and charging citizen commissions with the formulation of protected river corridor management plans.

As New Hampshire joined other states in assuming greater responsibility for river protection and for incorporating the voice of local stakeholders into the process, a third national trend came into play. This trend involved a shift toward integrated planning and management of water, land and other related resources. Integrated water planning and management is an approach which addresses a broader range of river-related resources and demands than the single-purpose (or even multi-purpose) approach which historically dominated river planning and mana-

ment (Downs, Gregory and Brooks 1991; Lee 1993; Mitchell 2007). This approach has been increasingly promoted (over single and multi-purpose planning approaches) as a means to better address a growing number of demands placed upon rivers. Integrated planning efforts have also offered promise for promoting more equitable resource allocation and furthering sustainable management of larger ecosystems (Viessman 1997; Biswas 2004; Calder 2005). While the concept of integrated water planning and management is sound, it has proven difficult to put into practice and has therefore spawned a variety of implementation models, some more effective than others. New Hampshire's program, a forerunner in shifting toward a holistic approach for addressing river degradation and user conflicts, holds promise as a model for other states considering integrated planning.

This article offers a detailed look at New Hampshire's River Management and Protection Program with its emphasis on locally-led, integrated river management planning efforts that incorporate differing stakeholders' involvement. As state-level programs continue to be created and to evolve, reflection on New Hampshire's model can provide insight for those working on river protection around the country. To this end, the article examines key program components as well as implementation of the New Hampshire program including: (1) state rivers and river miles included; (2) the involvement of local stakeholders in resource planning; and (3) the use of an integrated river planning approach. Exploring this early example of a state-level program two decades after its implementation provides an opportunity to learn from New Hampshire's notable areas of river protection success and failure.

Overview of New Hampshire's Rivers Management and Protection Program

With over 10,000 miles of perennial rivers and streams, water resources have been historically important to New Hampshire's economy and quality of life (New Hampshire Department of Environmental Services [NHDES] 2008). The state's numerous rivers provided an environment suitable for early settlement and later industrialization. Water-powered sawmills and early nineteenth century textile mills fueled New Hampshire's industrial economy. As a result, rivers running through communities and the industrial buildings populating their banks have provided the distinct New England town landscape that, in large part, continues to exist today.

While the old lumber and textile mills closed long ago, New Hampshire's rivers are still considered to be one of the state's most important natural resources, as they are counted on to provide numerous water-related goods and services. Rivers have been dammed and diverted to provide flood control, hydropower, public drinking water, waste assimilation and to meet new industrial demands. However, while the state's rivers have successfully supported these activities, demands placed upon rivers over the last four decades has dramatically increased as New Hampshire's population has grown twice as fast as other New England states (New Hampshire Office of Energy and Planning 2006). This growth has led to an increase in development of riverfront properties which in turn has strained the health of New Hampshire's rivers (Society for the Protection of New Hampshire Forest 2005). At the same time citizens of and visitors to the state have placed a higher value and demand on rivers for recreation and aesthetic values.

A study of four uses of surface waters in New Hampshire (boating, fishing, swimming, and drinking water supply services) were estimated to contribute $1.5 billion annually in total sales to the state's economy (Shapiro and Kroll 2003). Additionally, a study of boaters, anglers, and swimmers found that a perceived decline in water quality would result in economic losses of $51 million in total recreation-related sales, $18 million in lost income, and the reduction of at least 200 jobs statewide (Nordstrom 2007). These studies speak to the importance of rivers to the state's current economy. They also highlight how rivers contribute to the quality of life and unique sense of place experienced by New Hampshire residents and visitors.

A group of concerned citizens and conservation organizations came together in 1985 to initiate the New Hampshire Rivers Campaign. This largely grass-roots campaign pushed for the establishment of a state program for river protection. Acknowledging both the value of state rivers and the growing pressures placed upon them, the New Hampshire Legislature passed RSA 483, titled New Hampshire Rivers Management and Protection Program (NH RSA 483 1988). The legislation called for river protection through joint state and local efforts. New Hampshire's program, like the federal-level Wild and Scenic Rivers Act, does not address all rivers. Instead the program protects specific rivers or river segments that have been nominated at the local level and approved at the state level.

The local-level nominating process requires completion of an inventory that defines and describes important resources associated with each nominated river. In addition to a formal resource inventory, each nomination must include a classification of the river based on the degree of development within the riparian corridor. The classifications established in the order of least-to-most developed are *natural, rural, rural-community, and community*. Given that rivers flow through different landscapes, each nominated river is divided into segments based on these classifications. *Natural* rivers (on one end of the classification spectrum) must be free-flowing, at least five miles in length, with predominate natural vegetation in the riparian area. *Community* rivers (on the other end of the spectrum) flow through concentrated population areas and have significant human impact in their riparian zones. River segment classifications are important in that specific state-level regulatory restriction measures are based upon them. A river or river segment's classification of *Natural* or *Rural* results in more restrictive regulation than does a *Rural-Community* or *Community* classification. Examples of state protective measures include restriction placed on: channel alterations; construction or reconstruction of dams; interbasin water transfers; new landfills; new septic systems; and new buildings (NH RSA 483 1988).

