Republican River Watershed Riparian Restoration

Submitted to:
Chris Sturm – Colorado Water Conservation Board

By:
Fred Raish – Yuma County Pest Control District
On:
Friday, December 13, 2013

PROJECT OVERVIEW

Colorado Water Conservation Board
Invasive Phreatophyte Control Program
Grant Application

1.0 Project Proposal Summary Sheet

Project Title

Republican River Watershed Riparian Restoration Project (RRWRRP)

Project Sponsor

Yuma County Pest Control District Supervisor Fred Raish, fred.raish@ycpest.org, 970-848-2509

Cooperating Partners

1. Yuma Conservation District
2. Natural Resources Conservation Service (NRCS)
3. U.S. Fish and Wildlife Service
4. Pheasants Forever
5. Colorado Corn
6. Colorado State University (CSU) and Appalachian State University
7. Colorado Parks and Wildlife
8. Colorado State Parks – Bonny State Wildlife Area
9. Three Rivers Alliance (Local Non-Profit Landowner Group)
10. Republican River Water Conservation District (RRWCD)
11. Private Landowners

Project Location

County (ies): Yuma, Washington, and Kit Carson
Watershed and Tributaries Effected: Republican River Watershed – Republican River, North Fork (including tributaries: Chief Creek, Holy Joe Creek, Hays Creek, and Bloom Creek), Arikaree River (including tributaries: Gordon Creek, Lickdab Creek, Dugout Creek, Hell Creek, Hackberry Creek, Copperkettle Creek, Sand Creek, Rocky Canon Creek, and Black Wolf Creek), and Republican River, South Fork (including tributaries: Hell Creek, Buffalo Creek, Duck Creek, Sand Creek, Spring Creek, Dry Gulch Creek, Landsman Creek, Bonny Creek, and Beaver Creek).

Nearest Community (ies): Wray, Idalia, Hale, and Burlington

Grant Request/Amount

Total Project Cost: $300,000
CWCB Funds Requested: $100,000
CWCB Funds Granted: $90,000
Applicant & Partner Cash Funds: $150,000
Applicant & Partner Cash Funds Actual: $160,000
Applicant & Partner In-Kind Services: $50,000

Acres Treated

Total Acres: 375
Approx. % of acres Private Land: 100
Approx. % of acres Federal Land: 0
Approx. % of aces State Land: 0
Approx. % of acres Other Land: 0

Estimated Completion Date

December 2016

Brief Description of the Project

The RRWRRP has numerous phases and objectives, this is why the completion date for the entire project is an estimated date and has been modified to show the challenges this project has faced over the last five (5) years. The first three phases of this project have been the removal of tamarisk and Russian-olive starting in 2008 with the North Fork of the Republican River and the tributaries. The North Fork of the Republican River phase had 315 acres (85%) of Russian-olive removed by December 2013. Over the past five years the partners in the RRWRRP have been in communication with the landowners that own the 15% of Russian-olive left for removal. The project on the North Fork of the Republican River has continued during December 2013. We are hopeful that the landowners and the partners within the RRWRRP on the North Fork of the Republican River can agree to terms and have the project completed by 2016.

The second phase of the project, the removal of tamarisk and Russian-olive from the South Fork of the Republican River and the tributaries, was scheduled for completion in December 2010. This date has been changed to June 2015. The reasoning for this change is due to the increased cost in removal and the increased demand for the contractor on this project. Berghorst Land Clearing is one of the top phreatophyte removal companies in the United States. This company has been working on the RRWRRP since 2009 and has added other projects in Nebraska, Kansas, and South Dakota to their workload. This has meant that all four projects have had to work together and completion dates have been pushed back. This has allowed the RRWRRP the capability to obtain other funds for other portions of this project. The RRWRRP has removed 1,150 acres (38%) of Russian-olive or tamarisk from the South Fork of the Republican River and the tributaries. This includes 95% of the Russian-olive and tamarisk from Bonny Dam to the Kansas state line.

The third phase of the project, the removal of tamarisk and Russian-olive from the Arikaree River and the tributaries, has seen 125 acres (24%) of Russian-olive and tamarisk removed by July 2013. The original completion date was set for October 2011, but due to landowner requests, financial obligations, and contractor scheduling the completion date has been extended. The RRWRRP is still scheduled to be completed by December 2016 this includes the monitoring, restoration, and maintenance portion of the project. The RRWRRP has established a priority for projects on the South Fork of the Republican River, but continue to work with landowners throughout the Republican River watershed.

The final phase of the project is being conducted by Colorado State University and Appalachian State University with the study "*Ecological Impacts of Russian-olive along the South Fork of the Republican River*", this study started in 2010 and will be completed in 2014 (the latest report has been attached to this application).

The RRWRRP will follow all guidelines set within the *Republican River Watershed Weed Management Area (RRWWMA) Strategic Plan;* titled "*A consolidated Woody Invasive Species Management Plan for Colorado's Republican River Watershed*" which was established in November 2008 in calibration with the Colorado Water Conservation Board, Yuma County Pest Control District, Three Rivers Alliance, The Nature Conservancy, and the Tamarisk Coalition and approved by the Colorado Noxious Weed Coordinator for the Colorado Department of Agriculture (see attachments). The boundaries of the planning area include: 1) the Republican River watershed from the headwaters of the North Fork and South Fork of the Republican River and the headwaters of the Arikaree River to the Colorado state line, 2) tributaries to these three rivers that are within the Republican River watershed. Russian-olive and tamarisk are not the only non-native, invasive species present in the watershed and invasive species are not the only problem impacting this river system. However, due to their extensive growth patterns and high profile images, these species serve as the main emphasis for riparian restoration. Russian-olive infestations within the RRWRRP study area occur primarily below 4,900 feet in elevation. Tamarisk occupies a similar range although in smaller populations. Russian-olive infestations dominate most riparian habitats within the Republican River watershed. Tamarisk is mainly found around what was previously known as Bonny Reservoir and small scattered patches in southern Washington County and along the Arikaree River drainage. These infestations degrade wildlife habitat, agricultural lands, recreational activities, and water resources. If no action was taken, the potential intensification and expansion of ecosystem degradation in the future is prohibitively high. The control of Russian-olive and tamarisk in the watershed has and will continue to utilize a full suite of techniques including hand control, herbicide treatment, biological control, and mechanical treatment. No one technique is right for all situations. Additionally, all of these techniques must be matched with an effective restoration plan for the riparian corridor. Restoration is the ultimate goal.

