Clean Water Act §319(h)
PROJECT FINAL REPORT

for

Grant # C9994861-05

Application Title:
Cromer Ridge Watershed Restoration

Application # EP-DOW-NPS-05-05

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B. Acknowledgements

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This project would not have been possible without cooperation and assistance by the following organizations and individuals:

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D. Executive Summary

Until implementation of the Cromer Ridge Watershed Restoration project, the land at Cromer Ridge was severely scarred from 30 years of unmanaged off-highway vehicle (OHV) use. This use began with the introduction of recreational 3-wheelers in the early 1980s. The production of 4-wheelers soon followed. Full-sized 4-wheel drive vehicles and rail buggies joined the mix, and Cromer Ridge quickly became an extensive OHV playground. The resulting damages to soil, water and vegetation were also extensive, spreading across an 8,000-acre area.

In 1992 the Daniel Boone National Forest placed the lands they administered at Cromer Ridge under a "Limited Use Area" designation. Within this area, OHV use was limited to open public roads and street legal vehicles. Unfortunately, the illegal use continued to increase on both public and private lands. In 2005, project implementation under the §319(h) grant began to change this trend and improve a once devastated landscape.

The Cromer Ridge Watershed Restoration project was designed to improve watershed conditions and reduce sedimentation in the Rockcastle River and the Woods Creek Reservoir. The project also provided educational opportunities for the public and other land managers.

Specific improvements constructed as part of this project included the following:

- Reduced stream sedimentation by 5,502 tons/year
- Closed 36.1 miles of illegal OHV trails
- Closed 3.4 miles of eroding road
- Seeded and mulched 395 acres
- Reduced erosion along 5.9 miles of road

Many public involvement and educational components were incorporated into this project. Interpretive signs were designed and installed at several locations. Brochures were developed and made available to the public to help them find legal and, more environmentally friendly areas to ride 4-wheelers. Public service announcements were developed and broadcasted on local radio stations at key times over a three year period. Many land managers visited Cromer Ridge and learned techniques for closing illegal OHV areas.

The Cromer Ridge project achieved the "Measures of Success" established during planning. Each goal and objective was met. The lessons learned during this project will be used in other areas of the Daniel Boone National Forest and across the southeastern United States.

E. Introduction & Background

The Cromer Ridge project area lies within the Rockcastle River watershed, which is home to a number of endangered fish, mussel and bat species. This section of river is also a proposed federal Wild and Scenic River. The western half of the project area drains directly into the Rockcastle River. The eastern half of the area drains into Wood Creek Lake, a municipal water supply.

Forty years ago, the Forest Service managed only a small tract of land along the Rockcastle River in this area (Figure 1).