Using the administrative leadership of the New Hampshire Department of Environmental Services (NHDES), the state has responsibility for enforcing regulatory protection measures. A River Coordinator position within NHDES was created to administer and oversee the program. A statewide Rivers Management Advisory Committee (RMAC) was also established. The state-level RMAC's membership represents various appointed river interests including public water suppliers, elected municipal officers, business and industry, hydropower, conservation commissions, conservation interests, recreation organizations, agriculture, historical, and archaeological interests. Meeting quarterly, the RMAC reviews proposed river nominations and provide advisory comments on proposed legislation and rules impacting designated rivers. Additionally, this state-level body is charged with adopting instream flow requirements for each protected river.

Once state-level approval occurs, a local advisory committee (LAC), composed of appointed citizens from the towns and cities along the designated river, is established. Each river's LAC includes representatives from different river towns who have varied backgrounds and interests. The program defines stakeholders as those representing local government, business, conservation, recreation, agriculture, and riparian landowner interests. The primary task of the LAC is the development of a river corridor management plan. In theory, the plans provide river management recommendations based on an integrated planning approach that considers water quality and quantity issues as well as the influencing activities within the riparian landscape. The scope of these plans is the river's narrow corridor, not its watershed. The corridor is defined by the program to be the river and the land area extending 1,320 feet (1/4 mile) from the river's normal high water mark. Through the corridor management plans, LACs articulate potential impacts of different land uses on river quality. While the LACs do not have enforcement or implementation authority, they do encourage and advocate local governments' adoption and implementation of relevant recommendations within their plans. This is often accomplished through amendments to town master plans and conservation commission actions.

The LACs are also called upon to function as liaisons between local river communities and the state. In this role, LACs are directed to assess existing zoning regulations for adequacy in protecting identified river-related resources and to provide advisory recommendations to the state-level RMAC and the NHDES Commissioner. While limited to providing advisory opinions, all proposed activities in the corridor which have the potential of impacting the values and characteristics of a designated river must pass through an LAC for advisory comments.

Implementation of New Hampshire's Rivers Management and Protection Program

Over the last twenty years, state and local actors in New Hampshire have worked together to implement the RMPP. At the state-level in the first year, the Rivers Coordinator position and the RMAC were established. Shortly thereafter, five locally-led river nominations were submitted and approved in 1990. These early nominations were largely shepherded by nonprofit groups, such as the New Hampshire Rivers Council, an organization that had previously worked toward the establishment of the program. In the years to follow, additional nominations trickled in.

By the end of the first decade, eleven rivers and/or river segments had been formally entered into the program. During the next decade, four additional rivers were designated. Late in 2009, thirty-five miles of the Cochecho River, running from New Durham to Dover, made it through the designation process and twelve miles of the upper reach of the Ammonoosuc River came under review. Formal nominations for three additional rivers (Oyster, Mascoma and Squamscott) are anticipated by the end of 2010. Figure 1 displays the sixteen protected rivers, and each river's segment classification.

The number of river miles varies from only fifteen miles of protection for a segment of the Lamprey River, up to 269 miles for New England's largest river, the Connecticut. Table 1 lists the sixteen rivers in the program, the number of miles protected and the date each river was designated. With 905 miles of rivers under protection, this program only covers a little over 8