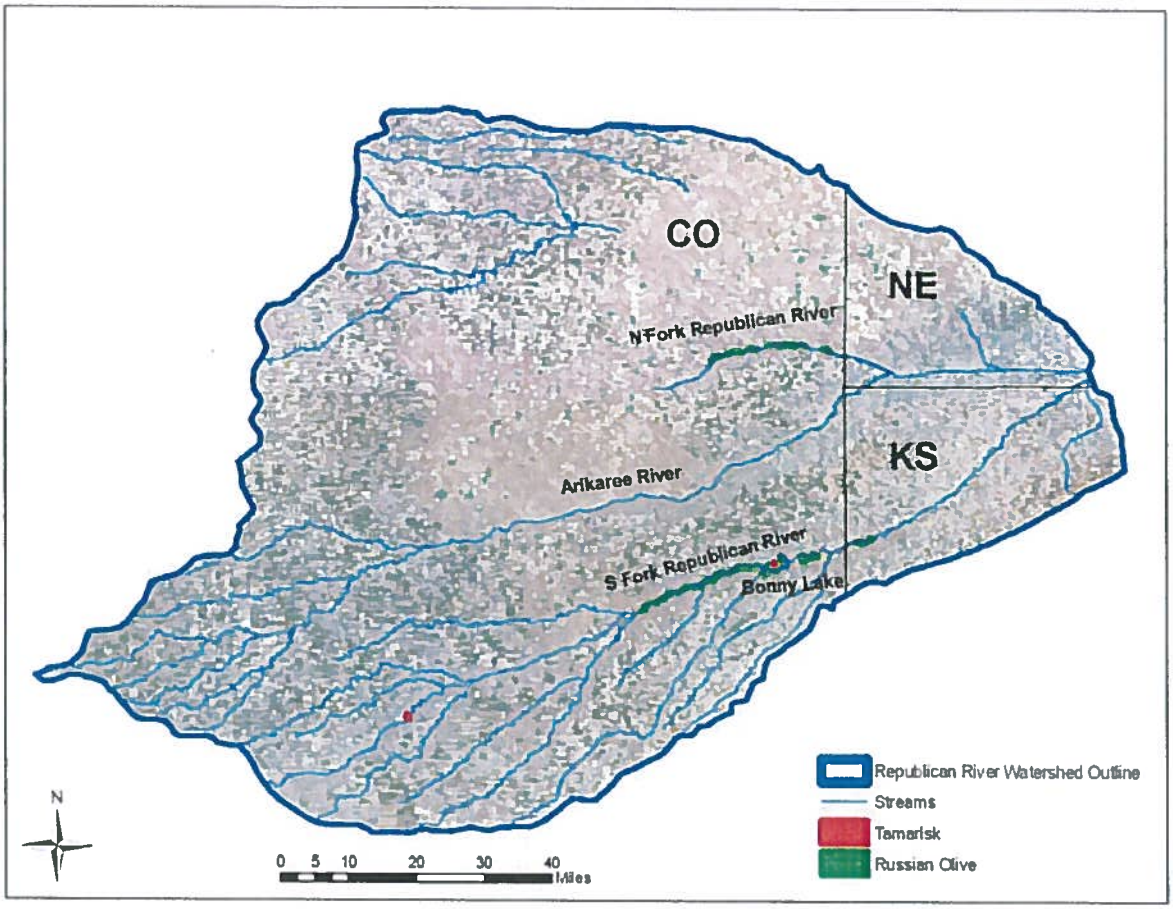
The RRWRRP, tamarisk and Russian-olive removal, will be completed mainly by using a cut stump method of control. This will be done by a hired contractor and Yuma County Pest Control District, with help from private landowners. The RRWRRP complies with the rules pertaining to the *Colorado Noxious Weed Act.* Under these rules tamarisk is mandatory for eradication within the watershed with the exclusion of Bonny Reservoir. At Bonny Reservoir there have been

releases of the biological control *Diorhabda elongate* and other efforts by the Colorado Parks and Wildlife to contain and control the tamarisk around Bonny Reservoir.
The formation (2007) of the Republican River Watershed Weed Management Area (RRWWMA) has allowed input from numerous agencies, local governments, and private citizens.

Through the numerous meetings that RRWWMA sponsored it was decided that Yuma County Pest Control District and Three Rivers Alliance would pay for 75% of the cost of tamarisk and Russian-olive removal and that the landowner would pay the remaining 25%. Yuma County Pest Control District will monitor the sites for resprout and control any and all state or county listed noxious weeds that may be found on these sites. The local conservation districts, NRCS, Pheasant Forever, U.S. Fish and Wildlife Service, and CSU Extension will help the landowners with revegetation, grazing, and fencing recommendations. The members of the RRWWMA decided to not begin revegetation for three years on removal sites to promote natural revegetation.

Expected and seen results of tamarisk and Russian-olive control in the Republican River watershed include restored aquatic, riparian, and floodplain ecosystems.
The quantity and quality of these habitats for fish and wildlife, including endangered status fish species, have and will continue to be improved. Project areas have also provided and will continue to provide for environmental education, improved aesthetics, recreation, and improved management of flood flows.

Map and Photos of Project



2.0 Describe the plan to control invasive phreatophytes in priority infested areas through "integrated pest management" (IPM).

The Republican River Watershed Weed Management Area Strategic Plan "*A Consolidated Woody Invasive Species Management Plan for Colorado's Republican River Watershed*" follows all regulations set forth by the Rules Pertaining To The Administration And Enforcement Of *The Colorado Noxious Weed Act* 8 CCR 1206-2 Part 4.7.5 §D. If during the course of this project the regulations set forth by the Rules Pertaining To The Administration And Enforcement Of *The Colorado Noxious Weed Act* 8 CCR 1206-2 Part 4.7.5 § D change the strategic plan will change to mirror those changes. Best management practices utilizing Integrated Pest Management (IPM) techniques will be used and, as research and experience dictates, updated through adaptive management. Mechanical extraction, grab and cut-stump control, will be used to obtain the cut-stump control work around valuable vegetation and in inaccessible areas. Biological control has been attempted at Bonny Reservoir, without success, for tamarisk and will continue to be monitored with the help of CSU. The project will remove the seed source from the riparian area and with the help of CSU extension and the NRCS grazing management will be addressed along the riparian corridor.

Native revegetation/restoration will occur through the natural process through the majority of the project, areas considered fragile will be revegetated once the tamarisk and Russian-olive have been removed. All areas will be monitored for three years by the NRCS, local conservation districts, and Yuma County Pest Control District. If revegetation does not happen to the satisfaction of the landowner or the surveyors, within three years, then pole plantings of cottonwoods and willows along the channel edges and tall-pot, deep plantings of native shrubs and grass seed mixes will be used. Continued monitoring will happen throughout the project to ensure all noxious weeds or other invasive species are controlled and that the revegetation/restoration is completed within five years.

Monitoring of the RRWRRP will occur on two scales for at least five years. Pre-restoration monitoring will occur to establish baseline data to determine if the goals and objectives are being achieved on the landscape scale. The large-scale monitoring that will be completed will assist policy makers, land managers, and the public to evaluate the potential impacts of remediation on water resources, vegetation, wildlife habitat, biodiversity, economic health, society, and culture. The small-scale monitoring will be implemented to provide useful information on the effectiveness of control and remediation activities. Modifications to the revegetation/restoration plan will be implemented using all the information gained during the monitoring of the RRWRRP. The current study being conducted by CSU will also help in determining monitoring practices and revegetation/restoration practices.

