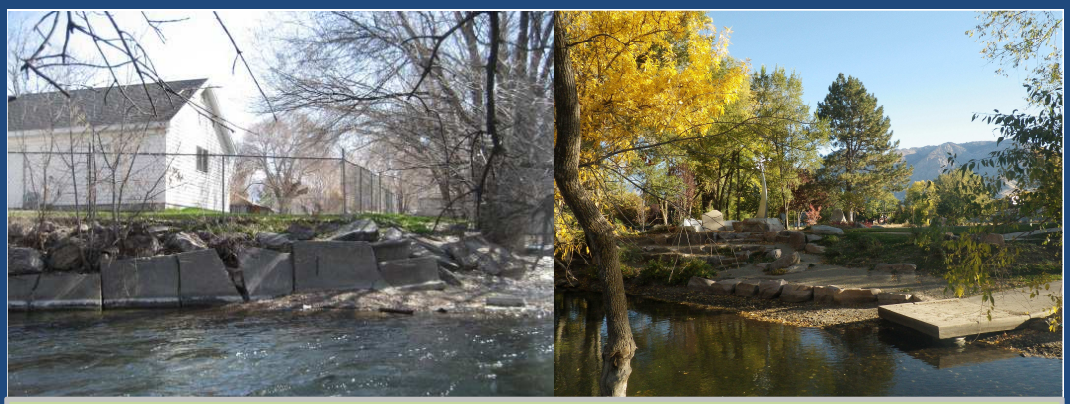

Restoring Riparian Buffers: A What Works Snapshot

A River Network Report, by Merritt Frey

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A River Network Report
Rivers and Habitat Program
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What Works series
This is the second in an occasional series of "What Works" snapshots from River Network's Rivers and Habitat Program. The series is built around case studies from the great work watershed organizations and others are doing on critical river habitat issues. The series doesn't attempt an academic level of research and analysis, but rather attempts to use real world stories to illustrate ideas other organizations may want to import to their own watershed, to share peer-to-peer lessons (good and not-so-good) learned, and to document replicable practices.

Acknowledgements
Our sincere thanks go to those who took part in the riparian buffer project survey. We especially thank those groups featured in our case studies. Thanks also to Mary Frey, our volunteer editor.

Cover photos
Courtesy RiverRestoration.org. Showing the same spot on the Ogden River pre- and post-restoration – see case study one for more information.

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Introduction

Around the nation, river and watershed groups are breathing life back into our rivers and streams through projects focused on restoring a "riparian buffer" along the water's edge.

What is a riparian buffer? Definitions abound, and they run from general to very specific. At its core, the phrase breaks down to two fundamental pieces: ripa, which is Latin for bank, and buffer – something that is neutralizing or softens a shock or blow. The definition used for the purposes of this report is quite broad and general: a vegetated area adjacent to a creek or river which provides multiple benefits (e.g., water quality, habitat, etc.) to the creek while buffering the impacts of associated land uses.

Keep in mind that riparian buffers are referred to by many names, some of which may be used interchangeably with the term buffer but are actually different, though related, practices such as grassed waterways and filter strips. Other related terms may refer to the area along the water, whether or not there is an actual "buffer." These include terms such as stream corridors, riparian zones, or floodplains.

In this short report, we present a snapshot of work to restore and protect riparian buffers in the United States. We provide two types of information: 1.) a summary of the results of a short, national survey of organizations involved in riparian buffer restoration and 2.) a selection of case studies documenting projects in various watershed situations.

> Every riparian buffer project will have its own goals, social factors, and other drivers that will influence how you approach the project.

The goal of this report is to share the lessons learned by river and watershed groups (and others) that have tackled riparian buffer restoration projects. Our hope is that you can learn from the creative ideas, successes, challenges and even failures described here, and use that learning to design and implement even better projects in your home watershed.

Please understand that every watershed is unique. Every riparian buffer project will have its own goals, social factors, and other drivers that will influence how you approach the project. Still, we've provided recommendations at several levels that are worth contemplating as you think about your own project:

- General recommendations for riparian buffer projects – see page 42.
- Peer-to-peer lessons learned from survey respondents – see page 9.
- Case study-specific lessons – at the end of each case study.

Overview:
Surveying Riparian Buffer Project Leaders

In June 2013, River Network conducted an informal online survey about work our Partner organizations and others are doing to restore riparian buffers. Notice of the survey was sent to River Network's Partner listserv, but the invitation to participate circulated to organizations outside of our network. The survey generated 43 respondents, with 38 finishing the 10-question survey.

Who responded

Responses were received from 24 states – from Alaska to Georgia. The best-represented states were California (five respondents), Montana (four respondents) and North Carolina (four respondents).

Respondents self-identified as one of a selection of organization types; a chance to add more information about the organization was also provided. Nonprofits in general made up 91 percent of the respondents. Five percent of respondents identified themselves as local governments and another 5 percent as "other" (totals do not equal 100 due to rounding). The most common respondent represented a watershed organization (59 percent). In total, water-related nonprofits made up 76 percent of the respondents (i.e. watershed groups, statewide river groups, etc.). Fifteen percent identified themselves as another type of nonprofit (for example, a community group).

The vast majority (95 percent) of respondents had been involved with riparian buffer restoration in the past and/or were currently engaged in a project. The remaining 5 percent had not yet conducted a project, but were planning a future project or considering getting involved in buffer restoration.

We asked respondents to identify the primary land use in their project watershed or watersheds. Understanding that watershed land use is often mixed, we strongly encouraged them to identify the dominate land use, and offered three very general categories: urban, suburban and agricultural. Because some respondents would have multiple projects in various watersheds, we also offered the following as a choice: "It is hard to say – we have multiple projects in various types of watersheds" and encouraged them to describe those situations in a comment field. Thirty-eight percent of the respondents were working in primarily agricultural watersheds, 19 percent in urban and 19 percent in suburban. The additional 25 percent fell into the "it is hard to say" category.

In summary, while the survey response pool was not large, it did reflect a useful mix of respondents for the purposes of this report. Respondents represented diverse parts of the country, largely reflected River Network's partnership in terms of organizational

types (i.e. largely watershed organizations), and were experienced in riparian buffer restoration and protection projects. The respondents also represented a range of watershed land use types – from urban to agricultural and beyond.

Respondents' project goals

We were interested to learn what respondents identified as their primary (and second- and third-tier) goals for their riparian buffer projects. We offered five goal options and an "other" field. Respondents were allowed to rank those options as first-, second- or third-tier goals.

Water quality improvement was the most popular choice, with 56 percent of respondents ranking it as their primary goal. Another 37 percent identified water quality improvement as their secondary goal. Overall, 27 respondents identified water quality as one of their top three project goals.

> 56 percent of respondents ranked water quality improvement as their primary goal.

Streambank stabilization/erosion control was a very close second as a project goal. Fifty percent of respondents identified streambank stabilization as their primary goal, with another 21 percent identifying it as a secondary goal. In all, 28 (one more than for water quality) identified streambank stabilization as one of their top three project goals. Wildlife habitat improvement ranked far behind as a primary goal (12 percent), but was very highly ranked as a second- (52 percent) or third- tier (36 percent) goal. Overall, 25 respondents identified wildlife habitat as one of their top three project goals.

The remaining two options – flood control/protection and recreation or aesthetics – were ranked far below the first three goals. Only seven respondents ranked flood control/protection in their top three project goals. Only 12 respondents ranked recreation or aesthetics in their top three project goals.

In summary, most of the projects undertaken by our respondents were designed to address water quality improvement and/or streambank stabilization/erosion reduction. Wildlife habitat improvement is very commonly a secondary or tertiary goal of these projects.

Challenges

Respondents were asked to share the biggest challenges they faced when implementing their buffer projects. The question was open-ended, with a narrative comment box provided. Some respondents shared one challenge, while others shared several.
As might be expected, diverse challenges were described. However, themes of challenges emerged, and we used professional judgment to group answers into thematic categories. Themes included funding, operation and maintenance, working

with private land owners, regulatory issues, lack of education, and local government engagement.

Top challenges

The top two types of challenges recorded will likely not be a surprise – securing funding (13 responses) and operation and maintenance of projects (11 responses, although another eight responses were closely related – invasive species and planting survival). Funding challenges included the general challenges of raising funds, a lack of funding for baseline data and follow-up monitoring, and a lack of funding for maintenance (despite requirements that maintenance be done for long periods).

The top two types of challenges recorded will likely not be a surprise – securing funding and maintaining projects.

Maintenance issues were equally varied (and overlapped with funding concerns, as seen earlier) – the general maintenance issues, the challenge of funding on-going maintenance, and challenges with getting volunteers enthused about maintenance. Two other themes were closely related to the maintenance theme – invasive species (four responses) and planting survival (four responses). Problems in these areas included the general never-ending need to be vigilant against invasive species, challenges with irrigating plantings, loss of plantings to wildlife, etc.

Second-tier challenges

Challenges related to working with private landowners were the next most-common issue, with nine responses. The challenges here included finding willing property owners, meeting landowners' expectations with limited funding, coordination of landowner projects (i.e. many sites), and addressing concerns from landowners about "giving up" land to buffers (especially for deeper/wider buffers).

Following closely behind were responses related to wrestling with the regulatory system for permitting activities related to riparian buffer projects (seven responses). These responses appeared to be mainly concerned with issues involving stream alteration, including timing for permits as part of the larger restoration project.

Third-tier challenges

As mentioned earlier, invasive species (four responses) and planting survival (four responses) were fairly common challenges. In addition, the general need to educate the public about the need for and benefits of buffers was raised in five responses, and the challenges of working with local governments that may not see the benefits of buffers or be eager to enforce their own buffer ordinances was also noted (three responses). Other challenges identified by only one or two respondents included volunteer recruitment and retention, targeting buffer placement, the sheer size of the buffer

restoration need, a lack of technical expertise, varying water levels, and partner coordination.

Lessons to share

We next asked respondents to share any lessons they learned that might benefit other organizations taking on a riparian buffer project. Again the survey provided a comment box for sharing lessons and advice. We have grouped the advice under several themes.