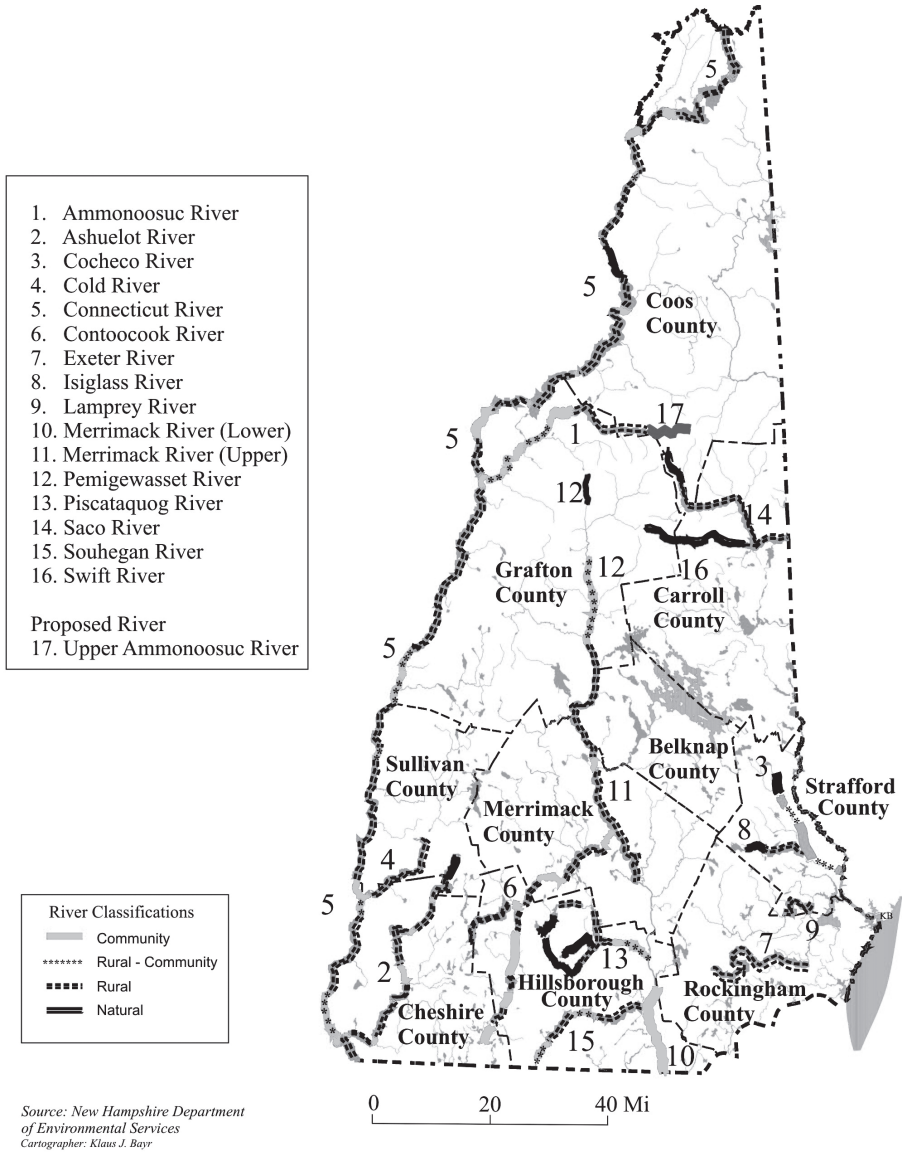


Figure 1 Designated Rivers in New Hampshire Rivers Management and Protection Program

percent of New Hampshire's river miles. If the Connecticut River is not included, the remaining protected rivers consist of less than 6 percent of the estimated 10,800 river miles in New Hamp-

shire. When thirty-eight miles protected by the federal Wild and Scenic Rivers Act are factored in, still less than 9 percent of the state's river miles fall under protection.

Protected River	Miles	Date Adopted
Ammonoosuc River:	45	2007
Ashuelot River:	69	1993
Cochecho River:	35	2009
Cold River:	21	1999
Connecticut River:	269	1992
Contoocook River:	133	1991
Exeter River:	34	1995
Isinglass River:	16	2002
Lamprey River:	15	1990
Lower Merrimack River:	17	1990
Upper Merrimack River:	31	1990
Pemigewasset River:	54	1991
Piscataquog River:	67	1993
Saco River:	40	1990
Souhegan River:	35	2000
Swift River:	24	1990
Total NH River Miles Protected:		**905**
Total NH River Miles:		**10,800**
Nominated Rivers		
Upper Ammonoosuc:	12	in review

Table 1. New Hampshire's Protected Rivers under RMPP

When examining the location of designated rivers, four (Ammonoosuc, Pemigewasset, Saco, and Swift) run at least partially through the federally managed White Mountain National Forest. An additional six rivers (with a collective 373 designated river miles) are found in the south western and south central counties of Cheshire, Hillsborough and Merrimack.

Of the four river corridor categories, the majority of river miles (567 river miles or 63 percent) are classified as *Rural*. A rural landscape dominates the riparian corridors of most designated rivers. Rural-river miles flow through landscapes most impacted by agriculture, forest, or dispersed residential development. Rivers not dominated by the *Rural* corridor sections are the Lower Merrimack and the Cochecho rivers, both having more *Community* miles. *Community* miles make up 160 miles or over 17 percent of the total river miles in the program. Conversely, the Piscataquog River is located in a sparsely populated area of the state and has the majority of its sixty-seven river miles classified as *Natural*. *Natural* and *Rural-Community* river miles are approximately 10 percent each of the total program river mileage.

All of the designated rivers have established and functioning LACs. Given the Connecticut River's size and interstate nature, an organization called the Connecticut River Joint Commissions, composed of members from both New Hampshire and Vermont, was established to coordinate its corridor management plan. Instead of forming one LAC for the entire river, five geographically-based subcommittees (Headwaters, Riverbend, Upper Valley, Ascutney, and Wantastiquet) were assembled to develop sub-plans for the New Hampshire/Vermont 267 miles

of the Connecticut River.

For the designated rivers or river segments, all but three have completed river corridor management plans. For most LACs, it has taken between three and five years to move from river designation to completion of a corridor management plan. Common issues which have emerged in the thirteen completed plans include nonpoint source pollution controls; shoreline erosion; relicensing of hydroelectric dams; flood control; wetland losses; recreation access; fish and wildlife habitat (including endangered species); and land development. While plans exist, questions remain regarding their implementation and, ultimately, how they will achieve the goals of the enabling legislation.

The River Management and Protection Program's Strengths and Challenges

The effectiveness of New Hampshire's RMPP in achieving the overall goal of ensuring the continued viability of state rivers has been mixed. This section highlights six notable strengths alongside six limitations of the program. The strengths include: (1) expansion of integrated resource planning; (2) emphasis on local stakeholder participation; (3) increased public involvement in river issues; (4) development of river protection partnerships; (5) adoption of state-level river protection measures; and (6) establishment of greater state-level oversight and leadership. Notable limitations of the program include: (1) inadequate state funding; (2) over dependency on volunteer/citizen science; (3) limited river enrollment; (4) lack of correspondence between location of protected rivers and population densities; (5) constraints of the targeted planning unit; and (6) challenges to program implementation.

Rivers Management and Protection Program Strengths

The first program strength is its emphasis on integrated river management planning. Understanding that many threats to river health are caused by activities taking place on the adjacent landscape, those who created the RMPP acknowledged that effective planning for water resources must go hand-in-hand with land use planning. Management plans produced by the LACs therefore focus on observations and recommendations regarding not just the river, but also land use activities in the adjacent river corridors. As previously noted, current research supports the shift toward integrated river planning as an approach which more effectively addresses the multifaceted aspects of rivers (Mitchell 2005a).