Maintenance of the RRWRRP will be handled by the landowners and Yuma County Pest Control District. Each private landowner has signed a maintenance contract, 5 year commitment, with Yuma County Pest Control District that outlines that Yuma County Pest Control District will control all resprouts of tamarisk and Russian-olive along with all other noxious weeds free of charge for the first three years.
The landowner will have to pay for herbicide for all maintenance done for the final two years. The landowner must also work with CSU extension, NRCS, and the local conservation districts on maintenance of revegetation/restored areas.

3.0 Organizational Capability

Yuma County Pest Control District is the lead project sponsor. Over the last 25 years Yuma County Pest Control District has accomplished many projects like the current project. The latest project is the Russian-olive and tamarisk removal project that was started in 2008 and continues today. The latest project that was finalized was a large scale, nine square miles, Spotted and diffuse knapweed eradication and control project in the southern portion of Yuma County. This project took five (5) years and is currently in the monitoring stage. Many of the same partners that are working on this current project worked on the knapweed project, CSU extension, NRCS, local conservation districts, and private landowners.

In May of 2008 a partnership was formed to address the infestations of tamarisk and Russian-olive within the Republican River watershed. This partnership is called the Republican River Watershed Weed Management Area (RRWWMA). The main focus of the RRWWMA is the restoration of the riparian areas within the Republican River watershed.

The RRWWMA is made up of private landowners, local governments, state and federal government agencies, and non-profit/non-government organizations. This group directed Yuma County Pest Control District and Three Rivers Alliance to partner with the Tamarisk Coalition, Colorado Water Conservation Board, and the Nature Conservancy to put together a strategic plan titled *"A Consolidated Woody Invasive Species Management Plan for Colorado's Republican River Watershed"* which was finished and accepted in November 2008. This plan is still followed today (attachment B).

Staffing of this project will mainly be achieved by Yuma County Pest Control District with 3 staff members with 25 years of combined experience in invasive species control. There will also be volunteers from CSU, NRCS, U.S. Fish and Wildlife Service, Pheasant Forever, Colorado Parks and Wildlife, local conservation districts, and private landowners utilized throughout this project. This does not include the contractor or any laborers that may work on the project. We have tried to utilize the Colorado Youth Corps on this project. To date utilizing the Colorado Youth Corps has not been a success for many reasons. We continue to have conversations with the local chapter of Colorado Youth Corps and will hopefully utilize them in the near future.

Since the start of the RRWRRP Yuma County Pest Control District, Three Rivers Alliance, and other funding partners, including CWCB, has contributed $931,778 for this project and the in-kind portions equal $173,000. This does not include any funds from NRCS EQIP or U.S Fish and Wildlife Service Partners Program. While this money cannot be used as a match for the current CWCB proposal it does show that the partners in this project are serious about the project. Yuma County Pest Control requesting $100,000 from CWCB and received $90,000. Yuma County Pest Control District and Three Rivers Alliance are dedicated to this project and will continue to help fund this project until its completion. This project will continue until all criteria set for in the strategic plan are met. The chart below outlines the contributions for this portion of the project.

Partner	Cash	In-Kind
Yuma County Pest Control District	$100,000	$25,000
RRWCD	$10,000	
Colorado Corn	$10,000	
Private Landowners	$15,000	$15,000
Yuma Conservation District		$2,500
NRCS		$2,500
Three Rivers Alliance	$25,000	$5,000

The local conservation districts, NRCS, Pheasant Forever, U.S Fish and Wildlife Service Partners Program, and Yuma County Pest Control District will continue to educate the general public about the efforts of this project and potential harm that tamarisk and Russian-olive have on the watershed. These efforts will take place through tours of the site, local newspaper reports, newsletters, and Power Point presentations at local, state, and national conferences.

4.0 Effectiveness of Project

The quantifiable results that will be seen with the completion of the RRWRRP are, replacing non-native noxious weeds with native vegetation, changes to the hydrologic condition of the watershed, improvements to the habitat for wildlife along the riparian areas within the watershed, and enhanced protection of threatened and endangered species through the planned efforts to establish native riparian communities and restore the natural processes. The proposal is complete and the steps that have been taken to implement the project will minimize the likely hood of any further infestations of tamarisk or Russian-olive. Throughout the planning stage and the implementation of the project low impact on land has been made a high priority. By utilizing machinery that will disturb the ground in low impact manner infestations of other noxious weeds will be kept to a minimum.

The choice of using the cut-stump control method is the best control method for this project. By using the cut-stump method no non-targeted species should be harmed. Yuma County Pest Control District and the local conservation districts put out test plots of different control methods along Chief Creek. This test site was used to determine the best control method to be used within the Republican River watershed. The cut-stump method was determined to be the best control method with the lowest impact on native species.

The main goal of the project is watershed restoration and enhancement of stream flow. This is being done by the removal of tamarisk and Russian-olive along with debris that has fallen in the river channel. By removing the infestation of tamarisk and Russian-olive and the debris from the river channel this will help in the delivery of water and with flood mitigation. Restoration of the riparian areas is the ultimate goal. The project has been an ongoing project for the last four (4) years and is now scheduled to go another four (4) years. Depending on rule changes from the Colorado Department of Agriculture, funding sources and contractor availability this project could be completed sooner. Currently there is no NEPA regulation to comply with.

The RRWRRP is not just about the removal of Russian-olive and tamarisk. The RRWRRP has been working with the Colorado Parks and Wildlife on cattail mitigation on the South Fork of the Republican River. During 2013 Yuma County Pest Control District hired a helicopter to apply herbicide to the cattail population. The total acreage that had an herbicide application was 85 acres east and west of the Highway 385 Bridge that crosses the South Fork of the Republican River. This brings the total acres of cattails controlled between 2012 and 2013 to 208 acres. This project was started to help maximize stream flow before Bonny Reservoir was drained. Now that Bonny Reservoir is drained this project continues to be about stream flow but also had a large emphasis on wildlife habitat. This is one of the many projects that continue to happen thanks to the RRWRRP and the partner involved in this project.

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MONITORING AND MAINTENANCE PLAN

Maintenance and Monitoring Plan

Monitoring

The Yuma County Pest Control District Supervisor or designated employee will drive and walk through the project area two times each year from 2011 to 2016. Re-growth from cut stumps, new seedlings and any possible trees missed along with the quality and quantity of the native vegetation will be monitored during these inspections.