Plan, plan, and plan some more

The importance of planning was a clear theme in the responses. From study design to permitting to maintenance, make sure you're planning ahead for a successful project.

> "Plan for your permitting to take longer than you expect." Julie Renter, River Partners

> "NRCS programs and restoration plans need to be integrated with other partners' plans and assessments." Constanza von der Pahlen, Flathead Lakers

> "We did a lot of study and design work prior to implementing restoration for our riparian habitat. We had a good understanding by the time we began of what we needed for a successful project. Being in an arid region, determining shallow groundwater level and planting to that depth has been an important part of high survivorship." Ann-Marie Benz, Prescott Creeks

> "Don't overlook grass/weed control and long-term maintenance. Planting trees is not a plant-and-walk-away activity. You must plan for weed and invasive control. You also must have an aggressive strategy to minimize competition around newly planted trees." Bryan Seipp, Center for Watershed Protection

Build maintenance and monitoring into the very bones of your project

Another very common theme in the responses was the need to think about maintenance and monitoring from the beginning. Respondents stressed the need to have a plan in place for these issues, to secure funding for implementation, and to address the nitty-gritty of working with others to make sure the buffers are protected from mowing or other harmful activities.

> "Develop a sustainability plan beyond your project funding." Rob Hutsel, San Diego River Park Foundation

> "Try to put most of the maintenance and plant establishment effort early on in the project. Plantings seem to do best with at least three years of maintenance to suppress non-native plants until the installed plants become established. Things like seedling protectors and weed matting may seem expensive, but they

cut down on maintenance and increase survival of plantings and overall success of projects." Chas McCoy, Scappoose Bay Watershed Council

"You MUST work with site maintenance people beforehand to ensure that all the hard work is understood so they do not undo all of the improvements." Laura Hardwicke, Tennessee Environmental Council

"Try to secure funding for five years or longer so you can perform monitoring and maintenance after installation." Julie Rentner, River Partners

"The first big lesson was to plant a row of balled root trees at the edge of buffer areas to discourage mowing." White River Partnership
"Long-term sustainability of the project is dependent on having a designated entity that can do regular inspections and follow-up." Elizabeth Riggs, Huron River Watershed Council

Communication is key, and pretty darn tricky
Many respondents provided thoughts on something that is tricky in any context: communication. Advice included creating clear shared goals and expectations, establishing written agreements, and identifying landowners most open to your messages.

"… need to have clear expectations and understanding with partners before beginning work." Shannon Hatch, Tamarisk Coalition

"Make sure everyone is on the same page about the project design and goals. Have all partners sign an agreement that summarizes these goals, tools and budget." Alan Rollo, Sun River Watershed

"Don't pick the project – let the project pick you! Willing landowners are the key to a successful project, so don't bang your head against a wall trying to get somebody signed up that isn't interested. Work with folks that are open to the idea. We've had much success by targeting our initial outreach efforts to landowners who largely have a conservation easement, etc. – they tend to be more open to the idea of planting a buffer." Ron Rhodes, Connecticut River Watershed Council

These things take time, my friend
The bottom line? Be prepared – and plan for – your project to take much longer than you may have first thought.

"Patience. Time. Create committed stakeholders by getting folks directly, on-the-ground involved. Be willing to change your course of action. Find partners. Patience." Linda Lehrbaum, Kansas City Wildlands

"Persistence in completing the project is key." Dennis Regan, Housatonic Valley Association

"Give yourself plenty of time for site preparation. This could take a year or more depending on the condition of the site." Bryan Seipp, Center for Watershed Protection

"It will take a long time and involve many, many government agencies." Robert Emerson, Friends of South Newport River

Volunteers are the answer – or are they?

Interestingly, this was an area of advice with some divergence of opinion. Many respondents focused on how great volunteer help can be for implementing buffer restoration through plantings and other activities. However, others cautioned to make sure you scale your thinking on this topic – really large projects may not be the best endeavors for volunteers. The reality? Look frankly at the size of your project and the size of your volunteer turn-out ability and plan accordingly – don't bite off more than you can chew and end up with a sloppy or incomplete project.

"Corporate groups LOVE volunteering for reforestation projects – it fulfills requirements on their end and they get out of their cubicles …" Laura Hardwicke, Tennessee Environmental Council

"Kids can be a great help on riparian buffer projects! We tend to rely on adult volunteers for our plantings, but we recently teamed up with a fifth-grade science club and it was a great experience. The kids had fun planting and learned a lot about the riparian area, plus it was a good morale booster for the other volunteers to have the energetic and excited young people around." Heather Mullee, Bitter Root Water Forum

"Understand the limitations of volunteer labor. Avoid using volunteers for large projects – using professional tree planters almost always results in a more successful and effective project. If you want to engage volunteers on a large project, use only a small portion of the project site for volunteer planting and do it as early as possible. This will allow you to have the professional contractor go through and check the trees and reinstall as needed." Bryan Seipp, Center for Watershed Protection

Sweat the details

Although buffer projects may seem relatively easy to implement, there are hundreds of details involved in any of these projects. From the planning phase to the maintenance effort, think about the details and bring in expert help if you are at risk of getting in over your head.

"[You]…need to understand hydrology and soils, hard to get plants established without proper soil amending and irrigation planning." Shannon Hatch, Tamarisk Coalition

"Order trees early; inspect planting stock if possible. Don't be afraid to reject bad stock." Bryan Seipp, Center for Watershed Protection

"[You] need a professional restoration ecologist to plan and implement or oversee projects." Constanza von der Pahlen, Flathead Lakers

"We have a great partner who is tops in his specialty. When he retires, we will lose lots of accumulated knowledge and there aren't many in the business to come after him." Nancy Steele, Council for Watershed Health

"Lessees of agricultural land can make or break a project. You can be rightfully negotiating with the landowner and setting everything up, but if you don't take the time to involve the lessee … you could end up nowhere." Callie Moore, Hiwassee River Watershed Coalition

Protection of restored buffers

We also asked respondents if they pursued any sort of permanent or long-term protection of the buffer areas they restored through their projects. Twenty respondents said yes, they made sure the areas were protected post-restoration. Fourteen reported they did not pursue protection, and seven did not respond to the question.

About 60 percent of respondents reported placing some sort of long-term or permanent protection on the newly restored buffer areas.

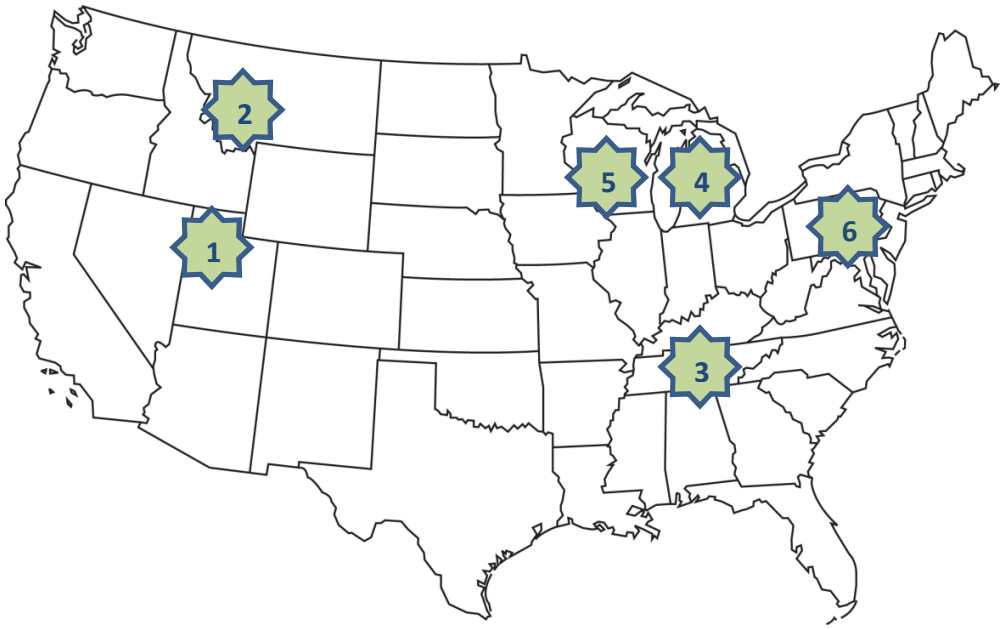
Those who did pursue protection were asked to describe the mechanism(s) they used to make sure the buffers were protected. Placing conservation easements on the restored areas or the more general concept of an "agreement" or contract with a landowner were the most popular responses. In many cases the land was actually leased for a set period of time. Within each of these protective tools, the length of time an area was protected varied – from 10 to 30 years to in perpetuity. The length of time areas were protected was driven by landowner willingness, the programs used to put the protections in place and funding. In a few places, local ordinances or zoning served to protect restored areas.

Several of those who reported they did not pursue protection shared a common-sense reason why they did not – their projects were largely or entirely on public land. Please note that this may not guarantee protection, but in some cases public land ownership may provide long-term protections through plans and other restrictions.

Introduction to six case studies

Pages 16-47 of this report feature six case studies of riparian buffer restoration projects. These projects were featured not because they were "perfect" but because they were representative of different types of watersheds, geographies, restoration goals, and land uses; because the project leaders were willing to share their lessons learned; and because they had at least some measurable results to share.

Although your project may be quite different than most or all of these case studies, there is still much to learn from the experiences of your peers. At the end of each case study, project leaders and others share their lessons learned. After the case studies (on page 48), we summarize some of the broader lessons you should contemplate as you design your own riparian buffer restoration project.



Case Study 1:
Ogden River, Utah

The Ogden River case study provides an example of a comprehensive urban restoration effort, including permanent buffer protection, with goals ranging from flood protection to water quality improvement to economic revitalization.