The second strength of the program is the involvement of local citizens and stakeholders in resource protection. The role of river communities and the importance placed on local support is a principle program feature. Through the river corridor plans, protection recommendations are made by individuals directly in touch with the demands placed on their rivers and the expressed visions of their communities. When given adequate assistance, individuals representing various interests within river communities are expected to be in the best position to define measures which are locally acceptable (Doppelt et al. 1993; Lant 1998; Durham and Brown 1999; Barr 2003). Citizen involvement, characterized in the RMPP, promotes a transpar-

ent planning process and balances represented interests. Additionally, recommendations that emerge from LAC efforts have been perceived to be more just and effective than those dictated by state-level officials. In short, without local support and buy-in, implementation of unbinding resource plans such as those generated by LACs is less likely to occur (Harrison et al. 2001; Irvin and Stansbury 2004).

Representatives of the LACs also come together to form local teams of river advocates who serve as the eyes and ears of designated rivers. In their advisory role under RMPP, the LACs review all proposed activities impacting their rivers. This statutory requirement ensures that participating members will be informed of any pending actions and able to formally voice their reservations or support. While the majority of advisory opinions have been made on site-specific developments, LACs have also provided opinion on more broad, state-wide legislation such as the expansive amendment made to the state's Comprehensive Shoreline Protection Act in 2008. In the case of the shoreline protection policy, LACs provided essential political support for the enhancement of this state-level policy.

A third program strength involves the awareness and education gained by river communities as they move from river nomination through resource planning and implementation. The creation of both the nomination document and the corridor management plan requires that dedicated community members examine their local river-related resources and articulate their values and priorities for resource enhancement and protection. An indication that this has indeed occurred can be found within the LAC completed planning documents for each designated river (NHDES 2010).

Articulated priorities within adopted plans have given rise to a host of other river advocacy actions initiated by active LACs. Over the past two decades, local advisory commissions have taken on numerous activities including river clean-ups and volunteer water quality monitoring efforts. The Ashuelot River LAC, for example, established a summer water quality monitoring program which has informed the public as well as local and state government agencies regarding water quality problems (Ashuelot LAC 2009). Going down a somewhat different but related track, the Upper Merrimack LAC developed a bio-monitoring program (Upper Merrimack LAC 2009). These two LAC-initiated programs provide river education to interested citizens who have elected to be involved with the collection of river quality data. Such voluntary monitoring activities add to local and state agency efforts by increasing the collection of physical, chemical and biological data used to guide policy while also inviting interested citizens into the process.

Other LAC river education and advocacy activities include: production of river maps which highlight recreational opportunities and detail key river features; provision of river recreation/educational opportunities such as guided canoeing trips and river walks; placement of educational river protection signs along river corridors; and development of river education materials for public schools. The Connecticut Joint River Commissions and its five sub-committees have taken on numerous ambitious challenges over the years including riverbank erosion and riverfront property development, two key issues for New England's largest river. The many volunteer activities and efforts by RMPP LACs were recognized at the national and state levels in 2008 when these local groups were given both the President's Volunteer Service and the Spirit of New Hampshire Volunteer Service Awards.

The promotion of river-related partnerships involving differing agencies and levels of government as well as nonprofit organizations and local community groups is an exhibited fourth strength of the New Hampshire program. The RMPP's creation stemmed from such partnerships which involved both nongovernmental organizations and state-level agencies. Today, collaborative partnerships are relied upon to address common interests and concerns around river protection and are necessary to further integrated river planning and management efforts (Genskow and Born 2006). Actions of the LAC and RMAC require that official program members work with other governmental and nongovernmental organizations. One such notable partnership has formed among the LACs and the state regional planning commissions. Because special emphasis is placed on riparian corridor management, the LACs have relied on assistance and input from regional land-use planning commissions. New Hampshire's nine regional planning commissions have provided LACs with critical technical assistance such as gathering and analyzing GIS data. It is clear that the partnerships between LACs and regional planning commissions strengthen integrated river planning efforts.

While not yet fully realized, RMPP's mandate for the establishment of instream flow, along with other protected measures, in designated rivers serves as a fifth program strength. The program's enabling legislation committed New Hampshire to a formal protection policy for establishing water quantity flows in designated rivers. This measure has been supported by a large and growing body of research which has examined instream flow protection as a means to restore and protect rivers (Postel and Richter 2003; Annear et al. 2004; Naiman et al. 2007). Furthermore, instream flow is only one of several protection measures mandated under RMPP. Channel alteration, dam construction, and interbasin transfers are prohibited in most segments of designated rivers.

The final program strength involves the many activities undertaken by the state-level RMAC. Foremost, this state-level committee provides leadership and guidance for policies regarding all designated rivers. Meeting on a semi-quarterly basis, RMAC assists the Rivers Coordinator in matters pertaining to the state's designated rivers. Made up of diverse state-wide interests, the RMAC provides greater legitimacy to the program at both the state and local levels, and facilitates coordination among key state agencies working on river protection. Responsibilities of the RMAC include reviewing river nominations and advising the state on instream flow rules. This committee also provides program oversight and works toward strengthening state-level river protection policies.