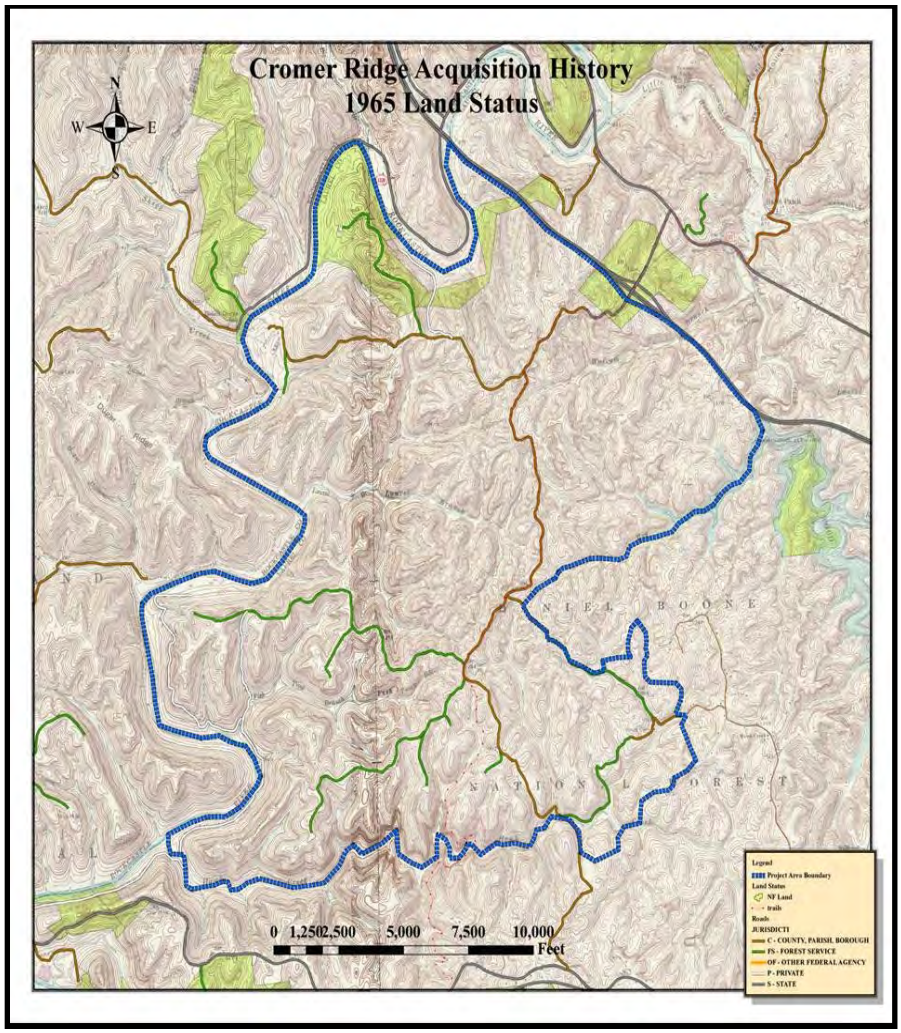

Figure 1: Land ownership in 1965.

During the 1960s, a private landowner in the area opened his property to the public as a motocross park. Word quickly spread about Cromer Ridge, and off-road vehicles of all types were soon showing up to take part in the action.

Most Cromer Ridge property owners were absentee landholders. In many cases, the property owners were unaware of the unregulated motorized use occurring on their land. Eventually, the OHV use spread out of control, and many adjacent landowners desired to sell their land.

Over time, the Forest Service acquired some of the private tracts of land (Figure 2). While agency officials were initially excited to acquire these lands within such an important watershed, their concerns soon grew regarding the extensive amount of unmanaged recreation and its impacts on natural resources at Cromer Ridge.

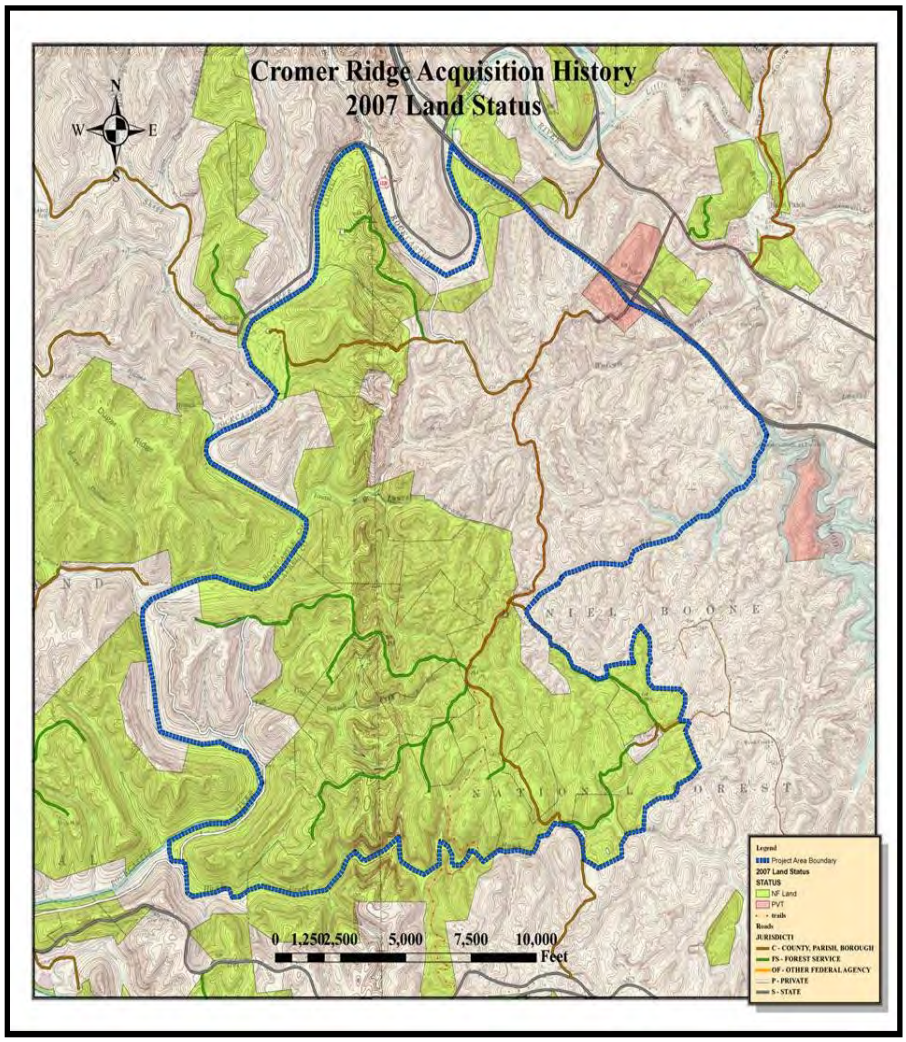

Figure 2: Land ownership in 2007.

In the late 1990s, the Forest Service discovered the extent of resource damages in the Cromer Ridge area. State and federal officials realized the water quality impacts occurring to Wood Creek Lake and the Rockcastle River. They began working to solicit support from the absentee landowners, local county government and the local sheriff's office. The law enforcement efforts were vital in shutting down the illegal OHV use. The Forest Service also used internet posts and community contacts to spread the word among OHV groups that Cromer Ridge was closed to off-road activity.