The setting

The 300-square-mile Ogden River watershed lies along the western edge of the Wasatch Range in northern Utah. The river begins in the mountains and flows through a narrow, scenic canyon. As it leaves the canyon, the river enters residential neighborhoods and then flows into the urban heart of Ogden City. After passing through the City, the river joins the Weber River about 12 miles upstream from the Weber River's final destination – Great Salt Lake.

This story focuses on the mile-long stretch of the Ogden River flowing through the heart of Ogden City. For over 60 years the river here was used as a dumping ground for waste and channelized in an attempt to move flood waters quickly through the city.

Flooding was a regular and dramatic problem. The stretch was identified as impaired (not meeting water quality standards) by the Utah Division of Water Quality.[1] Water quality and habitat in the section was described as fair to poor, and the riparian area was narrow to non-existent.[2] The river's banks were artificially hardened with concrete and car bodies, invasive vegetation filled the riparian area, and bank erosion was a problem.[3] Modifications to flows from an upstream dam and pollution from stormwater runoff were also harming the river.[4]

The approach

For several decades, Ogden City knew reviving the river was a critical piece of reviving the City's downtown. In the early 2000s, the City created a redevelopment zone to reclaim the blighted area.[5] An opportunity for comprehensive restoration came when a private investor who owned several parcels on the river intersected with the

Quick View

Watershed size
Large, approximately 300 square miles. Project addresses a 1.1-mile stretch.

Primary land use
Urban.

Type & extent of buffers
Buffer width was based largely on the 100-year floodplain, generally about 60 feet on each side of the river. Buffer plantings include trees, shrubs and grasses. The buffer area also incorporates recreational trails, recreational access points, and stormwater treatment areas.

Long-term protection
Buffer placed into permanent easements held by the City.

Cost
Approximately $6 million.

City's vision. The developer was interested in redeveloping his properties in the downtown core, and reached out to a consulting firm – RiverRestoration.org – to help gather information required for improvement permits. However, once the discussions began more creative thinking began to take hold and those involved started seeing restoration of the river as core to the idea of redevelopment – a healthy, attractive river would add value to riverfront properties.[6]

RiverRestoration.org coordinated with natural resource managers, Ogden City, land owners, the Utah Department of Natural Resources and the Army Corps of Engineers to develop an organic and natural function vision for the Ogden River. Ogden City became the leader of the project. The consulting group – RiverRestoration.org – did the design and implementation. Other partners included local property owners and developers, Utah Division of Wildlife, Utah Division of Water Quality and the Army Corps of Engineers.

While the project ideas were still in their infancy the recession hit so the developer who was part of the early vision for the project provided valuable easements but did not participate financially. Luckily however, the ideas behind the project lived on and were carried forward through the dedication of Ogden City. The Utah Division of Water Quality had grant funding available and RiverRestoration.org prepared a grant application tackling the Ogden Project. With support from the City and others, funding through the federal stimulus package was secured and the first phase of the project was underway.

The core idea of the project was to create a "property right for the river" – essentially a buffer at least five times the width of the river's floodway.[7] The City took the lead in working with landowners to voluntarily place the buffer area in easements. The incentive for landowners? Largely economic benefit.

Restoring the river to a healthy condition was seen as something that would increase property values, hence increasing the value of a landowner's remaining holdings. The design also provided storm water finishing areas to accommodate future growth of adjoining properties. The economic message worked – all but one landowner has placed an easement on their property. Most of the easements were donated, with just a few purchased by the City.

Buffer depth was based on the 100-year floodplain, so the depth varies based on the terrain. This generally resulted in a buffer of about 60 feet on each side of the river, although factors such as landowner willingness to participate also contributed to variation in buffer depth.[8] Buffer plantings include trees, shrubs and grasses. The buffer area also incorporates recreational trails, recreational access points, and the stormwater treatment areas.

"We really just allowed the river to breathe," says Justin Anderson of Ogden City. "During the tail end of phase one of the project we had a 100-year storm event and even where we had pinch points – water slapping right up to the bottom of bridges – we had no flooding."[9]

Protecting the buffer area was just the start of this project. Massive cleanup of the stretch generated 5,000 tons of concrete and metal, 6,000 cubic yards of other waste materials and entire cars.[10] Fish habitat and bank stabilization structures were installed and 40,000 new plants were planted. The river trail was updated and recreational access points for fishing, picnicking or just relaxing by the water were installed.

"We were really looking for a long-term fix to address water quality problems, flow issues, invasive species, and dumping on the river's banks," says Justin Anderson, City Engineer with Ogden City. "This project was designed to deliver all of those benefits while also providing economic benefits for the city and its residents." [11]

The entire restoration project will cost just more than $6 million.[12] This does not include the value of donated easements.

The results

Water quality monitoring data are not yet available to show the project's results. However, several anecdotal outcomes speak volumes:

- During work on Phase 1, the Ogden River experienced a 100-year flood. Although the project was not yet complete, the newly engineered river and its buffer rode out the huge flood without a hitch, or even a sandbag. In 1983, similar flood flows had wreaked havoc – flooding homes and roadways.[13]

- In 2012, this intensely urban stretch of river was named a Utah Blue Ribbon Fishery. This designation highlights the return of a high-quality fishery and recreational resource to Ogden City.

"We've had widely spread reports of trout spawning and kids swimming, so much so that the river's water quality standards may even need to be strengthened," says Jason Carey of River Restoration.[14]

Lessons to share

- *Baseline monitoring is critically important; funding for on-going monitoring is hard to come by.* Project supporters feel that having baseline water quality monitoring for the project really helped them make the case that the project could have a measurable benefit. However, despite the existence of a detailed

post-project monitoring plan, project supporters have not been able to garner the resources to implement the plan.[15]

- *Economic messages can really work.* Ogden City has already seen a desire by developers and residents who want to be near the river. A new 65-unit townhome project is being constructed and has attracted the attention of many potential buyers who would not previously have considered living in a downtown area. In addition, the development of an additional 15 acres with a mixture of retail and residential uses is now going through the initial steps for approval. The city anticipates this type of renewed interest and development to spread throughout the area where the river has been rehabilitated.

- *Change the discussion about urban rivers from one focused on moving floodwaters through the city to one focused on the multiple benefits a healthy urban river can provide for a city.* This project not only allowed Ogden City to protect the river from the direct introduction of storm water, but it has increased the river's use as an urban fishery with anglers able to freely move up and down the river with multiple access points, has allowed the establishment of a standing wave feature for in-stream recreation with a downstream eddy allowing easy exit from the river, and improved aquatic habitat by removing an old water measurement structure that caused the river to stagnate and replacing it with a USGS measuring device that does not interfere with the river's natural flow.

- *The biggest challenge with this project may not be about property rights or even funding, but rather about the long-term challenge of dealing with invasive species.* The City is tackling the project with volunteers, spraying and other strategies but it is a never-ending fight. Project supporters suggest others tackling a buffer project plan up-front for the cost and long-term investment necessary to battle invasive species.[16]

- *Even where – as here – physical restoration is successful, the hydrology of a system is critically important … and challenging.* Part of the restoration plan for the river involved using existing water rights held by the City to better mimic natural flows for channel maintenance. Without these flows, over time the restoration effort may be stymied. Negotiations continue, but making the changes to in-stream flows will be just as involved as the physical restoration effort.[17]

Case Study 2: Madison River, Montana

This case study features an example of a large-scale buffer restoration effort using a relatively low-tech approach – electric fencing and rotational grazing – in an agricultural setting. Working with just one land owner and a modest budget, the project is allowing natural buffer revegetation along 7 miles of the Madison River in Montana.

Goals

The primary goals of the project are to reduce bank erosion and reverse the loss of riparian vegetation resulting from unfettered cattle access to the Madison River. A secondary goal is more social – to reduce conflicts between recreational users such as anglers and agricultural users.

The setting

The Madison River begins in Wyoming, and flows west and then north through Montana. At a spot known as Three Forks, the Madison combines with the Jefferson and Gallatin rivers before emptying into the Missouri. This case study is set on a stretch of the Madison in southwestern Montana, just upstream of the town of Ennis. The area is largely agricultural, with cattle ranching the primary agricultural activity. The river is extremely popular with anglers.

The approach

The roots of this buffer restoration project lie in another project. The Granger Ranch has been undertaking one of the largest wetland restoration projects in Montana. This project is known as the O'Dell Creek Headwaters Wetlands and Conservation Easement Project (O'Dell Project), and is focused on the restoration of a tributary to the Madison River.[18]

As a result of Granger Ranch's leadership on the O'Dell Project, the Madison River Foundation (Foundation) knew the ranch owners were open to restoration solutions. The Foundation approached the ranch owners in 2009 to start a discussion about management along the ranch's significant Madison River frontage. Although the Madison River is generally healthy through the reach on the ranch, cattle

Quick View

Watershed size
Very large, 1.24 million acres. 7 miles of river were treated.

Primary land use
Agricultural, grazing ranchland.

Type & extent of buffers
Buffer depth of varied, ranging from 10 feet to 100 yards. Buffer depth was driven by the project goal of protecting and restoring riparian vegetation Areas revegetated naturally.

Long-term protection
Agreements with land owners establish a 10-year commitment to protection, with an option for another 10-year renewal.

Cost
$30,000 to $35,000, along with in-kind labor and material contributions.

had unrestricted access to the river, resulting in a loss of riparian vegetation and eroding banks.[19] The solutions envisioned were relatively simple – establishment of temporary electric fencing each grazing season to hold cattle away from the river and implementation of a rotational grazing plan.[20]

Beginning in 2010, these solutions were incorporated into a 10-year project. The project began with a memorandum of understanding (MOU) between the Foundation and the ranch. The simple MOU laid out the expectations for each of the parties and outlined two primary goals: 1.) to preserve, protect and restore the riparian corridor and 2.) to improve the ranch's pasture quality.[21]

Although the Madison River is generally healthy through the reach on the ranch, cattle had unrestricted access to the river, resulting in a loss of riparian vegetation and eroding banks.