Rivers Management and Protection Program Challenges

The advantages of New Hampshire's River Management and Protection Program have been tempered by several statutory constraints as well as by complications that have occurred since the program's inception. The first challenge involves constraints on state funding. Essentially, state funding is limited to the salaries of the Rivers Coordinator and a staff member. While the Rivers Coordinator is to assist local efforts, funds are not directly provided for LAC work or activities. In order to undertake local river activities, many LACs have pursued grants. A common funding source for the LACs is the Clean Water Act Section 604(b) grants awarded by

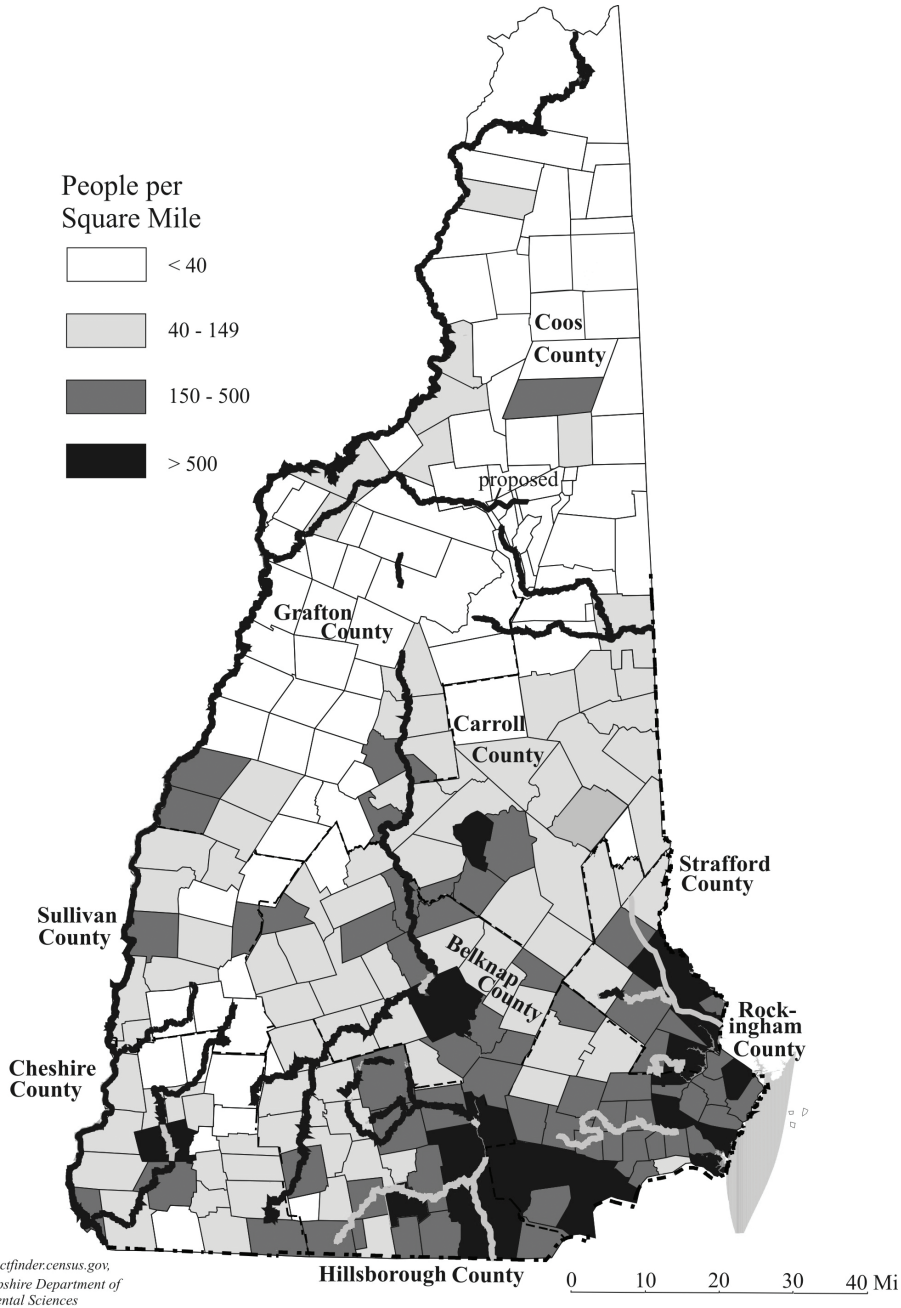
the United States Environmental Protection Agency. In the 2008/2009 biennium, eight LACs received federal dollars from this source. While grant moneys have been secured by several LACs, the lack of guaranteed funding at both the state and the local levels clearly has restricted what this program has been able to accomplish over the last two decades.

A related issue to the lack of state funding involves the heavy dependence on volunteer citizen scientists to produce the integrated river corridor management plans. While there is general agreement among researchers over the importance of including local citizens and communities in the development of integrated river management plans, there is also concern about relying solely on "citizen science" for the creation of these plans which are then used to guide local policy-makers (Ewing, Grayson, and Argent 2000; Wohl et al. 2005). Adding to this, concerns have been expressed by LAC members about their own ability to craft somewhat complex planning documents (NHDES 2008). While there are definite benefits derived from local stakeholder involvement, relying solely upon individuals who lack access to data and in most cases have a limited scientific background raises questions regarding the soundness of recommendation emerging from LACs.