Before law enforcement efforts began, the Cromer Ridge area was so popular with OHV riders that weekend traffic on I-75 South would frequently backup along the interstate exit leading to this area. Trucks, trailers and RV's would be lined-up to find a parking spot off the exit, and vendors set up along the state highway and at the parking lots of two local gas stations off the exit (Figures 3& 4).

In the article "Cromer Ridge, Kentucky: Obituary for a Landscape," published in the summer 1996 edition of *Wild Earth,* Professor Paul Kalisz estimated an erosion rate of 60 tons/acre/year from the impacted areas of Cromer Ridge. For comparison, Patric and others (1984) estimated soil loss from established eastern forests at 0.25 ton/acre/year. Kalisz estimated a road density of 46 miles/miles^2, a number that better represents an urban area such as Louisville, Kentucky than a section of undeveloped woodland. Kalisz also determined that the disturbed sites were more than twice as compacted as the undisturbed sites (disturbed soils required 395 pounds of pressure per square inch [psi] to insert a penetrometer versus 150 psi for undisturbed). These three parameters speak to the level of impact within the Cromer Ridge project area.

Figure 3: Examples of ATV/OHV use prior to 319(h) grant

Figure 4: Crowd on Memorial Day 2003

Memorial Day 2003 (Figure 4) was the last major gathering of OHV users at Cromer Ridge, just prior to the expanded law enforcement operations targeted at stopping the illegal land use. Since that time, special law enforcement operations and monitoring efforts have continued at Cromer Ridge. The number of violations is now minimal.

In 2005 the Forest Service formed partnerships with The Nature Conservancy, Kentucky Division of Conservation and Kentucky Department of Fish and Wildlife Resources. The partners applied for and received an EPA §319(h) grant through the Kentucky Division of Water. The Cromer Ridge project received $582,000 in federal funding. Matching funds were supplied by the partners (Appendix A).

The project goal was to reduce sediment into the Rockcastle River and Wood Creek Reservoir. To reach this goal, the following objectives were developed:

I. Stop OHV-caused erosion (Figure 5).
   1. Continue policing the area in cooperation with the Laurel County Sheriff's Department to curtail any remaining OHV use.
   2. Obliterate as many of OHV travel corridors as possible.
   3. Install water bars and other "best management practices" (BMPs) in areas where travel corridors cannot be obliterated.
   4. Revegetate the areas with appropriate species (native when possible).

II. Reduce sediment loads in the affected area by reestablishing vegetation on 400-1600 acres (pending land owner agreement) within the project area.
   1. Revegetate the area with appropriate species (native when possible). Disking may be necessary in some cases.
   2. In case riparian areas are disturbed by channel restoration (a separate project), an initial crop of cereal grains or other non-propagating plants shall be planted prior to restoration; permanent self-sustaining species shall be planted after restoration.

III. Remove the large, potentially toxic garbage dumps onsite.
   1. Cooperate with Laurel County to collect and remove all dumped material.

IV. Provide educational opportunities to the public and other land managers.
   1. Provide guidance concerning appropriate OHV use through law enforcement efforts and brochures.
   2. Provide technical demonstrations on how to close heavily-used OHV areas.

3. Utilize interpretive signs to indicate that Cromer Ridge is a watershed restoration project area and explain what actions are being taken. These signs shall also include information regarding legal recreation opportunities within the project area.

Figure 5: ATV/OHV playground area and the resulting sediment plume in Woods Creek Lake, a municipal water supply.

The erosion control BMPs implemented at Cromer Ridge resulted in restored vegetation and ground cover. The BMPs reduced sediment loads into the Rockcastle River and Wood Creek Lake Reservoir. Some of the eroded soils were pulled back into the roadbed to reestablish a suitable surface. The main roads were graveled in an effort to change the type of use in the area. Cut-off ditches and sediment ponds were developed to control erosion. Berms were constructed and trees were used to close illegal OHV routes that extended from the main roads. Where soil had eroded down to bedrock (Figure 6), topsoil from a nearby highway project was brought in to reestablish a seedbed. The closed roads, ditches and roadsides were seeded.

As a result of implementing creative BMPs and law enforcement efforts, the OHV use at Cromer Ridge was drastically reduced. Several environmental education and public outreach activities helped with the effort.

Figure 6: Many ridges had eroded 10 to 15 feet below original surface level, exposing the bedrock substrate. These areas were reshaped and covered with topsoil.

F. Materials & Methods

Project Area

The Cromer Ridge Watershed Restoration area is approximately 8,000 acres in size (Figure 7). Nearly 50 percent of this area is managed by the Daniel Boone National Forest. The remainder of private land is owned by absentee landowners. The EPA §319(h) grant was designed to restore both private and national forest lands at Cromer Ridge.