As a result of that agreement, each spring Foundation staff and volunteers install seasonal electric fencing along the river. Seven miles of stream are fenced, protecting the riparian vegetation from grazing and the river's banks from degradation. Temporary fencing – a single strand of electric wire – is used for a variety of reasons. These reasons include: temporary fencing is a fraction of the cost of permanent fencing, winter "ice gorges" from the river can knock down permanent fencing, electric fencing is easy to install (allowing for volunteer labor) and easy to move (allowing for establishment of various rotational pasture configurations), and the single strand fence allows wildlife to easily move over or under the fence.[22]

The project applied riparian buffers of varied depth, ranging from 10 feet to 100 yards. Buffer depth was driven by the project goal of protecting and restoring riparian vegetation – where the riparian zone was deeper, so was the area protected. The project did not conduct buffer planting, but rather is allowing the vegetation to reestablish itself naturally.

"Because we were starting out with a pretty healthy riparian area, we were able to allow the system to self-correct," says Richard Lessner, Executive Director of the Madison River Foundation. "Although there were a few problem areas even those were able to bounce back without plantings or other intervention."

The fencing effort is combined with implementation of a grazing rotation management plan developed by a consultant under contract to the Foundation. The consultant surveyed the ranch's 2,000-acre grazing area and found that grazing was concentrated in certain areas, while other areas were ignored. Under the rotational grazing plan, cattle are moved through multiple pastures to create more uniform grazing and allow for plant recovery between grazings.[23] In the project's first two years, the 2,000-acre area was divided into five pastures. In the third year, the area was further subdivided

into 10 pastures to allow for even more subtle management.[24] The cattle are moved on to a new pasture on a schedule driven by the quality of the pasturage, but they never stay more than 10 days in any one pasture.[25]

The rotational grazing has helped improve the ranch's bottom line. Cattle are now kept on better quality grass throughout the season, resulting in better cattle growth. Although some additional work is required of the ranch staff in order to move the cattle, the return is seen as worth it.[26]

"The new approach means the cattle are on better grass, which means more weight on cattle, which translates into better prices for the cattle in the fall. More pounds means more dollars," says Lessner.

One question you might be asking yourself: what about access to water for the cattle? The project was lucky in that cattle can still access O'Dell Creek. This could have simply shifted the problem from the Madison to O'Dell, but dividing up the area for rotational grazing pastures allows the ranch to shift the water access point for the cattle as well – meaning no area of O'Dell Creek becomes a sacrifice zone for concentrated access.[27]

The project is now entering its fourth year. On-going involvement from the Foundation includes regular volunteer days to set up the fence in the spring and remove it in the fall. Volunteers also assist with moving the fence as cattle move through the various rotational pastures. Operation and maintenance investment is small, but not non-existent. Electric fences must be monitored and the ranch staff has taken this task on. The Foundation stays on top of maintenance needs – lightning strikes can take out electric fence, batteries can fade, and chargers can fail.[28]

The project's cash budget to-date has been a modest $30,000 to $35,000. The funds were granted from the Montana Fish, Wildlife and Parks' Future Fisheries Improvement Fund. This budget does not include in-kind contributions of volunteer time, in-kind labor time from Granger Ranch, and material contributions from Granger Ranch.

The Foundation was hopeful that the Granger Ranch project would serve as an example to other landowners along the river, and that already appears to be occurring. The Foundation is currently discussing a similar approach on a ranch neighboring Granger Ranch.[29] The owners of Granger Ranch are sharing their experience with their neighbor, providing peer-to-peer sharing about the investment and results from the project.

The results

The first three seasons of the 10-year project have resulted in significant improvement in the riparian vegetation. Willows and other riparian plants have bounced back quickly, and are now reaching heights capable of shading the stream.[30] The changes have also benefited the ranch, with improved pasturage resulting from the more hands-on management of rotational grazing.[31]

Permanent legal protection was not placed on the buffers. Funding from Montana Fish, Wild and Parks' Future Fisheries Improvement Fund is based on a 20-year agreement with landowners. Because the materials (electric fencing) have a shorter lifespan, the Fund approved a 10-year renewable agreement, renewable for an additional 10 years if all parties agree. The project did not set out to establish legal protections, but hopes permanently improved grazing/practices will be adopted by the ranch as best practices.

Lessons to share

- *Collaborative approaches to restoration open doors if you invest the time and have patience.* The Madison River Foundation's model is focused on finding collaborative approaches to river protection that highlight the benefits a healthy Madison River provides to all users. Although this approach requires a big investment of time to build relationships and trust, it has proven very effective on projects such as this one. Here the Foundation built off of a previously successful project on Granger Ranch, made sure the buffer restoration approach provided benefits to the river and the ranch, and established a good working relationship to keep the project functioning over the long haul.

- *Sometimes the solutions are really pretty simple.* Although restoration projects can be quite technical and expensive, this isn't always the case. In this example, use of temporary fencing and volunteer labor keeps the costs low, while generating a slew of benefits not associated with more expensive permanent fencing. The project was also not overly technical – because buffer protection was put in place before the area was seriously degraded there was no need for engineering-intensive bank stabilization or even vegetation planting and maintenance.

- *Rancher-to-rancher communication is effective.* Although it is still in process, it appears that the Granger Ranch's neighbors are embracing a similar project on their stretch of the river. The neighboring ranch had watched the O'Dell Creek project and the Madison River buffer project with cautious interest, but hadn't been ready to dive into a buffer project themselves. The Foundation has wisely stepped back and let the Granger Ranch owners talk with the neighbors about the project and its benefits, rather than pushing in themselves. Time and again we hear just how effective this type of communication is – we all want to learn from our peers, not some outside "expert."

Case Study 3:
Nashville-area creeks, Tennessee

The Tennessee Department of Agriculture Division of Forestry's Clean Water from Urban Forests Project focuses on restoring forested riparian buffers along streams in Tennessee. This case study tells the story of the Project's pilot area, covering seven small watersheds in urban and suburban Nashville.[32] The Project provides an interesting example of a successful, voluntary effort to work with government agencies and numerous individual landowners in an urban setting to restore forested buffers at a scale that can make a real difference to stream health.

The problem

Urban creeks and rivers often have hard development such as structures or pavement right up to their banks. Even where this isn't the case, urban river and stream corridors are often stripped of their forest cover, leaving them with little or no protection from urban stormwater runoff, their banks prone to erosion, and their channels unshaded, which can warm streams to the point that fish and other aquatic life are harmed. The Nashville-area watersheds involved in this case study were identified by the Tennessee Department of Agriculture's Division of Forestry as creeks where two-thirds or more of their length lacked adequate riparian buffers. This fact made restoration of a forested buffer in these watersheds a high priority for the Division of Forestry's Clean Water from Urban Forests Project (Project).

Goals

The goal of the project's Nashville area pilot work is to enhance water quality by establishing forested riparian buffers to help mitigate stormwater runoff. To achieve this goal, the project has sub-goals of providing technical assistance to municipal planners in priority areas; planting native trees and reducing invasive exotic plants in priority riparian areas; and generally promoting the conservation, protection and enhancement of forested riparian buffers.

Quick View

Watershed size

The project is focused on seven 12-digit HUC watersheds.

Primary land use

Urban

Type & extent of buffers

The width of buffers varies, but 50 feet on each side of the stream is the norm. Buffers are planted with a variety of tree species. To date approximately 15,480 linear feet of buffer have been planted (for a total of about 10.21 acres).[1]

Long-term protection

No legal protection. Participants are asked to protect trees until they reach maturity.

Cost

Approximately $600,000.

The setting

The project's pilot focuses on seven urban watersheds in Nashville, Tennessee – Upper and Lower Mill Creek, Richland Creek, Browns Creek, Hurricane Creek, Stone's River Middle, and Stone's River Upper.[33] All seven watersheds drain to the Cumberland River, which flows to the Ohio River. The extent of development in the focus watersheds varies. Several watersheds are intensely urban, while others have a mix of urban and suburban areas. At least one of the watersheds is still home to some small agricultural areas. [34]

Several of the watersheds are identified by the Tennessee Department of Environment and Conservation as failing to meet water quality standards to protect humans and aquatic life, with problems stemming from too much nutrients and pathogens, pH issues, and habitat alteration.[35]

The Clean Water from Urban Forests project selected the Nashville area as their pilot municipality "…due to its central and prominent location within the state, existing partner resources, dedication to water quality and open space initiatives, and an elevated national profile due to the historical floods that affected Nashville and the surrounding areas in May 2010."[36] The project will use the seven watersheds in Nashville as a case study to help promote the ideas and lessons learned in other communities around the state.

> "… word of mouth made the project succeed – volunteers at tree plantings and the Project's partnership with local non-profits involved in the planting events were the most important successful audience"

The approach

As mentioned earlier, the seven watersheds were targeted based on a variety of factors, including their current lack of buffers and the existence of strong partners. Within the watersheds, the project selected restoration sites using a mix of proactive targeting and reacting to opportunities. To identify priority restoration sites in the first year of the project (2011), staff overlaid their seven watersheds with the Metro Nashville Open Space Plan to see where priorities overlapped. These sites were public lands, so with Metro Nashville as an active partner, buffer projects could move forward relatively quickly and show on-the-ground results in the first year.

In the second year of the project (2012), staff began to shift to working more with private landowners to install buffers. The Project used all the classic outreach strategies – media work, community meetings, distribution of a brochure, tables at the state fair, signage at completed projects, and more. Staff noted that the most useful outreach tools were the media work – coverage was extensive and positive, the website (with

strong promotion via Facebook and other means), and direct outreach to volunteers who came out to plant trees. In the end, it was really word of mouth that made the project succeed – volunteers at tree plantings and the Project's partnership with local non-profits involved in the planting events were the most important successful audience for identifying new project sites and participants.

Once landowners were interested, staff offered them three key types of support: education about the benefits of restoring riparian buffers, technical assistance in planning the buffer, and trees for planting.