A third program limitation involves the restricted number of rivers and river miles protected. With only sixteen designated rivers making up 905 river miles, the program applies to a small fraction of the state's total river miles. While new rivers can be added at any time, merely four additional rivers have been designated since 2000. Initial barriers to inclusion in the program involve the burden of completing the inventory and river nomination documents. Also, the process from river nomination to designation can be lengthy. These and other impediments have narrowed the number of rivers which have made their way to designated river status.

Another constraint of the program involves the scope of planning and management efforts, which is focused on quarter-mile river corridors instead of the larger watersheds. For the last several decades, researchers have emphasized the importance of planning for cumulative impacts involving numerous activities at a watershed scale, not for a scale limited to a narrow riparian corridor (Montgomery, Grant and Sullivan 1995). In such cases, the program falls short in recognizing the critical link between upland watershed activities and mainstem river problems. Additionally, some rivers, such as the Merrimack and the Pemigewasset, are only protected in discrete segments. The Merrimack River is divided into two discrete sections, the Upper Merrimack and the Lower Merrimack, with over fifteen river miles between the two sections not included. Notably, the gap in protection in the Merrimack River occurs as it flows through the state's largest city, Manchester. In cases like this when only sections of rivers are enrolled, the program fails to fully address the importance of upstream and downstream connectivity.

A related fifth concern involves threats to the state's rivers related to high-population densities. When looking at a map of New Hampshire's protected rivers in light of the state's population concentration, it is evident that few protected river miles run through high-density areas. New Hampshire's estimated 2007 population was approximately 1.3 million, with the highest concentrations found in the southeast (U.S. Bureau of the Census 2009). Figure 2 shows that only four designated rivers (less than 100 protected river miles) can be found in the most heavily populated southeast counties of Rockingham and Strafford. The possible future addition of fourteen miles of the Oyster River and approximately six miles of the tidal Squamscott River



Source: factfinder.census.gov, New Hampshire Department of Environmental Sciences

Figure 2 New Hampshire Population Density and Designated Rivers

would add river miles to the program in this more densely populated area. However, many more unprotected miles of rivers and streams populate this region. If the program is to adequately address river bodies most impacted by human activities, greater effort should be placed on securing protection of river miles in the state's southeast.

The final issue which limits New Hampshire's program centers on implementation problems. Those involved at both the state and local levels have faced significant challenges when executing key elements of the program. One such example is that of instream flow. While presented earlier as a measure which offers potential to strengthen river protection, it must also be examined for its current implementation shortcomings. Shortly after the passage of RMPP, instream flow became a divisive issue. Debates over appropriate methodologies for establishing instream flow delayed implementation until 2002 when a compromise pilot project was launched on two designated rivers, the Lamprey and Souhegan. With the exception of this limited pilot program, the establishment of instream flow requirements for other designated rivers has not occurred.

Along with the problems of establishing instream flow, a more concerning challenge to the success of the RMPP involves the implementation of LAC corridor management plans. Over the years, LAC members have spent significant time and effort educating and persuading city and town officials to incorporate portions of their corridor management plans into community master plans. In some cases, local governments have cherry picked the most politically palatable components of the LAC plans for adoption. Furthermore, river corridor plan adoption into a community master plan does not guarantee that recommendations will be acted on. While those who crafted the enabling legislation hoped that the program would increase awareness and appreciation of the river resources in designated river communities, and thus motivate communities to adopt and implement plans, the reality has fallen short. Without any real authority to mandate plan adoption and implementation, the decision to act upon LAC recommendations is entirely up to the discretion of towns and cities along designated rivers.

Conclusion

On a strong positive note, the New Hampshire RMPP has established a structure to marshal local community citizens willing to actively advocate for the protection of their rivers. The LAC members representing various stakeholders have come together to further river-related partnerships and fashion integrated protection planning documents. As explored throughout this article, key strengths of New Hampshire's RMPP lie in its integrated river planning process. Not surprisingly, this aligns with two river management trends occurring across the country. Additionally, the education which results when interested citizens draft river nomination documents (and then corridor management plans) is inestimable. Such work encourages communities to identify, define and protect their own river resources and to take true ownership of the process. The organizational structure of the RMPP—based on forming local advisory committees which not only produce management plans, but also undertake activities and act as advocates for river protection—ensures that a balance of river needs are both identified and addressed. Lastly, program-defined, state-level measures offer long-term protection for the designated rivers.

Unfortunately, fundamental problems have also become evident in this largely volunteer-based program. Arguably, the most critical of these problems centers on resource support. While fiscal and administrative support does not in and of itself result in successful resource protection programs, in its absence, local participants are limited in what can be reasonably accomplished. The fiscal hardship currently experienced in both public and private sectors regrettably suggests that state agencies and programs such as RMPP will continue to operate with significantly constrained budgets for the foreseeable future. Along with inadequate state funding are valid concerns surrounding the use of volunteers to carry out complex resource planning and secure plan implementation within river communities. While citizen involvement is a positive, the overdependence on citizen scientists with little-to-no training and support as they go about producing integrated management documents is problematic.

Another area of significant concern centers on implementation. Regrettably, implementation of some aspects of the program has faltered. The most notable example is the establishment of instream flow, one of the original protection measures called for in the 1988 Act. Successful implementation is a common failing for programs such as RMPP which lack resources and regulatory force. While the state has the authority to regulate the protected measures outlined in the original legislation, it has run into problems in doing so. Overall, the state has been unable, or in some cases unwilling, to force local governments within the designated river corridors to adopt and implement LAC recommendations found within their river's plan.