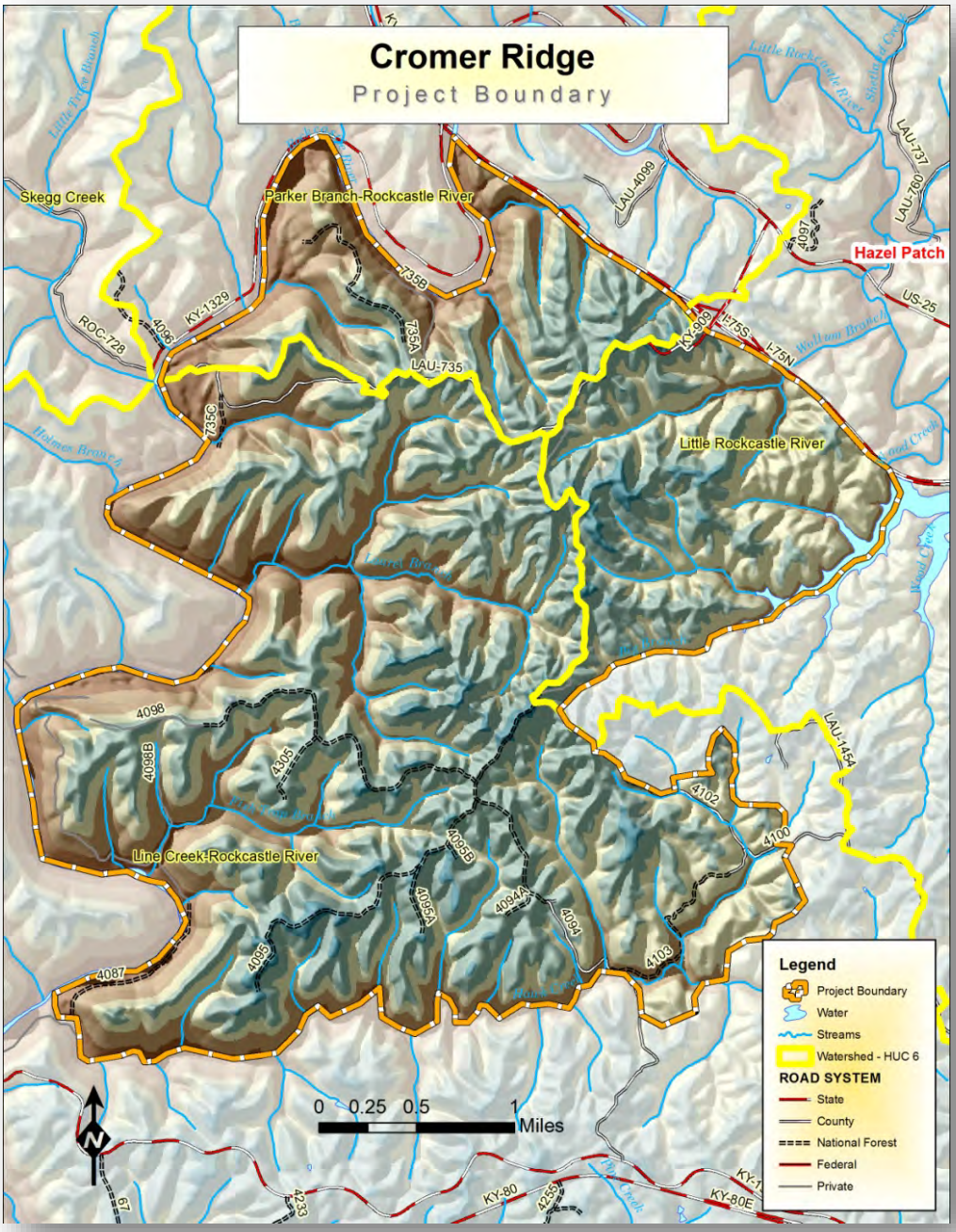

Figure 7: Location and watershed map.

The project area is located at the intersection of three 12-digit (HUC 6) watersheds that drain directly into the Rockcastle River or Wood Creek Lake (Table 1). The land in these watersheds is almost entirely forest with a small amount of developed area near I-75.

Table 1: Watershed size.

Watershed Name	Watershed Number (12 digit HUC)	Total Watershed Acres	Watershed Acres in Project Area
Parker Branch – Rockcastle River	051301020405	23,856 acres	1,148 acres
Line Creek – Rockcastle River	051301020502	35,288 acres	5,567 acres
Little Rockcastle River	051301020402	36,058 acres	1,371 acres

Methods Used

This project had four main objectives: 1) stop the OHV-caused erosion; 2) re-establish vegetation; 3) remove large garbage dumps; and 4) provide environmental education. Different methods were used to accomplish each objective, although the first two objectives were implemented at the same time.

Objectives 1 and 2: To control erosion and reestablish vegetation at Cromer Ridge, several trails and roads were closed using BMPs (Figure 8). The closures included the development of water bars and lead-off ditches, brushing, seeding and gate installations. Some sections of road were improved by eliminating ditches and putting down gravel to discourage illegal OHV use.

The following summarizes the techniques used to restore Cromer Ridge. A more detailed description is found in Appendix C.