The Project's education work focused on sharing the benefits of restoring riparian buffers and on the how-to for restoring your own property. The Project got this message out through its brochure and its website, but the best education opportunities were at the planting events. Volunteers were briefed about not only what they were doing, but why. In addition, the Project is planning to install its first education kiosk at a restoration site near a local library branch and a popular playground. The kiosk will include interpretive signs explaining the restoration and its benefits, as well as a list of books available at the library for learning about rivers, buffers and more.

Technical assistance on designing and installing the buffer is central to the project's services. The specific buffer design is driven by site-specific issues (soils, etc.) and landowner preferences. Generally speaking, the project strives for 50 feet or more of buffer on each side of the stream and provides a site-specific tree planting plan focused on encouraging the proper species and planting density for the site.[37] Only native species are installed.[38]

The project then provides landowners with trees to make the buffer design a reality. Originally the project had planned on providing large tree stock for planting in order to create a quick, very visual change in the landscape. However, the project has shifted to using smaller, year-old stock because these trees are much easier for volunteers to plant and the cost-savings are significant.

This project installs forested buffers. The specific buffer design is driven by site-specific issues (soils, etc.) and landowner preferences. Generally speaking, the project strives for 50 feet or more of buffer on each side of the stream (30 feet is generally the minimum) and provides a site-specific tree planting plan focused on encouraging the proper species and planting density for the site.[39] Only native species are installed.[40]

After buffers are in place, the project Coordinator conducts regular site visits to check on planting success, identify maintenance needs, and offer advice to the landowner as needed. Approval for these visits is included in the agreement that land owners sign when they are joining the project.

Signage is used to educate about the protected buffer and its benefits. The signs may also help prevent harm to the new plantings from mowing or other activities.

This project relies heavily on a diverse group of partners from local government and non-profit organizations. Governmental partners include Metro Nashville Government, Metro Water Services, Tennessee Department of Environment and Conservation, Tennessee National Guard, LaVergne Parks and Recreation, and others. Non-profit partners include Tennessee Environmental Council, Cumberland River Compact, Harpeth River Watershed Association, Richland Creek Alliance, Land Trust for Tennessee, SoundForest.org, Hands on Nashville, Tennessee Wildlife Federation's Great Outdoors University, Girl Scout and Boy Scout troops, and many others. The project was funded by a grant from the USDA Forest Service, making them an important partner.

The project is funded through a grant from the USDA Forest Service. The fiscal year 2011 grant provided $300,000 over the course of three years, and required a one-to-one match for a total project budget of $600,000. Match sources included the Division of Forestry (which hired a part-time project coordinator), the Land Trust of Tennessee (which provided mapping services), the City of Nashville, and volunteer time.

The results

The Division of Forestry is not conducting water quality monitoring on this project, but rather is relying on literature reviews to show that restoring forested buffers improves water quality and stream stability. The Project is tracking detailed numbers to measure their impact in other ways. See the chart below for results as of April 29, 2013.

Clean Water for Forest Results To-Date[41]

Total Individual Projects	46
Total Planting Sites	18
Total Trees Planted	10,889
Total Feet of Buffer Planted	15,480
Total Acres Planted	10.21
Total Seedlings Potted	3,035
Total Volunteers	848
Total Volunteer Hours	2,530.50

Lessons learned

The project staff have many insights to share with others contemplating a similar project.[42] Some of the following lessons apply specifically to urban buffer projects, but many will be useful to anyone working on buffer restoration efforts:

Planning ahead is critical.

- Underground and overhead utilities along many urban streams will limit the buffer planting area, and their locations and restrictions must be determined well in advance of final buffer planning. Mark these areas in the field prior to planting.

- Potential planting sites should be identified the summer prior to planting season, and all necessary approvals should be completed prior to planting season.

- A careful analysis of each potential planting site must be made prior to final project planning to determine if neighbor notification is warranted (door to door, door hangers, mailings, site notification signs, neighborhood meetings, etc.). If so, notification must be completed prior to final site planning.

- Management of seedling inventory can be difficult. Bare-root seedlings are shipped in bags, and a cool, dark storage area must be identified prior to ordering. Seedlings must be kept cool and away from light, and should not be stored longer than one month. Do not order more seedlings at one time than can be planted in one month. Seedlings stored incorrectly, allowed to dry out, or stored too long may not survive.

- A primary objective of this project was to maximize the number of stems per acre. As a result, they planned for a high density planting of bare-root seedlings, with some balled or container trees and shrubs used to establish an “edge" or “visual screen” if needed.

- Focus primarily on long-lived overstory species, as many shrubs and light-seeded pioneering species will come up on their own.

- Consider using native species that flower, fruit, and have good fall color along the outer edge of the buffer, including some 1 inch caliper trees along the outer edge to establish an early screen and to define the edge of the planting.

- Test a few random planting holes on a site prior to final planning to determine if a site is going to present difficulties in digging due to rock, clay, excessive tree roots, etc. Sites that are more difficult to dig should be matched up only with adults, while sites that are easier to dig can be matched with youth or adults.

If you are using volunteers to implement your plantings, make sure you’ve set up a structure for success.

- Don’t overestimate the number of volunteers that will be available and the number of seedlings that can be planted on a given day (est. 6 bare-root seedlings/hour/volunteer).

- An adequate number of supervisors (one supervisor per 10 volunteers) should be trained in advance and be available for each planting project. Issues to watch closely for include: seedlings not being planted deeply enough, being planted too far apart, or being planted too close together; seedlings being exposed to direct sunlight while waiting to be planted; seedlings being planted outside the planting area (i.e. planted in utility exclusion areas or outside planting boundaries), and not mixing species appropriately.

- Planting sites that are difficult to access should be matched up with adults, while sites that are easy to access and have nearby accessible restrooms can be matched up with youth or adults.

<u>Urban buffer projects will likely need to incorporate some special considerations</u>

- Invasive exotic species often are the dominate vegetation along most urban buffers, and can be difficult to address. Removing invasive exotic species from the bank of a waterway is most likely beyond the scope of a typical riparian buffer project and may result in destabilizing the bank. However, such species within a planting area but not immediately on the bank should be removed if resources permit.

- There will likely be some vandalism to seedlings, trees and signs at sites near heavily used public areas like parks, ball fields, and playgrounds.

- In many cases, plantings in urban riparian buffers are more likely to be on dry sites than wet sites due to deeply incised streams and fast drainage. Therefore, species that can tolerate dry sites and occasional short-duration flooding should be selected.

- Urban areas can mean projects face extensive structural restrictions (e.g., roads, buildings) on buffer placement and size. Overhead and underground utilities in can also be an implementation concern in urban areas.

Case Study 4: Cedar Creek, MI

The Cedar Creek project provides a good example of a project strategically built on existing restoration planning, allowing a modest project budget to result in relatively large-scale buffer restoration.

Goals

The project goals were to restore in-stream habitat and mitigate alterations in the stream corridor resulting from both human and natural activities.[43]

The setting

Located in north-central Michigan, Cedar Creek is a major tributary to the Muskegon River. The Cedar Creek watershed is generally divided into three sections: The lowest third of the watershed is the least developed, the middle third is residential, and the upper third is largely in agricultural production.[44] Cedar Creek is a sandy-bottomed stream, and is home to native brook trout, rainbow trout, steelhead, and Chinook salmon.[45]

The Michigan Department of Natural Resources (DNR) Fisheries Division conducted an assessment of the Muskegon River watershed and found three types of problems plaguing the river and its tributaries: excessive sediment bedload, loss of riparian vegetation, and a lack of in-stream habitat.[46] As a result, Cedar Creek was identified as a priority area for a stream habitat assessment and follow-up improvements that could benefit the larger Muskegon system.

The resulting assessment and improvement plan provide restoration recommendations for seven identified reaches of the creek. This case study focuses on work done in reaches 4 and 5, near the middle of the creek's length. Recommendations for these reaches included creating additional in-stream cover through restoring undercut banks and placement of large woody debris, and increasing channel shade and riparian diversity.[47]

Quick View

Watershed size
A medium-sized watershed within the larger (2,700 square mile) Muskegon River watershed.

Primary land use
A mix of agricultural, residential and undeveloped. The project site is in both a residential area of the watershed and Manistee National Forest.

Type & extent of buffers
Generally 100-foot, forested buffers were used. Tree-plantings were made up of varied native mixes of species, and planting densities were driven by various formulas.

Long-term protection
On private land via 10-year maintenance plans; on USFS lands via normal USFS management.

Cost
The project's budget was $61,222.

The approach

This project was inspired by the improvement plan developed by the Timberland Resource Conservation & Development Council (Timberland RC&D), and focused on implementing that plan's recommendations. Priority sites for restoration were selected using a variety of filters. First, the project focused on two key reaches as mentioned earlier. Within those reaches, the project supporters selected two types of specific sites: one working on public U.S. Forest Service lands and one on private lands.

For the U.S. Forest Service lands, restoration areas were selected in consultation with Forest Service staff. On private lands, site selection was pragmatic – first using aerial photographs to search for areas that were void of canopy and then finding willing landowners within those areas.[48]

Project partners were a critical part of site selection. The U.S. Forest Service stepped up as a partner. In addition, the Assembly brought in the Muskegon Conservation District to work with private landowners. The District had existing relationships in the area, and was central to the successful outreach with landowners. Under an agreement with the Assembly, the District did all the legwork and meetings with landowners, as well as establishing maintenance agreements and contracts. The District also implemented fieldwork installations on both private and public lands.

> The project treated approximately 19 percent of the total length of Cedar Creek, planting 11,000 seedlings.

"The Assembly doesn't do anything by ourselves, we always look to engage partners," says Gary Noble of the Muskegon River Watershed Assembly. "We're always looking for partners who can help us make a better project by contributing their financial strength or knowledgeable people. Funders also appreciate good partnerships, so this can translate into real dollars."[49]

Once the sites were selected, a variety of restoration practices were designed. The improvement plan had identified the need for in-stream work as well as riparian buffer restoration, and each site required a unique mix of practices. On the riparian buffer restoration front, the project implemented approximately 100-foot-wide buffers, planting a mix of native tree species. The mix and the density of the planting varied depending on the sites – the U.S. Forest Service had their own requirements for mix and density while the private land sites' density was driven by the specifics of the site and a formula from the District. The project used professional planters for the installation.