Like the federal Wild and Scenic River System, New Hampshire's program is also greatly limited in terms of the number of rivers involved. The sixteen rivers that made their way into the program have done so largely because local individuals or groups have gone through the lengthy nomination process, not because of state-wide comprehensive assessments outlining rivers in need of protection. As a result, there is less than perfect correspondence between the protected rivers in the program and the rivers facing the greatest threats related to high population densities. Furthermore, while the overall RMPP is integrated in nature, the basic planning unit is a narrow river corridor, not the greater watershed. While some LACs have expanded their planning documents to include watershed recommendations, the statutory language should be amended to call for watershed, not narrow river corridor plans.

On the near horizon, other challenges are becoming evident that may further threaten the effectiveness of the program. Accelerated development continues to impact the southern counties of New Hampshire, particularly in the southeast where relatively high population densities already exist. Despite educational campaigns and local restrictions, impervious surfaces continue to encroach upon riparian zones, funneling pollutants directly into the rivers.

Climate change presents another challenge for New Hampshire's rivers. As climate researchers predict that spring will arrive earlier and summers and winters will grow warmer with less winter snowpack and greater drying conditions in the other seasons, rivers in the state will be additionally stressed. These climate shifts could threaten existing river uses and further complicate efforts to establish instream flow requirements.

The question ultimately boils down to how the state will establish a means to adequately address these and future threats to its rivers through the RMPP. Directly connected to these recent challenges and the inherent program shortcomings identified in this article, the state

has begun to reconsider what will be needed to create policy for future river protection. While no definitive answers or plans have been released, a report generated in early 2008 called for an aggressive effort to address issues threatening the state's surface waters (NHDES 2008). This report cites some of the noted limitations of the RMPP and calls for changes to address them. While this 'sustainability initiative' could lead to improvements in RMPP as well as river protection outside of the program, it is likely to face roadblocks of its own, particularly in the area of funding. Given current economic conditions within the state, the most feasible answer may lie in securing additional federal grants while concurrently shifting scant state resources in order to support local efforts. Certainly, the intent and early efforts of the RMPP are admirable. Now they must be adjusted, amplified and continued in order to ensure the longstanding health of New Hampshire's invaluable river resources.

JO BETH MULLENS is a Professor of Geography at Keene State College, Keene, New Hampshire 03435. Email: *jmullens@keene.edu*. Her research interests include river planning and management, dam removal, and more recently faculty-led field courses.

Acknowledgments

This author wishes to thank Dr. Pru Cuper for her review and insightful comments which significantly improved this article. The author thanks Dr. Klaus Bayr for producing the maps that appear in the article. Finally, the author greatly appreciates the editors of *The Northeastern Geographer* as well as the anonymous reviewers of the manuscript for their careful attention to detail and helpful recommendations.

References

Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other co-authors. 2004. *Instream Flows for Riverine Resource Stewardship*. Cheyenne, WY: Instream Flow Council.

Ashuelot LAC 2009. *Annual Report*. http://des.nh.gov/organization/divisions/water/wmb/vrap/ashuelot/index.htm (last accessed 26 February 2010).

Barr, S. 2003. Strategies for sustainability: Citizens and responsible behavior. *Area* 53(3): 227-40.

Biswas, A. K. 2004. Integrated water resources management: A reassessment. *Water International* 29: 248-56.

Calder, I. R. 2005. *Blue Revolution: Integrated Land and Water Resources Management*. London: Earthscan.

Doppelt, B, M. Scurlock, C. Frissell, and J. Karr. 1993. *Entering the Watershed: A New Approach to Save America's River Ecosystems*. Washington, D.C.: Island Press.

Downs, P. W., K. J. Gregory, and A. Brooks. 1991. How integrated is river basin management? *Environmental Management* 15(3): 299-309.

Durham, L., and K. G. Brown. 1999. Insights and applications assessing public participation in