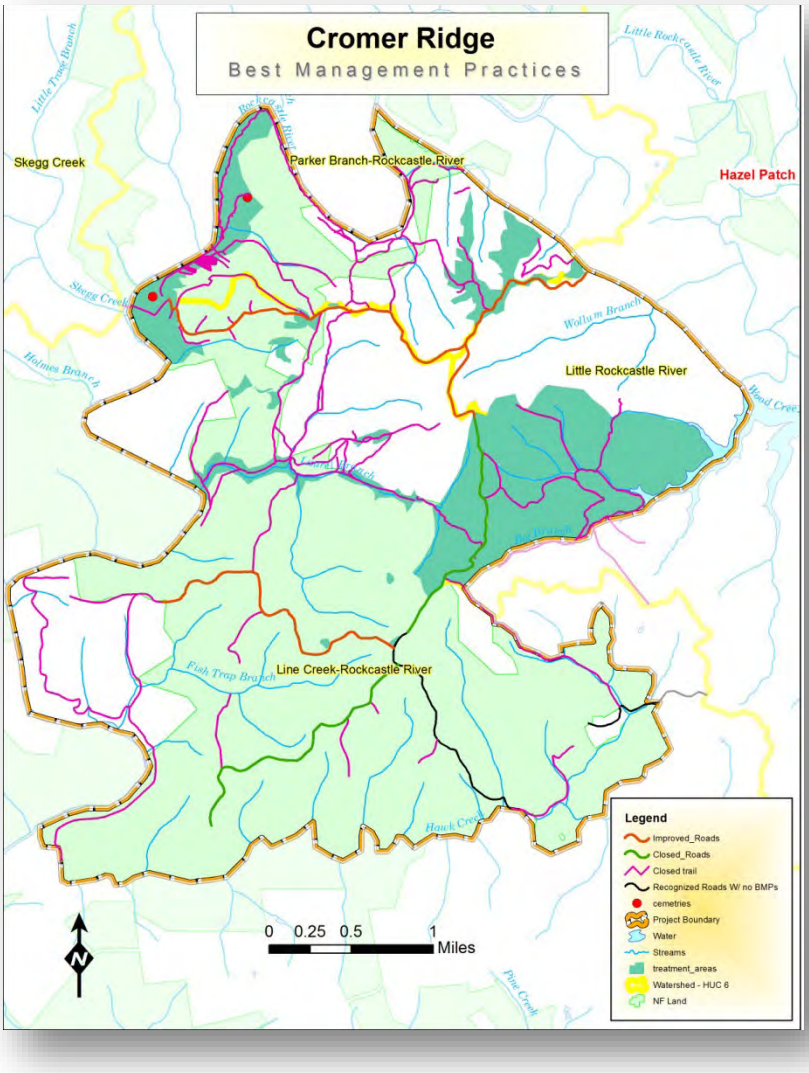

Figure 8: Location of erosion and revegetation Best Management Practices (BMPs).

Water Bars: Water bars are narrow structures that may be shallow or deep, depending on the need. The deep bars are usually used on roads being closed to vehicle traffic. Figure 8 shows the typical dimensions for narrow-based water bars.

At Cromer Ridge, water bars were constructed mainly with heavy equipment (bulldozers and excavators). The work started at the far end of the road and continued back to the main access point so the bars were not damaged during construction. The water bars were usually installed at a 30-degree angle downslope. The outflow end of the water bar was designed to keep water from accumulating or flowing directly into a stream, which prevented erosion by allowing sediment to settle out of the water. As a supplement to water bars, logging slash was lopped and scattered across the closed roads and grass was planted.

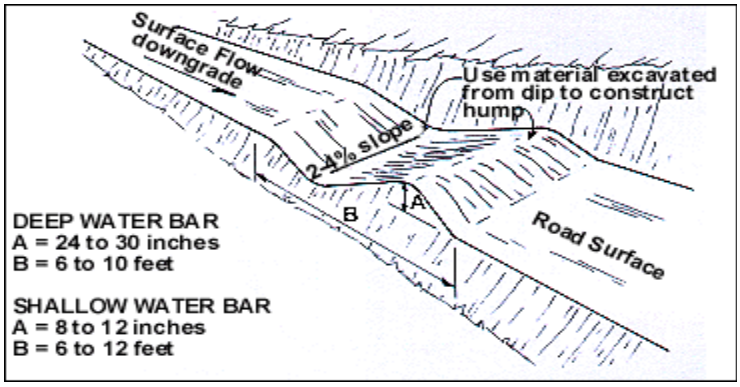

Figure 9: Typical water bars.

Lead-off Ditches: Lead-off ditches or turnouts are important structures for reducing erosion from the outfalls of water bars. Care was taken to ensure adequate drainage at the outflow of a dip. They were never installed to discharge directly into a stream. The discharge area was protected with stone, grass, heavy wood litter, brush or logs to reduce the velocity of water. Sediment basins were sometimes installed at the outfalls.