A spring inspection will be made in mid June and a fall inspection made in early October. Each inspection will be scheduled for 2 day. The cost of this will be:

Salary: $22.50 per hour at 32 hours = $720

Equipment: $15.00 per hour at 32 hours = $ 480

Total: $1,200 per year at 5 years = $6,000

Other inspections will come from private landowners along the South Fork of the Republican River and Berghorst Land Clearing the contractor hired to continue this project.

Maintenance

If any re-growth from the cut trees is found during these inspections, the plants will be treated by Yuma County Pest Control District before the plants produce viable seed. The cost for treating the re-growth will be minimal as Yuma County Pest Control District will donate all the herbicide needed.

If the native plants are not filling in and keeping the area stabilized, and restoration is needed, it will be conducted by the Yuma Conservation District and Three Rivers Alliance through reseeding and tree plantings as appropriate. This will be done at a cost of:

Reseeding: $75 per hour at a maximum of 5 hours = $ 375.00

Trees will be purchased by private landowners through Yuma Conservation District. Three Rivers Alliance will help plant trees purchased by the private landowners.

The expenses for the monitoring and maintenance work are included in the base grant as in-kind contribution from each of the partners.

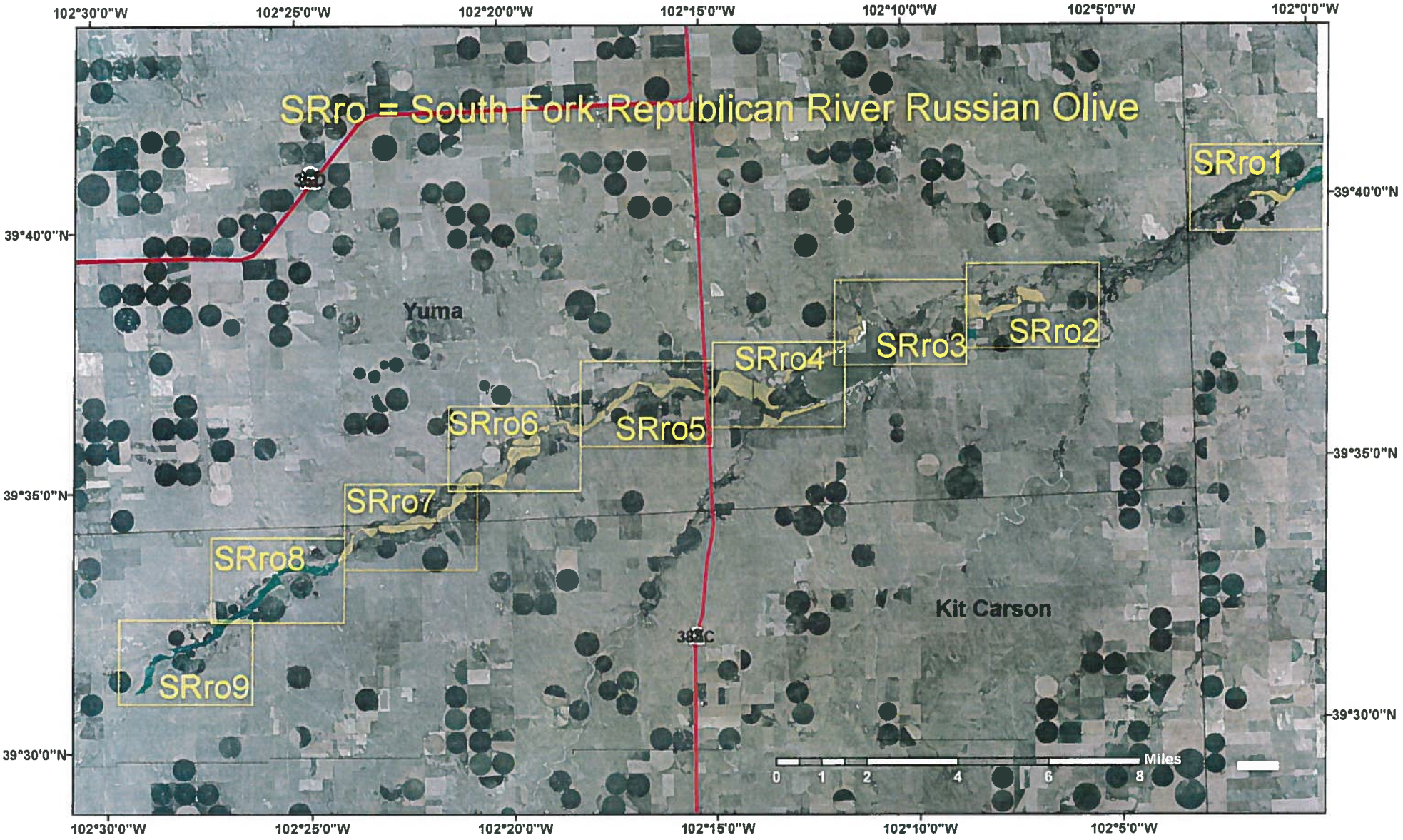
A monitoring and maintenance report will be filed annually through 2016. A representative of Yuma County Pest Control District will file this report every December.