The riparian buffer project treated approximately 19% of the total length of Cedar Creek – creating approximately 11 acres of riparian buffer.[50] This means buffers were created

along roughly 4,790 linear feet of stream. Approximately 11,000 seedlings were planted in this area by Muskegon Conservation District staff.[51]

On private land sites the buffers are protected under 10-year maintenance plans which require landowners not disturb plantings for the duration of the plan.[52] On USFS lands the project relies on the USFS to protect the buffers as part of their normal management planning.[53]

The project's budget was $61,222.[54] About half ($28,400) of the funds came via a 2011 National Fish and Wildlife Foundation Sustain Our Great Lakes grant to the Muskegon River Watershed Assembly.[55] Match dollars for that grant came from the Great Lakes Fishery Trust ($19,278), Muskegon Sport Fishing Association ($3,500) and the Muskegon Conservation District ($10,044). In addition, the USFS provided in-kind support through pre- and post-project fish surveys.

The results

The majority of the project work was completed in the late summer and fall of 2012, with an additional 2,000 trees planted in early spring 2013. As a result, data is not yet available on water quality or habitat trends resulting from the project. This fall the District will do some initial monitoring of tree survival rates, and the U.S. Forest Service has added the project to its rotating electro-shocking (fish count) monitoring schedule for 2015/2016.[56]

Lessons learned

- *Start thinking about project partners early.* Identifying the right partners means you can enlarge your project – perhaps beyond what you alone can imagine or do. Think early on about the variety of skills partners might bring to the table. Consider technical skills, academic knowledge, financial capacity, land-owner relationships, and more.

- *Existing plans and data may provide most or all of what you need to target and implement your work.* Many of the case studies in this report included fairly resource-intensive planning and targeting as part of the restoration effort. This project shows how well a project can be built out from existing plans and resources, and how much that can help with the size of the project budget. Never overlook the need for good planning, but be sure to be strategic and look for project opportunities that allow you to leverage planning work already complete. Of course, project leaders still had to find the willing landowners and design the specific practices, but the why and the general where and what were already outlined in watershed plans.

- *Beware of funding surprises.* Every project will have its special fundraising and finance challenges. In the case of this project, the Assembly received Sustain Our Great Lakes funds which, as federal funds, carried with them specific procedural requirements. These included a "Section 106 review" – an examination of the project's possible impacts on historical sites. The Assembly was not initially aware of this requirement and found that the review (i.e., archaeological survey) could cost more than the entire project! Luckily, the Assembly worked with their partner – the U.S. Forest Service – to use a previously conducted historical survey to save the expense. The lesson? Every project is special and each funding source is unique … make sure you are aware of all the possible curve balls!

- *Long-term protection of newly restored buffers can be built in on public lands projects.* One – although certainly not the only – reason the Assembly included U.S. Forest Service lands in their priority restoration areas is the fact that the newly restored buffers would receive long-term protection under the Service's management plan. Those planning projects might consider adding this idea to their list of prioritization factors to help ensure the restoration sticks. (On the other hand, never assume public lands will automatically be protected. Whether you're working with a local park, a federal agency or any other public entity, make sure you understand their long-term management vision and requirements.)

Case Study 5: Pecatonica River, WI

The Wisconsin Pecatonica project provides an example of a project in year seven of measuring the outcomes of targeting buffer restoration and related practices to provide the greatest pollution reduction in a 12,000-acre watershed.

Goals

The goal of the Pecatonica project is to reduce sediment and nutrients (especially phosphorus) running off farm fields and into the creek. It is striving to target conservation practices to the fields and pastures contributing the most nutrients to the watershed – piloting approaches to get the biggest "bang for the buck" in terms of nutrient-reduction practices.

The setting

The Pecatonica River watershed is located in the Driftless Area of south-western Wisconsin. The Driftless Area was bypassed by the glaciation which scoured most of the state, so the region is home to steep valleys, bluffs and ridges unique to the area. Famous for its spring-fed creeks and trout fishing, the Driftless is also home to many rare species found within the prairies, grasslands and oak forests. The creeks and rivers of the Driftless drain ultimately into the Mississippi River. This project focused on two sub-watersheds within the Pecatonica watershed – one control and one experimental. The experimental sub-watershed is home to Pleasant Valley Branch. About 50 percent of the watershed is agricultural.[57] Farmers raise dairy and beef cows, as well as row crops.[58] The creek is listed on Wisconsin's impaired waters list (i.e., 303(d) list) as impaired by degraded habitat as a result of nonpoint sources of sediment.

Quick View

Watershed size
12,000 acres, a HUC 12 watershed.

Primary land use
Agricultural, row crops and pasture grazing.

Type & extent of buffers
Width of 10-100 feet based on site-specific factors (e.g., slope, soils) and farmer willingness to devote land. Some buffers planted with a non-native mix, others with a native mix.

Long-term protection
Two miles of streambank buffer placed in conservation easements.

Cost
To date, approximately $1.2 million. This includes efforts in the test watershed – Pecatonica – as well as monitoring in a control watershed.

The approach

The project was made up of several key stages: partnership formation, baseline data

collection and prioritization, and implementation. Monitoring and research activities are an important part of the project.

The partnership formed in 2006. Partners included The Nature Conservancy, U.S. Geological Survey; University of Wisconsin; Wisconsin Department of Agriculture, Trade and Consumer Protection; Wisconsin Department of Natural Resources; Wisconsin USDA Natural Resources Conservation Service; Dane Count Land Conservation Division; Green County Land and Water Conservation Department and the Iowa County Land Conservation Department.

The partnership's vision for the project was driven in part by interest all around the state in targeting riparian buffers rather than making all farmers buffer the streams running through their lands. The hypothesis was that targeting a few farm fields with buffers and with practices on the upland fields and pastures would be a better approach to address phosphorus pollution. From 2007 through 2009, the project focused on collecting data from the two targeted watersheds and using that data to prioritize fields and farms for treatment.[59] This stage of the project included inventorying 62 farms in the Pleasant Valley Branch watershed. The inventory included interviewing farmers about their management (e.g. crop rotations, manure managing, etc.) and soil sampling to identify phosphorus levels in individual fields.[60]

The partnership analyzed the watershed and found that 15 percent of the acres were delivering about 33 percent of the entire phosphorus load to the stream.

The goal of this work was to identify the fields contributing the most phosphorus and sediment to the creeks. The project used the Wisconsin Phosphorus Index (WPI) as their measuring stick. Using soil sample test results, one can calculate the amount of phosphorus, in pounds per acre per year, which will run off a farm field and into a stream. For example, a WPI of 6 means that 6 pounds of phosphorus per acre per year can be expected to leave the field and enter a local creek. The project's monitoring will help the state of Wisconsin determine if the WPI value, be it a value of 3 in some parts of the state or a value of 6 in others, can be a good tool to target efforts.

Using this information and other data, the partnership working on the Pecatonica River project analyzed the watershed and found that 15 percent of the acres were delivering about 33 percent of the entire phosphorus load to the stream.[61] This provided a clear way to prioritize farm pollution reduction efforts, and allowed the project to focus on just 10 of the 62 farms in the watershed. The farms were chosen based on fields with a WPI of more than 6, as well as a calculation of the total phosphorus from the next group of targeted sources (e.g. fields with WPI of 3-6, runoff from lots, etc.).

The project next moved to implementation. What was tackled in each phase was defined by the WPI index of the specific fields and by whether the treatment prescribed was "soft" or "hard." The project defined soft practices as management changes such as converting to no-till or developing a Nutrient Management Plan. Hard practices were defined as higher-cost, construction-related activities, such as stream restoration or treatments for barnyard runoff. The phases broke out as follows:

- Phase 1 (2010): Focused on soft management changes in fields with a WPI of more than 6.
- Phase 2 (2011): Focused on soft management changes in fields with a WPI of 3-6.
- Phase 3 (2011-2012): Focused on installing higher-cost hard practices to address remaining issues.

Riparian buffer establishment was only one in a suite of practices implemented in this project. Management changes made and practices installed included conversion to no-till, development of Nutrient Management Plans, barnyard runoff control systems, livestock crossings, livestock exclusion and stream habitat restoration.
Buffers came into play as part of excluding livestock from the stream and in the miles of bank stabilization work, box elder cutting and bank sloping done along streams in the test watershed. The project fenced cattle out of five miles of stream.[62] On more than a mile of stream, the project stabilized stream banks, planted grass and removed box elder trees after excluding the livestock. Buffer depth varied from 10 to 100 feet, depending on factors such as field slope and farmer willingness.

The cost of the project to date is approximately $1.2 million. The budget includes costs for staff time, producer cost-share on practices installed, soil testing, water quality monitoring, research components, and more.[63] This sounds like a lot, but remember that the project had to analyze and monitor two watersheds (the control and the test). Also, because the project is piloting new ideas and methods, it has required exceptionally rigorous data collection and documentation.

Funding sources included the Monsanto Company, the McKnight Foundation, U.S. Geological Survey, USDA Natural Resources Conservation Service, a United States Department of Agriculture research grant and the Wisconsin Department of Natural Resources. A large chunk of funding – $620,000 – came through a Natural Resource Conservation Service grant using funds from the Environmental Quality Incentive Program (EQIP).[64]

The results

The Pecatonica project gathered extensive baseline data before restoration implementation began. Starting in 2006, the U.S. Geological Survey, Wisconsin Department of Natural Resources and the University of Wisconsin-Madison monitored for phosphorus and suspended sediment at the watershed outlets, while also

conducting fish and invertebrate surveys and collecting core water quality data.[65] Also, work addressing the contribution of phosphorus stored in the stream banks is being done to estimate what the 'lag' effect would be of phosphorus already stored in the stream banks and stream bed. This legacy impact of agricultural practices must be accounted for and the time frame of when one can expect to see results must be adjusted accordingly.