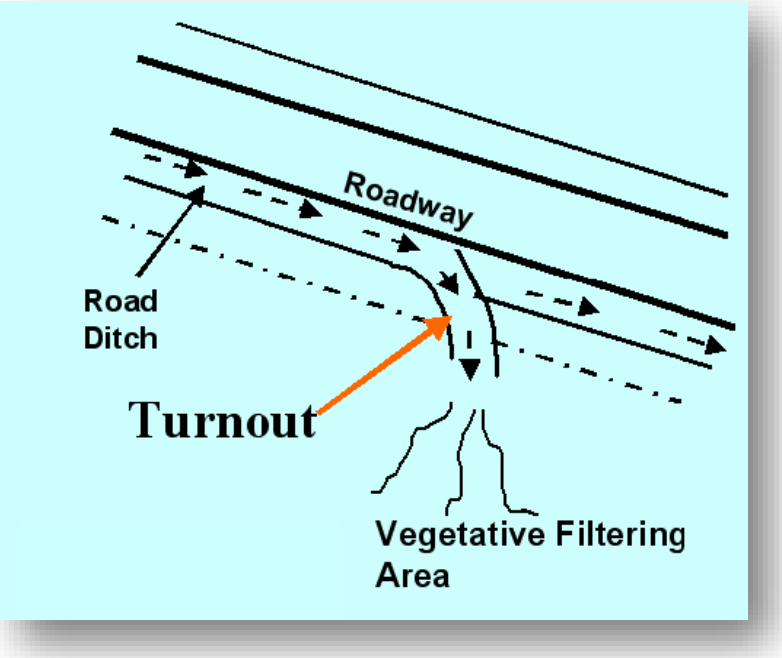

Figure 10: Drawing of a typical lead-off ditch or turnout.

Seeding, Fertilizing and Mulching: These activities were completed as soon as possible to reduce erosion and sedimentation (Figure 5). To obtain the best results, seeding was usually accomplished during the spring or fall. The timing was dependent on local weather conditions. Native grasses were used in some of the old fields and at other treatment areas (Figure 11).

Straw was the most commonly used mulch material where slope gradient, slope length and rainfall intensity were not excessive. The straw was applied at approximately two tons per acre to

effectively reduce erosion. Hydro-mulching was used in areas where it was difficult to establish a vegetation cover. Trees were also planted on some disturbed sites.

Figure 11: Area planted with native grass.

Brushing: OHV travel corridors at Cromer Ridge were closed by cutting trees and placing them over the road or trail. It was important for the material to be large and frequently placed along the corridor to deter future OHV use (Figure 12). This technique required good chainsaw skills and heavy equipment to place the brush in the proper location.

Figure 12: Trail brushing to control OHV use.

Gates and road blocking: Gates similar to those in Figure 13 were installed at a two access points. In areas where permanent closures were needed, boulders and concrete pillars were used.

Figure 13: Road blocking techniques.

Objective 3: Unfortunately, the removal of large trash and garbage dumps became a complicated issue. Several abandoned vehicles were encountered along with hundreds of used tires. To remove the vehicles, the contractors used heavy equipment. The tires were removed in cooperation with a private landowner. The Forest Service had the tires skidded to a landing, and the landowner loaded the tires on a tractor-trailer. Agreements were set up with Laurel County solid waste officials to accept the tires at a reduced rate.

Figure 14: Abandoned car on the slopes above Rockcastle River.

Objective 4: Environmental education, public outreach and law enforcement efforts played an important role in accomplishing the Cromer Ridge restoration project. Without these efforts, the illegal OHV use in this area would have been impossible to stop.

Various education and outreach activities were implemented. First, adjacent landowners were contacted and informed of about the Cromer Ridge project. Partnerships with these landowners were formed. The Nature Conservancy became part of this group.

The next step was to notify illegal OHV users that the Cromer Ridge area was closed to that type of use. Through a series of internet sites and chat rooms, the Forest Service spread the word that the closure would be enforced. Information was posted on the Daniel Boone National Forest website. Temporary signs were developed and installed at key locations throughout the area (Figure 15). Permanent signs were installed at the end of the project (Figure 16).

Figure 15: Temporary sign that was used early in the project.

Figure 16: One of four permanent signs installed.

Public service announcements and flyers were later used. The PSAs were broadcast on several radio stations over the Fourth of July and Labor Day holidays from 2009 through 2011. The message focused on erosion prevention and responsible OHV use. Some flyers listed places where OHV riding could occur legally. This information was distributed over the internet and at various local businesses.

The grant funding paid for a combination of law enforcement efforts. Forest Service law enforcement officers patrolled Cromer Ridge on a regular basis. An agreement was also developed with the Laurel County Sheriff's Department to provide local patrol and enforcement.

Throughout the project, numerous field trips were conducted for land managers with various agencies and special interest groups in the southeastern United States. The field trips provided interpretation and information concerning the restoration activities occurring at Cromer Ridge.