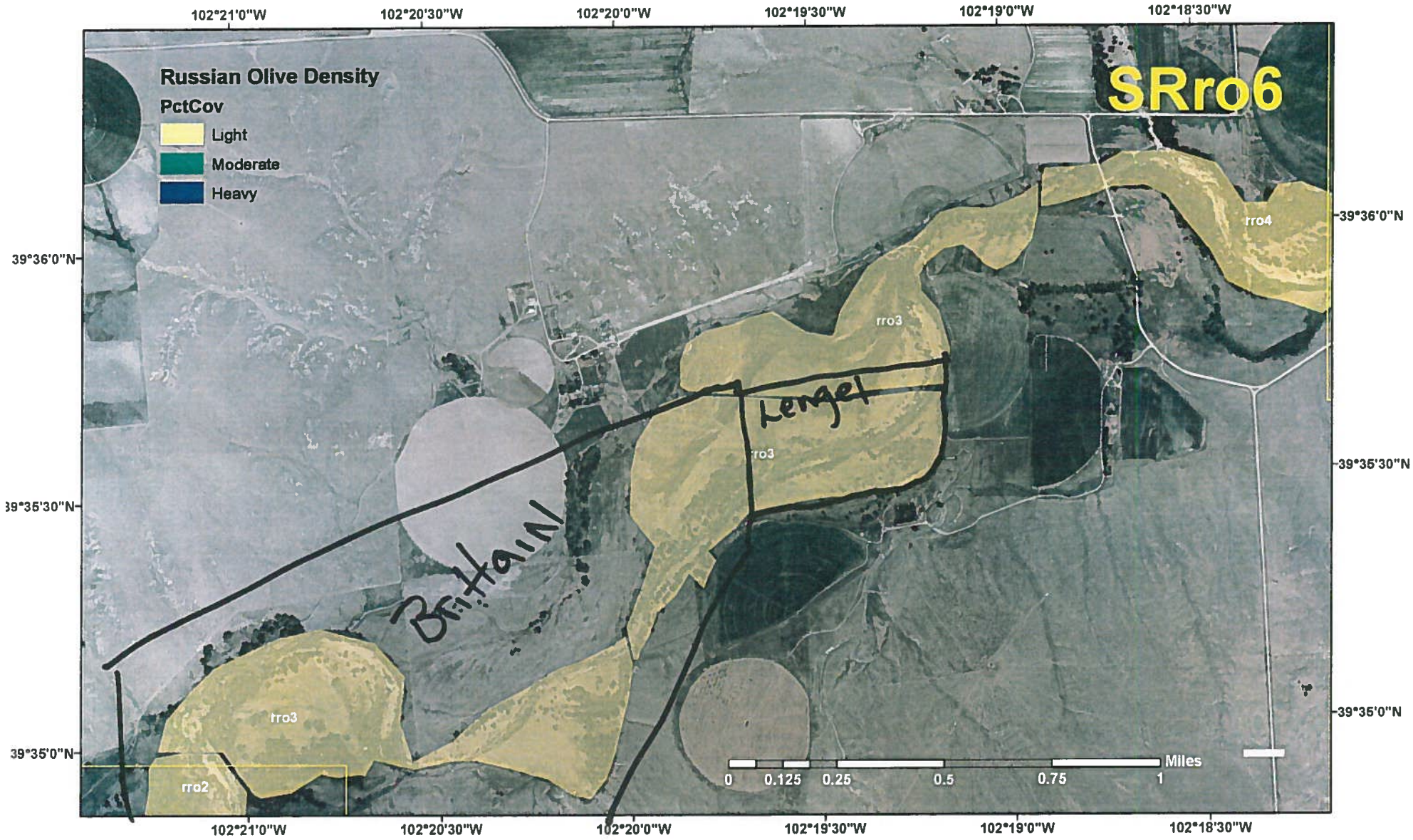
5.0 Attachments

Attachment A contains;

1. Detailed map of project area for the South Fork of the Republican River. This map shows the project area completed.
2. Project budget
3. Pertinent still photos of 2013 project sites

MAPS


SRro = South Fork Republican River Russian Olive
SRro1
SRro2
SRro3
SRro4
SRro5
SRro6
SRro7
SRro8
SRro9
Yuma
Kit Carson
102°30'0"W
102°25'0"W
102°20'0"W
102°15'0"W
102°10'0"W
102°5'0"W
102°0'0"W
39°40'0"N
39°35'0"N
39°30'0"N
Miles
0 1 2 4 6 8


Russian Olive Density
PctCov
Light
Moderate
Heavy
SRro6
rro4
rro3
rro3
rro3
rro2
Lengel
Bethany
102°21'0"W
102°20'30"W
102°20'0"W
102°19'30"W
102°19'0"W
102°18'30"W
39°36'0"N
39°35'30"N
39°35'0"N
0
0.125
0.25
0.5
0.75
1
Miles

Brittian Property

Invoices

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 6142013-1 Brittain
DATE June 14, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Brittain Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
5/31/13	2-saws	5.00	$ 350.00
6/4/13	2- saws	22.00	1,540.00
6/4/13	2 - Bobcat	22.00	2,420.00
6/4/13	Hydro-Axe	3.00	390.00
6/5/13	2- saws	22.00	1,540.00
6/5/13	3- Bobcats	33.00	3,630.00
6/6/13	2 - saws	22.00	1,540.00
6/6/13	3 - Bobcats	33.00	3,630.00
6/6/13	Hydro-Axe	10.00	1,300.00
6/7/13	2 - saws	18.00	1,260.00
6/7/13	2 - Bobcats	18.00	1,980.00
6/7/13	Hydro-Axe	9.00	1,170.00
6/10/13	2 - saws	12.00	840.00
6/10/13	2 - Bobcats	12.00	1,320.00
6/10/13	Hydro-Axe	2.00	260.00
6/12/13	2 - saws	11.00	770.00
6/12/13	3 - Bobcats	33.00	3,630.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$27,570.00					$27,570.00

REMITTANCE	
Statement #	6142013-1 Brittain
Date	
Amount Due	$27,570.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 6142013-2 Brittain
DATE June 14, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Brittain Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Invoice 6142013-1 Brittain		$ 27,570.00
6/13/13	1- saw	11.00	770.00
6/13/13	3- Bobcats	33.00	3,630.00
6/13/13	Hydro-Axe	7.00	910.00
6/14/13	1- saw	9.00	450.00
6/14/13	2- Bobcats	18.00	1,980.00
6/14/13	Hydro-Axe	9.00	1,175.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$36,485.00					$36,485.00

REMITTANCE	
Statement #	6142013-2 Brittain
Date	
Amount Due	$36,485.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 6292013-1 Brittain
DATE June 29, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Brittain Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
6/17/13	Hydro-Axe	8.00	$ 1,040.00
6/17/13	2 - Bobcats	16.00	1,760.00
6/18/13	2 - Bobcats	22.00	2,420.00
6/19/13	3 - Bobcats	33.00	3,630.00
6/19/13	1- saw	11.00	770.00
6/20/13	3- Bobcats	33.00	3,630.00
6/20/13	1 - saw	11.00	770.00
6/21/13	3 - Bobcats	27.00	2,970.00
6/21/13	1 - saw	9.00	630.00
6/24/13	3 - Bobcats	18.00	1,980.00
6/24/13	1 - saw	6.00	420.00
6/25/13	3 - Bobcats	33.00	3,630.00
6/25/13	1 - saw	11.00	770.00
6/26/13	Hydro-Axe	6.00	780.00
6/26/13	3 - Bobcats	33.00	3,630.00
6/26/13	1 - saw	11.00	770.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$29,600.00					$29,600.00

REMITTANCE	
Statement #	6292013-1 Brittain
Date	
Amount Due	$29,600.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

Hutton/Lengel Property

Invoices

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 6292013-1 Lengel, Dennis
DATE June 29, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Dennis Lengel Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
6/27/13	Hydro-Axe	11.00	$ 1,430.00
6/27/13	3 - Bobcats	33.00	3,630.00
6/28/13	Hydro- Axe	9.00	1,170.00
6/28/13	3 - Bobcats	27.00	2,970.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$9,200.00					$9,200.00

REMITTANCE	
Statement #	6292013-1 Lengel, Dennis
Date	
Amount Due	$9,200.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 7112013-1 Lengel, Dennis
DATE July 11, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Dennis Lengel Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
7/1/13	Hydro-Axe	8.00	$ 1,040.00
7/1/13	2 - Bobcats	16.00	1,760.00
7/2/13	Hydro- Axe	11.00	1,430.00
7/2/13	2 - Bobcats	22.00	2,420.00
7/3/13	Hydro-Axe	9.00	1,170.00
7/3/13	2 - Bobcats	18.00	1,980.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$9,800.00					$9,800.00