It is too early for firm water quality monitoring results, but the project has already proved the benefits of investing in monitoring and analysis to identify target areas for buffer restoration projects – by targeting just the critical portions of the watershed, the project will be much more efficient than if it had tried to treat the watershed through a scattershot approach. As of early 2013, the project had treated 80 percent of the priority acres in the watershed, and work on the remaining priority acres continues.[66]

Monitoring stations in both the treatment (Pleasant Valley) and the control watershed will provide very useful and interesting data in future years to everyone engaged in buffer restoration as a strategy for phosphorus and sediment reduction.

Lessons learned

- *A relatively small portion of your watershed may be creating a large part of the problem, allowing you to target efforts. Invest upfront in understanding the nuances of your targeted problem to make sure you're also investing in the right places and practices.* In this case study, the partnership found that 15 percent of the watershed was delivering about 33 percent of the pollutant load. Clearly, these areas were the highest priority for action and would deliver the "biggest bang" for the restoration buck.

- *Investing in baseline or pre-project monitoring will help tell the story of progress and success later.* As mentioned earlier, this project is set up with a control and a test watershed with extensive and on-going monitoring in both watersheds. This type of investment may not be possible – or even necessary – with most projects. However, spending the time and resources as appropriate to establish good pre-project data on the parameters related to your restoration goals will pay off when it comes time to talk about return on restoration investment.

- *Working with existing funding and Farm Bill programs is important, but diversifying funding with other sources is equally important for laying good groundwork.* This project benefited from large and diverse funding. The project leaders note that the Farm Bill programs are critical for the actual on-the-ground work. Steve Richter of The Nature Conservancy says: "Groups should be able to use existing state's EQIP dollars and make this kind of implementation

happen."[67] At the same time, the project benefited from corporate, foundation, and state agency funding, which allowed for the extensive monitoring, planning and outreach necessary for success.

- *Remember that watersheds and land use are dynamic.* For example, in this project 800 acres of what was Conservation Reserve Program land in the test watershed is now in row crops. As your project is implemented, stay aware of changes in the watershed and be prepared to be nimble – you may need to rethink your priority target areas, your partners, your buffer restoration design, or your entire approach.

- *Buffer restoration will often work best in concert with other practices.* In this story, a whole suite of on-farm practices and stream restoration work came together with buffer restoration. The stream restoration work was particularly important to make sure that restored buffers were able to establish themselves and hence provide the pollution reduction services hoped for under the project goals.

- *Listen to what farmers say for solutions that will work on their farms.* Steve Richter of the Nature Conservancy stresses this point time and again when he discusses this project. Don't approach your project with a one-size-fits-all vision. Talk with the farmers to understand their operations and how buffer restoration might fit in, ask about other practice changes they might consider, and listen, listen, listen.

Case Study 6: Pierceville Run, Pennsylvania

The Pierceville Run case study provides an example of a classic riparian buffer and stream channel restoration project that benefited from having extensive pre- and post-project monitoring. This provides an excellent insight into the kinds of benefits achievable with projects of this type – including the official removal of the project area from the state's list of impaired waterways.

Goals

The goal of the Pierceville Run project was to reduce sediment and phosphorus runoff into the stream in order to meet water quality standards for aquatic life use.

The setting

Pierceville Run is a small headwater stream within the larger South Branch Codorus Creek watershed in southeastern Pennsylvania.

The Run is designated as a cold-water fishery by the Pennsylvania Department of Environmental Protection (PADEP). However, several studies showed that the stream was impaired by siltation and flow alterations.[68] In 2002, PADEP included 9.7 miles of the Run (including 5.81 miles of the main stream and 3.9 miles of tributaries) on its list of impaired waters.[69]

Agriculture is the primary land use in the watershed, including both cropland and pastureland. PADEP's list of impaired waters identified the Run's source of impairment as siltation from agricultural sources. Studies found that both cropland and pastureland were contributing large nutrient and sediment loads to the Run, and livestock had damaged the streambanks to such an extent that the banks were eroding at a rate of 1.5 feet per year.[70]

Quick View

Watershed size

Small, Pierceville Run is a headwater tributary within the larger 72-square-mile South Branch Codorus Creek watershed.

Primary land use

Primarily agricultural.

Type & extent of buffers

PADEP's recommended three-zone, multi-species buffer. This buffer includes a tree, a shrub, and a grass zone. Depth of the buffer varies, but typically ranges from 35 to 100 feet.

Long-term protection

Restored buffer areas were provided with 10 years of protection through the Farm Bill's Conservation Reserve Enhancement Program (CREP).

Cost

Pre-project costs were $142,922. Implementation costs were approximately $535,888.

The approach

Much of the story of the Pierceville Run project is driven by the impairment identified in 2002. As a result of the stream's addition to the impaired waters list, Pierceville Run was part of a larger Total Maximum Daily Load (TMDL) or restoration plan developed in 2003 for the South Branch watershed. That TMDL set pollution limits for sediment and total phosphorus loads in the watershed, and in Pierceville Run. In addition, in 2007 a watershed implementation plan (WIP) was developed for the Codorus Creek watershed.[71] This WIP identified Pierceville Run as impaired by streambank erosion, and recommended streambank stabilization, livestock exclusion and the establishment of riparian buffers as solutions.

As a result of all these plans, interest in restoring Pierceville Run was high and partners – including Izaak Walton League, York County Conservation District and the Pennsylvania Department of Environmental Protection (PADEP)– came together to develop a restoration project for the Run. Other active partners included the United States Department of Agriculture, the Aquatic Resource Restoration Company and the Pennsylvania Department of Transportation. In 2006, work on the project got underway. The Pierceville Run project had two main components: natural steam channel restoration and forested riparian buffer re-establishment.

The natural stream channel restoration effort addressed 2,272 linear feet of the stream. This section had been identified by the Watershed Implementation Plan as important for achieving the TMDL's goals. The section was also home to willing landowners who embraced the restoration goals. In part this was because the area was bottom wetland pasture – not as valuable as some cropland and hence easier for the farmers to consider taking out of production.[72] The channel work included grading and stabilizing streambanks and installing in-stream rock structures. This work was designed to stop erosion of the streambanks, reconnect the stream to its floodplain and generally improve aquatic habitat.

Once the channel work was complete, extensive riparian forest buffer restoration was conducted along the entire restored stretch. The buffer work included planting grasses, forbs and 600 trees. Fencing was also installed in pasture areas to exclude livestock and hence protect the buffer and the restored streambanks.

This project benefited enormously from extensive baseline data collected before restoration, and from an on-going investment in monitoring from the state agency. Monitoring efforts included pebble counts, macroinvertebrate sampling, habitat assessments, and water chemistry testing. For more on the findings, see the results section.

Pre-project costs included a $142,922 Clean Water Act Section 319 grant secured by the Izaak Walton League in 1999 to assess the watershed's restoration needs. For project

implementation, funding included: $356,888 from an Izaak Walton League 319 grant[73]; $25,000 from PADEP and the U.S. Department of Agriculture's Conservation Reserve Enhancement Program (CREP); $2,000 from the Izaak Walton League; $52,000 from the Aquatic Resource Restoration Company and $100,000 from the Pennsylvania Department of Transportation (for work near roadways).[74]

The results

The results from the Pierceville Run project are compelling. Sediment loads to Pierceville Run have been reduced by an estimated 39 percent – that's 1,400,000 pound per year![75] How much sediment is that really? Imagine about 56 dump truck loads full of dirt that would have otherwise entered this small stream annually. The sediment reduction is approaching the TMDL's goal of a 42-percent reduction. In addition, total phosphorus loading has been reduced by 39 percent – a significant contribution toward the TMDL's 87-percent reduction goal.[76]

> Sediment & phosphorus loads to Pierceville Run have been reduced by an estimated 39 percent.

The results of habitat and water quality monitoring are even more compelling. For example, in 2011 PADEP conducted an aquatic habitat assessment in the restored section of the Run. The assessment resulted in an Index of Biotic Integrity (IBI) value of 71.3, which places the stream comfortably in the healthy and unimpaired aquatic ecosystem category.[77] In fact, this data caused the PADEP to remove the lower section – the restored section – of Pierceville Run from its list of impaired water bodies.[78] The upstream and untreated sections of the Run remain impaired.

On a more qualitative level, the results are just plainly visible. Gary Peacock of the York County Conservation District visited the site this summer and says, "It just looks great. The willows and shrubs have matured, and some trees are approaching 20 feet tall. In some places the canopy is even starting to close over the stream."[79]

Lessons learned

- *Buffer restoration efforts don't exist in a vacuum – be sure to think through how buffers mesh with other restoration needs.* In this case, many streams in the region were historically home to dams and millponds. Although the dams are largely gone, the sediments that build up in the millponds change the structure and stability of creeks' channel banks. In this project, it was critical to first restore the stream channels and then restore the riparian buffers. In other projects, buffers had been planted only to have the new plantings disappear as unstable banks made up of loose sediments sloughed away.

- *Prioritize your focus areas for buffer restoration in several ways.* In this project, extensive planning under the TMDL and WIP process had identified priority stream areas for restoration. This prioritization focused largely on getting the largest pollution reduction possible. However, project supporters found that other factors – such as the willingness of landowners to participate in the project – had to be layered over the technical factors to identify areas with a big return in pollution reduction where a project really had a chance to take hold and succeed.

- *Be smart about partnering with others to reach out to landowners and others.* In this case, the PADEP found that a partnership with the York County Conservation District and the Izaak Walton League Association was critical. "The District and the League were heavily involved in outreach in the watershed," says Scott Heidel with the PADEP. "They have the time to do meaningful outreach and relationships with people in the watershed that are so critical to success."[80]

- *Know that outreach to landowners is going to take time and patience.* Gary Peacock of the York County Conservation District stresses this fact:"You really have to work person by person to break though. We can have all kinds of plans and priorities but it really comes down to finding a willing landowner and the money to make a project happen."[81]

- *Understand the barriers you may be facing with buffer adoption.* People will have diverse reasons to resist the idea of a buffer project on their property. Some reasons may be obvious, others may not be so clear to you. As you approach landowners, ask them about their concerns or hesitations and start from there. Gary Peacock of the York County Conservation District described a range of reasons to resist buffers he's come across – from a desire to see the stream from their home or the urge to have a perfect lawn in residential areas to resistance to the idea of buffers as "messy" from older farmers trained to strive for "clean and green" on their farmland. Of course, money is also often part of the issue – particularly in agricultural areas where good cropland may be at a premium. The lesson, though, is clear: Ask and listen and design your approach to address people's concerns.