G. Results & Discussion

As previously mentioned in the "Methods Used" section on page 16, this project had four main objectives. The results are discussed by objective and include the following "Measures of Success" from the original project agreement:

- Meet QAPP standards;
- Accomplish 75 percent groundcover in the revegetated areas on slopes less than 20 percent and 90 percent groundcover on the remaining slope classes after two growing seasons;

- Determine groundcover restoration by using monitoring transects, photo points and aerial photos;
- Show a reduction in sediment reaching stream channels through monitoring; and
- Maintain law enforcement efforts at effective levels.

Objectives 1 and 2: Several techniques were used to determine if the project successfully controlled erosion and reestablished vegetation at Cromer Ridge. First, road and trail closure miles and acres replanted were determined. These numbers were then used to calculate the reduction in erosion using the "Water Erosion Prediction Project" (WEPP) model (Eliott, 2000). Determinations were also based on erosion research by Dissmeyer and Stump (1978) and sediment delivery research by Roehl (1962). The results are expressed in tons per year. Since the accuracy of the WEPP model, as stated by Elliott, is plus or minus 50 percent of the true value, the results should not be viewed as absolute.

Table 2: Erosion reduction.

Treatment	Amount
Closed trail	36.1 miles
Closed road	3.4 miles
Improved road	5.9 miles
Areas revegetated	395 acres
Total reduction in stream sedimentation	5,502 tons/year

Nearly 40 miles of illegal OHV trails and roads were closed and another six miles of road was improved. Vegetation was planted on 395 acres, which drastically reduced erosion and stream sedimentation. Wildlife habitat and water quality has improved in the Rockcastle River and Wood Creek Lake area.

Another technique used to measure the success of erosion control efforts was before-and-after photographs. Figures 17 through 20 show at least 90% groundcover was achieved in areas planted with vegetation.

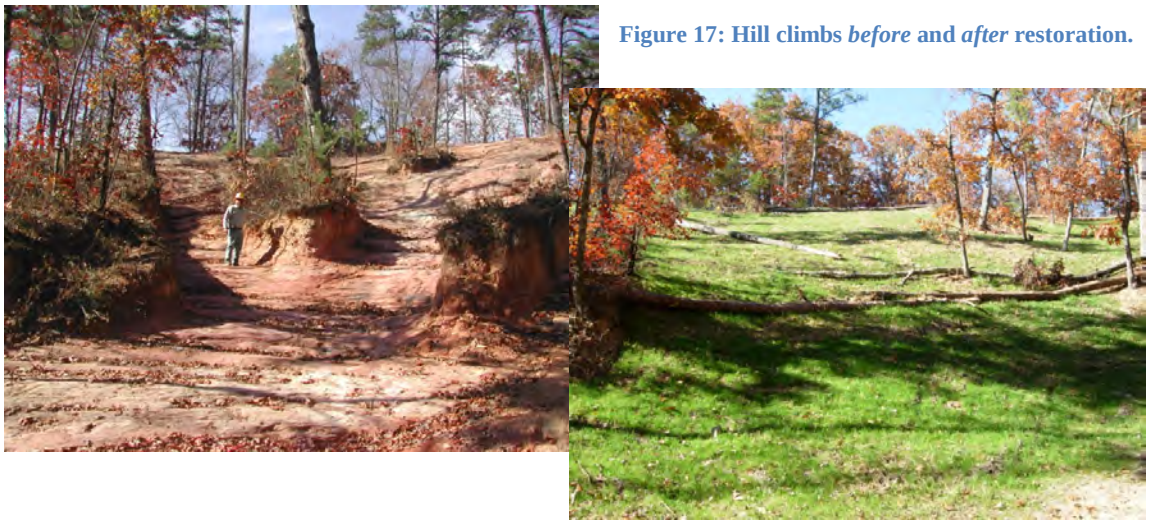

Figure 17: Hill climbs *before* and *after* restoration.

Figure 18: "Pink Rock" *before* restoration.

Figure 19: "Pink Rock" *after* restoration.

Figure 21: Playground area *before* and *after* restoration.

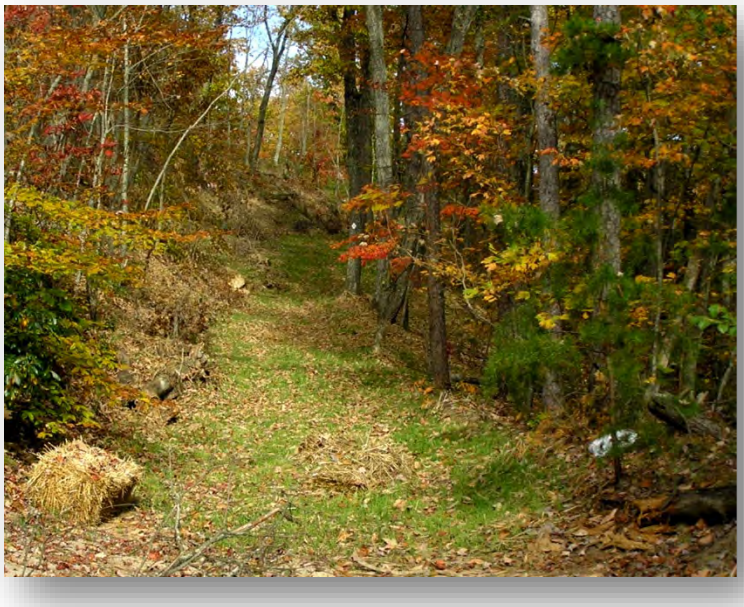

Figure 20: Sheltowee Trace Trail *after* reshaping and revegetation.