U.S. watershed planning initiatives. *Society and Natural Resources* 12(5): 455-67.
Durham, L., T. Loftus, J. Adams, C. L. Lant, and S. E. Kraft. 2008. Assessing the US watershed management movement: National trends and an Illinois case study. *Water International* 33(2): 231-42.
Ewing, S. A., R. B. Grayson, and R. M. Argent. 2000. Science, citizens, and catchments: Decision support for catchment planning in Australia. *Society and Natural Resources* 13(5): 443-59.
Genskow, K. D., and S. M. Born. 2006. Organizational dynamics of watershed partnerships: A key to integrated water resources management. *Journal of Contemporary Water Research and Education* 135(1): 56-64.
Harrison, A., G. Schmidt, C. Avis, and R. Hauser. 2001. World Wildlife Federations' Preliminary Comments on Public Participation in the Context of the Water Framework Directive and Integrated River Basin Management. Copenhagen, Denmark: World Wildlife Fund European Freshwater Programme.
Irvin, R. A., and J. Stansbury. 2004. Citizen participation in decision making: Is it worth the effort? *Public Administration Review* 64: 55-65.
Lant, C. 1998. The changing nature of water management and its reflection in the academic literature. *Water Resources Update*110: 18-22.
Leach, W. D., and N. W. Pelkey. 2001. Making watershed partnerships work: A review of the empirical literature. *Journal of Water Resources Planning and Management* 127: 378-85.
Lee, K. N. 1993. *Compass and Gyroscope: Integrating Science and Politics for the Environment.* Washington, D.C.: Island Press.
Mitchell, B. 1990. Integrated Water Management. In *Integrated Water Management: International Experiences and Perspectives.* ed. B. Mitchell 1-21 London: Belhaven.
Mitchell, B. 2005a. Integrated water resource management, institutional arrangements, and land-use planning. *Environment and Planning* A 37(8): 1335-52.
Mitchell, B. 2005b. Participatory partnerships: Engaging and empowering to enhance environmental management and quality of life. *Social Indictors Research* 71(1-3): 123-44.
Mitchell, B. 2007. Integrated catchment management and MSPs: Pulling in different directions. In *Multi-Stakeholder Platforms for Integrated Water Management*. ed. J. Warner, 49-68. Burlington, VT: Ashgate Publishing.
Montgomery D. R., G. E. Grant, and K. Sullivan. 1995. Watershed analysis as a framework for implementing ecosystem management. *Water Resources Bulletin* 31(3): 369-86.
Naiman, R. J., S. E. Bunn, L. Hiwasaki, M. E. McClain, C. J. Vorosmarty, and M. Zalewski. 2007. *The Science of Flow-Ecology Relationships: Clarifying Key Terms and Concepts. Ecohydrology* White Paper for UNESCO http://www.unesco.org/water/ihp/ ecohydrology/pdf/ essp.pdf (last accessed 25 February 2010).
National Research Council. 1999. *New Strategies for America's Watersheds*. Washington: D.C.: National Academy Press.
National Wild and Scenic Rivers. 2010. *Water Facts* http://www.rivers.gov/waterfacts.html (last accessed, 26 February 2010).
New Hampshire Department of Environmental Services (NHDES). 2007. *Guidelines for Naturalized River Channel Design and Bank Stabilization*. http://des.nh.gov/organization/

commissioner/ pip/publications/wd/documents/r-wd-06-37.pdf (last accessed 25 February 2010).

New Hampshire Department of Environmental Services (NHDES). 2008. *The Sustainability of New Hampshire's Surface Waters. A Summary Report by the NH Lake Management Advisory Committee and the River Management Advisory Committee*. http://des.nh.gov/organization/divisions/water/wmb/rivers/rmac/documents/sustainability initiative.pdf (last accessed 25 February 2010).

New Hampshire Department of Environmental Services (NHDES). 2010. *Environmental Fact Sheet R&L-14: River Classifications and State Regulated Protection Measures as They Apply to Each Classification*. http://des.nh.gov/organization/commissioner/pip/factsheets/ rl/documents/rl-14.pdf (last accessed 25 February 2010).

New Hampshire Office of Energy and Planning. 2006. *New Hampshire Population Projections for State and Counties* 2010 to 2030. http://www.nh.gov/oep/programs/DataCenter/Population/ documents/populationforcountiesbyageandsex.pdf (last accessed 25 February 2010).

New Hampshire Revised Statutes Annotated 483 (NH RSA 483). 1988. *New Hampshire Rivers Management and Protection Program.* http://www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-L-483.htm (last accessed 25 February 2010).

Nordstrom, A. 2007. *The Economic Impact of Potential Decline in New Hampshire Water Quality: The Link Between Visitor Perceptions, Usage and Spending*; Concord, NH: The New Hampshire Lakes, Rivers, Streams and Ponds Partnership.

Pettit, M. S., and F. A. Schoolmaster. 1995. River protection in Texas: Up a creek without a policy. *Great Plains Research* 5(2): 323-52.

Postel, S., and B. Richter. 2003. *Rivers for Life: Managing Water for People and Nature* Washington, D.C.: Island Press.

Shapiro, L., and H. Kroll. 2003. *Estimates of Select Economic Values of New Hampshire Lakes, Rivers, Streams and Ponds Phase II Report*. Concord, NH: Gallagher, Callanhan, and Gartrell.

Society for the Protection of New Hampshire Forest (SPNHF). 2005. *New Hampshire Changing Landscape 2005 Population Growth and Land Use Changes: What They Mean for the Granite State*. http://www.spnhf.org/research/papers/nhcl2005es.pdf (last accessed 24 February 2010).

Upper Merrimack LAC. 2009 *Annual Report*. http://www.merrimackriver.org/ (last accessed 25 February 2010)

U.S. Bureau of the Census. 2009. *Quick Facts*. http://quickfacts.census.gov/ (last accessed 26 February 2010).

Viessman, W. 1997. Integrated water management, *Water Resources Update* 106: 1-12.

Watanabe, A. 1988. *Two Decades of River Protection: A Report on the National Wild and Scenic Rivers System Past, Present and Future.* Report prepared for the U.S. Department of Interior, National Park Service and American Rivers.

Weber, E. P. 2000. A new vanguard for the environment: Grass-roots ecosystem management as a new environmental movement. *Society and Natural Resources* 13: 237-59.

Wilson, R. R. 1994. An integrated river management model: the Connecticut River

management program. *Journal of Environmental Management* 41: 337-48.
Wohl, E., P. L. Angermeier, B. Bledsoe, G. M. Kondolf, L. MacDonnell, D. M. Merritt, M. A. Palmer, N. L. Poff, and D. Tarboton. 2005. River restoration. *Water Resources Research* 41: W10301, doi:10.1029/2005WR003985.