REMITTANCE	
Statement #	7112013-1 Lengel, Dennis
Date	
Amount Due	$9,800.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 7112013-2 Lengel, Dennis
DATE July 11, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Dennis Lengel Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Carry over from Invoice 7112013-1 Lengel, Dennis		$ 9,800.00
7/8/13	Hydro-Axe	5.00	650.00
7/8/13	3- Bobcats	15.00	1,650.00
7/8/13	1- saw	5.00	350.00
7/9/13	Hydro-Axe	11.00	1,430.00
7/9/13	3- Bobcats	33.00	3,630.00
7/9/13	1- saw	11.00	770.00
7/10/13	Hydro-Axe	11.00	1,430.00
7/10/13	3- Bobcats	33.00	3,630.00
7/10/13	1- saw	11.00	770.00
7/11/13	Hydro-Axe	11.00	1,430.00
7/11/13	3- Bobcats	33.00	3,630.00
7/11/13	1- saw	11.00	770.00
7/12/13	Hydro-Axe	9.00	1,170.00
7/12/13	3- Bobcats	24.00	2,640.00
7/12/13	1- saw	9.00	630.00
	Herbicide deduction		(770.00)

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$33,610.00					**$33,610.00**

REMITTANCE	
Statement #	7112013-2 Lengel, Dennis
Date	
Amount Due	$33,610.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 7232013-1 Lengel, Dennis
DATE July 23, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Dennis Lengel Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

COMMENTS Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
7/15/13	3- Bobcats	6.00	$ 660.00
7/15/13	1- saw	2.00	140.00
7/16/13	3- Bobcats	33.00	3,630.00
7/16/13	1- saw	11.00	770.00
7/17/13	Hydro-Axe	11.00	1,430.00
7/17/13	2- Bobcats	22.00	2,420.00
7/17/13	1- saw	11.00	770.00
7/18/13	Hydro-Axe	6.00	780.00
7/18/13	2- Bobcats	22.00	2,420.00
7/18/13	1- saw	11.00	770.00
7/19/13	Hydro-Axe	4.00	520.00
7/19/13	2- Bobcats	22.00	2,420.00
7/19/13	1- saw	11.00	770.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$17,500.00					$17,500.00

REMITTANCE	
Statement #	7232013-1 Lengel, Dennis
Date	
Amount Due	$17,500.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

Hutton / Shivley

Hutton/Shively Property

Invoices

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 872013-1 Shivley, Linda
DATE August 7, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Linda Shivley - Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
7/22/13	Hydro-Axe	3.00	$ 390.00
7/22/13	2- Bobcats	6.00	660.00
7/23/13	Hydro-Axe	12.00	1,560.00
7/23/13	2- Bobcats	24.00	2,640.00
7/23/13	1- saw	12.00	480.00
7/24/13	Hydro-Axe	12.00	1,560.00
7/24/13	2- Bobcats	24.00	2,640.00
7/24/13	1- saw	12.00	480.00
7/25/13	Hydro-Axe	12.00	1,560.00
7/25/13	2- Bobcats	24.00	2,640.00
7/25/13	1- saw	12.00	480.00
7/26/13	Hydro-Axe	9.00	1,170.00
7/26/13	2- Bobcats	18.00	1,980.00
7/26/13	1- saw	9.00	360.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$18,600.00					$18,600.00

REMITTANCE	
Statement #	872013-1 Shivley, Linda
Date	
Amount Due	$18,600.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 872013-2 Shivley, Linda
DATE August 7, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Linda Shivley - Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 872013-1 Shivley, Linda		$ 18,600.00
7/29/13	Hydro-Axe	7.00	$ 910.00
7/29/13	2- Bobcats	14.00	1,540.00
7/29/13	1- saw	7.00	280.00
7/30/13	Hydro-Axe	12.00	1,560.00
7/30/13	2- Bobcats	24.00	2,640.00
7/30/13	1- saw	12.00	480.00
7/31/13	Hydro-Axe	12.00	1,560.00
7/31/13	3- Bobcats	31.00	3,420.00
7/31/13	1- saw	12.00	480.00
8/1/13	3- Bobcats	36.00	3,960.00
8/1/13	1- saw	12.00	480.00
8/2/13	3- Bobcats	27.00	2,970.00
8/2/13	1- saw	9.00	360.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$39,240.00					$39,240.00

REMITTANCE	
Statement #	872013-2 Shivley, Linda
Date	
Amount Due	$39,240.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 872013-3 Shivley, Linda
DATE August 7, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Linda Shivley - Property
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 872013-2 Shivley, Linda		$ 39,240.00
8/5/13	3- Bobcats	21.00	2,310.00
8/5/13	1- saw	7.00	280.00
8/6/13	3- Bobcats	36.00	3,960.00
8/6/13	1- saw	12.00	840.00
8/7/13	3- Bobcats	36.00	3,960.00
8/7/13	1- saw	12.00	1,040.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$51,630.00					$51,630.00

REMITTANCE	
Statement #	872013-3 Shivley, Linda
Date	
Amount Due	$51,630.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 9262013-1 Hutton Ranch
DATE September 19, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
8/26/13	1 - Bobcat	7.00	$ 770.00
8/26/13	1- Saw	7.00	490.00
8/27/13	2- Bobcats	22.00	2,420.00
8/27/13	1- saw	11.00	770.00
8/28/13	1- Hydro Ax	11.00	1,430.00
8/28/13	1 - Bobcat	11.00	1,210.00
8/28/13	1- saw	11.00	770.00
8/29/13	1- Hydro Ax	11.00	1,430.00
8/29/13	1 - Bobcat	11.00	1,210.00
8/29/13	1- saw	11.00	770.00
8/30/13	2- Bobcats	18.00	1,980.00
8/30/13	1- saw	9.00	630.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$13,880.00					$13,880.00

REMITTANCE	
Statement #	9262013-1 Hutton Ranch
Date	
Amount Due	$13,880.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 9262013-2 Hutton Ranch
DATE September 19, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 9262013-1 Hutton Ranch		$ 13,880.00
9/2/13	1- Hydro Ax	7.00	910.00
9/2/13	1 - Bobcat	7.00	770.00
9/2/13	1- saw	7.00	490.00
9/3/13	1- Hydro Ax	11.00	1,430.00
9/3/13	1 - Bobcat	11.00	1,210.00
9/3/13	1- saw	11.00	770.00
9/4/13	1- Hydro Ax	11.00	1,430.00
9/4/13	1 - Bobcat	11.00	1,210.00
9/4/13	1- saw	11.00	770.00
9/5/13	1- Hydro Ax	11.00	1,430.00
9/5/13	1 - Bobcat	11.00	1,210.00
9/5/13	1- saw	11.00	770.00
9/6/13	2- Bobcat	18.00	1,980.00
9/6/13	1- saw	9.00	630.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$28,890.00					$28,890.00