- *Think about maintenance for your riparian buffers right from the beginning.* The consultant involved in the project -- Aquatic Resource Restoration Company – has been involved in many similar projects and stressed the need for a real plan for maintenance. "Volunteers can follow up with some basic maintenance but it is a big and long-term job, and funding for this work is really hard to come by,"

says Lee Irwin of the Aquatic Resource Restoration Company. Irwin suggests creativity may be required. For example, they encourage landowners to enroll the newly restored buffer lands in the Conservation Reserve Enhancement Program (CREP), which provides long-term protection for the areas and requires maintenance for the critical first years of revegetation.

Wrap up:
Concepts to Consider in Your Own Projects

Every riparian buffer restoration project is different, but some general themes emerge from the survey and from the case studies featured in this report. Themes or lessons for any riparian buffer project proponent to ponder include:

- Be explicit about your goals, and tailor both the specifics of your buffer design and your strategies to address those goals.
- Planning is critical to success.
- Riparian buffer projects rarely stand alone.
- Thinking about maintenance from the beginning is critical to success.
- Urban riparian projects have special considerations and – guess what – so do projects in agricultural areas.
- Long-term protection of restored riparian buffers can be challenging, but is by no means impossible.

We provide a brief overview of each of these lessons below. Remember, these are general ideas and recommendations, and should be interpreted within the reality of your goals and your watershed. Also, check out the related lessons at the end of each case study and in the survey's lessons learned results on page 9 to learn more about each theme and specific examples of how each of them has played out in real projects.

Be explicit about your goals, and tailor both the specifics of your buffer design and your strategies to address those goals.

The collection of case studies here illustrates an important point: Every buffer restoration project is different. This is true for many reasons, but a central reason is that how you approach your project depends on what your goals are.

In fact, pretty much every single question you have about how to implement your buffer project depends on what your goals are. You may ask: Where are the critical areas for buffer restoration in my watershed? How wide does the buffer need to be? What plants do I need to establish in the buffer? How expensive will the project be to implement? How should I monitor my project and define success?

But until you're clear on your goals, the answer to your questions will be a frustrating "it depends." There is no one-size fits-all system. As you read through the case studies in this report, think about how the project goals mesh with your own. How did that drive the decisions the project managers made? Were there other drivers as well (for example, soil types or funding issues)?

Think very specifically about your goals. Are you trying to improve water quality (if so, what parameters are you trying to effect)? Wildlife habitat? Flood water retention? Once you have an idea about your goals, spend the time to learn more about how buffers can really help achieve those goals and what might limit the usefulness of buffers. Can those limitations be mitigated or overcome all together by pairing buffers with other best management practices or restoration approaches?

> The answer to pretty much much every single question you have about how to implement your buffer project depends on what your goals are.

Planning is critical to success.

This is such basic advice that it might be tempting to skip over it. But the investment in planning your project cannot be overstated. As you read through the case studies, notice how much work was invested up front to ensure the projects were successful. In some instances, like the Cedar Creek case study, the project benefited from planning work done previously by others and then project proponents built on that foundation. In other examples, such as the Pecatonica case study, the project team literally invested years in monitoring, targeting priority fields and other critical planning work.

The scale of planning and the specific elements of the plan will vary with each project. However, basic planning elements to have in place early include: clearly defined goals, partners with clearly defined roles, an understanding of the technical elements (e.g., width(s), vegetation, etc.) needed in your riparian buffer design in order to achieve your goals, some sort of prioritization of restoration areas, an outline of outreach strategies, a maintenance plan, a monitoring plan, and an identification of legal (or other) tools for protecting buffers once they are restored.

Riparian buffer projects rarely stand alone.

Although there are exceptions (see the Madison River case study), riparian buffer restoration is rarely the only best management practice or restoration strategy you will need to achieve your goals. In the case studies, you'll see buffer restoration paired with stormwater mitigation, floodplain reconnection, wetlands restoration, upland agricultural practices, and more.

What this means for your project may vary enormously. For example, in the Ogden River case study we see riparian buffer restoration (and protection through easements) implemented as just one piece of a holistic river restoration design. The Ogden case study is also a good example of integrating buffers into a broader message – the project wasn't pitched as a riparian buffer project, but as an economic and community

revitalization effort. On the other hand, integrating buffers into a broader vision could mean something like we see in the Bear Creek example – where a systematic program of integrating multispecies buffers with wetland restoration and streambank stabilization was the preferred prescription.

The best advice? Keep it simple, but not too simple. A stand-alone riparian buffer restoration through re-vegetation may be all you need to achieve your goals, but test that idea as you design your project. Step back, start from your goals, and ask yourself some tough questions. Will eroding streambanks eat away at your newly protected buffer area? Will changes in flow regimes wash out (or leave high and dry) your new plantings? Will tiles draining agricultural fields do an end run through your buffer and dump the same pollutant loads in your creek? Will nutrient management practices on adjoining farm fields simply overwhelm your buffer?

Thinking about maintenance from the beginning is critical to project success.

Don't bite off more than you can chew … or maintain.

In each of the case studies featured in this report, maintenance was an important concern. Successful projects incorporate thinking about long-term maintenance into the very design of their buffers and the scale of their undertaking. A few things to keep in mind:

- Don't bite off more than you can chew … or maintain. It might be hard to believe in the beginning, but finding willing landowners and restoring a riparian buffer can be a piece of cake compared to the challenges of maintaining that restored buffer for the years it will take to establish itself (and beyond). Will you need to water your plantings? Mow portions of the buffer? Move fencing? Plan ahead for the time and resources maintenance will require and scale your project back until you can realistically afford to maintain it.
- Think about and plan for invasive species! There's no easy fix for this one, but the vast majority of project leaders we talked with struggled with invasive plant species moving into newly restored areas. Make sure you understand what invasive species are likely to cause trouble for your project and plan your restoration to limit their toehold from the beginning. Assume you'll need to conduct invasive control (or set up a plan for someone else to do so) for at least several years after restoration … and likely longer.
- Consider the neighbors. It might not seem like the most important thing to worry about as you're scrambling to improve water quality or fish habitat, but aesthetics are really important in community settings. Make sure you

understand what property owners and their neighbors might be concerned about as riparian vegetation grows. Educate them about what to expect, and invest in maintenance that will help keep the buffer clean, weed-free and pleasing.

- Think through structural approaches that can help you maintain the restoration. Is fencing needed to limit human or livestock trampling? Should you consider spending extra on older, larger tree stock to increase survivability at a remote site that's hard to water regularly? Are tree tubes in order?

Projects in urban, suburban and rural areas will each require some special considerations.

Several of the case studies in this report (and comments in our survey findings) underline the fact that buffer restoration projects in urban, suburban and agricultural areas each have some special issues that are likely to arise. A few examples include:

- In urban projects economic messages and redevelopment planning may be a critical part of successful outreach around a project – see the Ogden case study for an example of this idea in action.

- Urban projects may generate special concerns around questions about safety from local residents, who may perceive buffers as hiding or hangout places.

- Projects in urban areas may be more likely to run into structural restrictions (e.g., roads, buildings) on buffer placement and size. Overhead and underground utilities may also complicate implementation of restoration.

- In rural settings, buffer size and placement may be limited by farmer concerns about "giving up" profitable acreage to the buffer. Buffers may also be plowed under as crop prices increase and drive more land into production or as new managers take over the farm.

- Projects in rural agricultural areas can be complicated if land is owned by one person or organization, but the right to farm that land is leased by another. Project leaders need to understand who makes land management decisions and how to best work with different people in these situations.

- In suburban and urban locations, numerous landowners holding small plots of land can complicate outreach and implementation. A stretch of river that might

be covered by one or two landowners in a rural setting instead could involve 20 or 30 (or more!).

- Particularly in suburban areas (but not necessarily only there), riparian buffer projects can run into concerns about aesthetics. The love affair with the lawn may seem to stand in stark contrast with how you view the beauty of a buffer. Education efforts with landowners can help explain how compelling the benefits of buffers are, and how beautiful – if different – the plantings will be. In addition, taking landowner input into account in planting selection and design can ease concerns. See the Nashville example for more.

Long-term protection of restored riparian buffers can be challenging, but is by no means impossible.

Even as you design your buffer restoration project, be thinking about the future of your buffers. In the survey results, we found that most participants did in fact succeed in placing some sort of permanent or long-term protection on their restored buffers. (Twenty respondents said yes, while 14 reported they did not pursue protection, and seven did not respond to the question.) Several of those who reported they did not pursue protection shared a commonsense reason why they did not – their projects were largely or entirely on public land.

Our case studies featured a similar range in terms of whether protections were in place, and what mechanisms were used in the cases that did provide protection. For example, the Ogden case study illustrates a permanent protection strategy – with easements donated to or purchased by the city. The Nashville case study lands at the other end of the spectrum, with no protections in place at all (although land owners are asked to protect the trees until they reach maturity). Ideas to learn from through our case studies and survey:

- Some groups target their buffer projects to publicly owned lands, where protections may be built into management plans.

- Some groups start their outreach to landowners who have already indicated their willingness to consider long-term protection, often through placing conservation easements on their lands.

- In some cases, a local government may be willing to pursue and hold easements that are donated or even purchased by the city. See the Ogden case study as an example.

- A range of options – from leases to grant agreements to more informal memorandums of understanding – may give you temporary, but concrete, protections for a specified amount of time.

- In some cases you may decide to pursue a project even where long-term protections can't be guaranteed – see the Nashville case study for an example.

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