The photo monitoring also showed several different trail and road closure techniques. Depending on the use in the area, the closures ranged from narrowing of trails to allow hiking but eliminate vehicles (Figure 22) to using concrete pillars (Figure 23). The concrete pillars were the most drastic closure method, which was used in an area where OHV riders had reopened a trail on several occasions by removing the closures.

Figure 22: Narrowed off-highway vehicle road.

Figure 23: Concrete pillar closure on a road difficult to close.

The QAPP discussed macroinvertebrate monitoring in tributaries to the Rockcastle River and Woods Creek Lake. Based on pre-project monitoring, it was determined that this method was not effective. The Kentucky Division of Water agreed to delete this criterion from the QAPP.

Objective 3: Trash was picked up from several dump locations. Site rehabilitation began once the tires, old cars and garbage were removed. The dump sites were seeded, mulched and planted with trees (Figure 24). The areas have remained relatively trash-free, which may be a result of changing land-use patterns (from off-highway vehicles to hunters, hikers, mountain bikers and horseback riders). The improved appearance of the land may also deter dumping.

Figure 24: Tree planting at an old dump site

Objective 4: The environmental education efforts appear to be successful. Cromer Ridge was once a destination for off-highway vehicle users who traveled from multiple states (Figure 4). Information concerning the Cromer Ridge project was distributed via internet, brochures, public service announcements and signs (Figures 15 and 16). These communications helped educate

national forest visitors concerning responsible OHV use and informed them of places to ride legally. Land stewardship and the need for restoration were also expressed in the educational messages.

Early in the process, law enforcement officials were very busy at Cromer Ridge. Numerous tickets and violation notices were issued. As education efforts continued, the number of illegal users decreased and the issuance of tickets became rare. Law enforcement officers eventually reduced their patrol efforts at Cromer Ridge.

The field trips were a successful way to demonstrate the restoration techniques used at Cromer Ridge. These practices have also been used on the Ozark National Forest in Arkansas and the Cherokee National Forest in Tennessee. Cromer Ridge was even used in a Forest Service-wide case study (Appendix E).

H. Conclusions

Today, Cromer Ridge is a different place. The illegal OHV use has drastically declined. As a result, stream and lake sedimentation is reduced in the Rockcastle River and Wood Creek Lake. The slopes eroded to bedrock are covered in topsoil and growing vegetation. The area where Dr. Kalisz (1996) once wrote an "Obituary for a Landscape" is restored to a more natural condition. , but some areas of concern remain. It will take many years for the Cromer Ridge area to fully recover from the environmental degradation that once occurred here. This area will need to be patrolled on a regular basis to ensure that illegal OHV use does not return. Hiking trails in the area also need to be reestablished where damaged by OHV use, particularly along the Sheltowee Trace National Recreation Trail.

Several lessons were learned from this project. First, public outreach is essential. It was important to coordinate with adjacent landowners, user groups and local officials. In a remote area such as Cromer Ridge, it would have been difficult to stop the illegal OHV use without educational and informational communications.

Another important key to success was improving the main road in the project area. This improvement made the area less desirable for OHV users while making it easier for law enforcement officers to quickly access the area.

The 5-year project duration was important to successfully stop the illegal OHV use, since some management practices required several attempts. Along some of the more popular OHV routes, riders often removed the obstacles used to close the roads and trails. Users cut logs off their favorite routes, pushed boulders that blocked roads out of the way, and destroyed revegetated fields. The longer timeframe of the project allowed for experimentation with different closure techniques. More importantly, the timeframe provided an opportunity to let OHV riders know that the area was permanently closed to that type of use. In the end, the best management practices began to take hold and the illegal OHV use declined.

The photo monitoring was a useful technique at Cromer Ridge. When visiting the area today and in the future, the photos will serve as a reminder of the previous land conditions. Depending on

the area, this technique may better quantify changes than biological monitoring. At Cromer Ridge, the most disturbed streams were smaller streams where it would have been difficult to consistently monitor macroinvertebrates. The seasonal restrictions for monitoring small streams also made it impossible to sample at the completion of the project. Whereas, before and after photographs can quickly show change that even a lay person can understand.

This project could not have been completed without funding through the EPA §319(h) grant program and the assistance of the Kentucky Division of Water. Overall, the Daniel Boone National Forest and its partners consider the Cromer Ridge Watershed Restoration project a great success, producing many future positive outcomes for years to come.

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