REMITTANCE	
Statement #	9262013-2 Hutton Ranch
Date	
Amount Due	$28,890.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 9262013-3 Hutton Ranch
DATE September 19, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 9262013-2 Hutton Ranch		$ 28,890.00
9/9/13	2 - Bobcat	14.00	1,540.00
9/9/13	1- saw	7.00	490.00
9/10/13	2 - Bobcat	22.00	2,420.00
9/10/13	1- saw	11.00	770.00
9/11/13	2 - Bobcat	22.00	2,420.00
9/11/13	1- saw	11.00	770.00
9/12/13	2 - Bobcat	14.00	1,540.00
9/12/13	1- saw	7.00	490.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$39,330.00					$39,330.00

REMITTANCE	
Statement #	9262013-3 Hutton Ranch
Date	
Amount Due	$39,330.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 9262013-4 Hutton Ranch
DATE September 19, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 9262013-3 Hutton Ranch		$ 39,330.00
9/16/13	2 - Bobcat	16.00	1,760.00
9/16/13	2- saw	16.00	1,120.00
9/17/13	2 - Bobcat	22.00	2,420.00
9/17/13	2- saw	22.00	1,540.00
9/18/13	3 - Bobcat	33.00	3,630.00
9/18/13	1- saw	11.00	770.00
9/19/13	3 - Bobcat	33.00	3,630.00
9/19/13	1- saw	11.00	770.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$54,970.00					$54,970.00

REMITTANCE	
Statement #	9262013-4 Hutton Ranch
Date	
Amount Due	$54,970.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 10092013-1 Hutton Ranch
DATE October 9, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
9/20/13	3 - Bobcat	27.00	$ 2,970.00
9/20/13	1- saw	9.00	630.00
9/23/13	3 - Bobcat	24.00	2,640.00
9/23/13	1- saw	8.00	560.00
9/24/13	3 - Bobcat	33.00	3,630.00
9/24/13	1- saw	11.00	770.00
9/25/13	3 - Bobcat	33.00	3,630.00
9/25/13	1- saw	11.00	770.00
9/26/13	3 - Bobcat	33.00	3,630.00
9/26/13	1- saw	11.00	770.00
9/27/13	3 - Bobcat	27.00	$ 2,970.00
9/27/13	1- saw	9.00	630.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$23,600.00					$23,600.00

REMITTANCE	
Statement #	10092013-1 Hutton Ranch
Date	
Amount Due	$23,600.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

STATEMENT

Berghorst Land Clearing

1020 East South E
Broken Bow, NE 68822
Home 308-872-5186 Cell 308-870-0915

STATEMENT NO. 10092013-2 Hutton Ranch
DATE October 9, 2013
CUSTOMER ID Yuma County Pest Control

BILL TO
Hutton Ranch Education Foundation
Yuma County Pest Control District
PO Box 311
Yuma, CO 80759

Russian-olive removal

DATE	DESCRIPTION	HOURS	AMOUNT
	Forward Balance from 10092013-1 Hutton Ranch		$ 23,600.00
9/30/13	3 - Bobcat	15.00	1,650.00
9/30/13	1- saw	5.00	350.00
10/1/13	3 - Bobcat	33.00	3,630.00
10/1/13	1- saw	11.00	770.00
10/2/13	3 - Bobcat	33.00	3,630.00
10/2/13	1- saw	11.00	770.00
10/3/13	3 - Bobcat	22.00	2,420.00
10/3/13	1- saw	11.00	770.00
10/4/13	3 - Bobcat	16.00	1,760.00
10/4/13	1- saw	8.00	$ 560.00

CURRENT	1-30 DAYS PAST DUE	31-60 DAYS PAST DUE	61-90 DAYS PAST DUE	OVER 90 DAYS PAST DUE	AMOUNT DUE
$39,910.00					$39,910.00

REMITTANCE	
Statement #	10092013-2 Hutton Ranch
Date	
Amount Due	$39,910.00
Amount Enclosed	

Make all checks payable to Berghorst Land Clearing
THANK YOU FOR YOUR BUSINESS!

BUDGET

Republican River Watershed Riparian Restoration CWCB 2013

SUMMARY BY SOURCES	Source of Funds	CWCB Grant Request	Applicant Match ($)	Partner Match ($)	Total Funding ($)	% of Total Cash by Entity	% of Total In-Kind by Entity
CASH							
	CWCB	90,000.00			$90,000.00	30.5%	
	Applicant/Yuma County Pest Control District (YCPCD)		100,000.00		$100,000.00	33.9%	
	Republican River Water Conservation Board (RRWCD)			15,000.00	$15,000.00	5.0%	
	Colorado Corn			10,000.00	$10,000.00	3.3%	
	Private Landowners			15,000.00	$15,000.00	5.0%	
	Three Rivers Alliance			15,000.00	$15,000.00	5.0%	
	Total Cash				$245,000.00		
IN-KIND							
	Applicant/Yuma County Pest Control District		25,000.00		$25,000.00		8.33%
	Private Landowners			15,000.00	$15,000.00		5.00%
	Yuma Conservation District			2,500.00	$2,500.00		0.83%
	NRCS			2,500.00	$2,500.00		0.83%
	Three Rivers Alliance			5,000.00	$5,000.00		1.66%
	Total Estimated Value In-kind Services		25,000.00	25,000.00	$50,000.00		
TOTAL PROJECT COST ALL SOURCES OF FUNDS		$90,000.00	$125,000.00	$80,000.00	$295,000.00		

CASH FUNDED ACTIVITIES	Describe Tasks for Use of Funds include vendor/service provider if known	Number of Units	Cost Per Unit	CWCB Funds	Applicant Funds	Partner Funds	Total Funding ($)
Professional Services							
Control & Maintenance							
Professional services,equipment, cut-stump treatment	These funds will pay for the contractor that is hired to complete the removal and herbicide application (cut-stump) of Russian-olive and tamarisk for the project.	370 acres	660.00	90,000.00	100,000.00	55,000.00	$ 245,000.00
USE OF FUNDS - CASH SUBTOTAL				$90,000.00	$100,000.00	$55,000.00	$245,000.00

IN-KIND FUNDED ACTIVITIES	Describe Tasks for Use of Funds include vendor/service provider if known	No. of Units	Cost Per Unit		Value Applicant Services	Value Partner Services	Total Funding ($)
Professional Services							
YCPCD	Herbicide Purchase	60 gal.	83.33		5,000.00		$5,000.00
Conservation Districts/NRCS	Technical assistance, education, program management	225.00	20.00			4,500.00	$4,500.00
Conservation Districts/NRCS	Host informational meeting	1.00	500.00			500.00	$500.00
Three Rivers Alliance	Field Day - Tour site/Producers time	2.00	500.00			1,000.00	$1,000.00
Three Rivers Alliance	Education of landowners and site visit	200.00	20.00			4,000.00	$4,000.00
Monitoring Program							
YCPCD	Monitoring for resprouts and other invasives	571.00	35.00		20,000.00		$20,000.00
Private Landowners	Equipment and labor	285.00	35.00			10,000.00	$10,000.00
Maintenance							
Private Landowners	Fencing material					5,000.00	$5,000.00
Other							
	USE OF FUNDS - IN-KIND SUBTOTAL				$25,000.00	$25,000.00	$50,000.00
	TOTAL PROJECT COST			$90,000.00	$125,000.00	$80,000.00	$295,000.00

PHOTOS

REPUBLICAN RIVER RESTORATION PROJECT RUSSIAN-OLIVE and TAMARISK REMOVAL 2013

BEFORE AND AFTER PICTURES

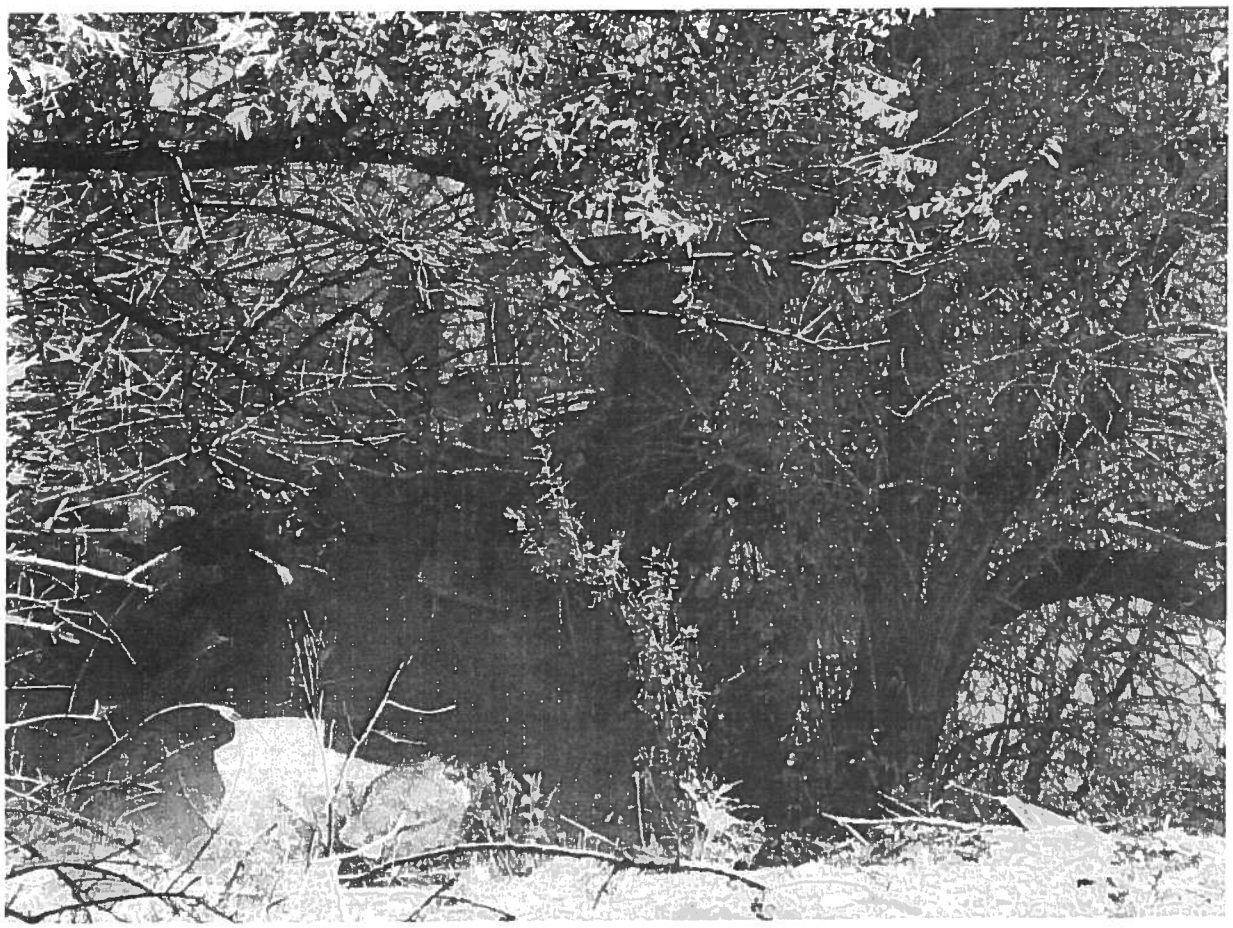
Hutton Property - Before

Hutton Property - After

Lengel Property - Before

Lengel Property - After

Hydro-Axe



Hydro-Axe

Stump

RUSSIAN-OLIVE IMPACT STUDY

Title: Ecological impacts of Russian olive along the South Fork of the Republican River

Submitted to: Three Rivers Alliance

Date: December 10, 2012

Authors:
Graham Tuttle[1], Andrew Norton[1], Gabrielle Katz[2]
1. Colorado State University, Fort Collins, CO
2. Appalachian State University, Boone, NC

Summary:
Over the past three years we have been collecting data on light, soil N and plant cover to better understand the impacts that Russian olive is having on the South Fork of the Republican River. From our first two years of data, before any Russian olive were removed, we found that shading and soil N is increased under Russian olive compared areas outside the tree's canopy. We also found that there is higher cover of exotics and broadleaf plants and lower cover of native and grasses under Russian olive compared to outside its canopy. In the first year after Russian olive has been removed we found that plant cover has dramatically decreased. This is most likely due to the heavy machinery used to remove the tree, in addition to dry weather in the summer of 2012. We are now eager to collect more light, soil N and plant cover data to see how the river system responds to the removal process and the loss of Russian olive's influence on light and soil N.

Background:
Russian olive (*Elaeagnus angustifolia*) was introduced to the US in the early 1900's from western Asia and southern Europe and has since become a common and in some cases dominant member of western riparian systems. This tree represents a new functional group in riparian habitats because it is both increases and is tolerant to shading, which is not true for any other native riparian tree species in the Great Plains (Katz and Shafroth 2003). Several studies (e.g. DeCant 2008, Follstad Shah & Dahm 2008, Reynolds and Cooper 2011) have demonstrated that riparian soil N levels are substantially higher under Russian olive than in areas outside of the tree's canopy. Decreased light availability and increased soil N availability associated with Russian olive represent significant changes to western riparian habitats, potentially leading to changes in plant community structure and increased invasion by exotics that are better able to exploit the novel conditions. In Colorado, many acres of Russian olive are being removed because of the potential impacts it has on the areas it invades. To date we have demonstrated that Russian olive dramatically alters available N and light and this is associated with a change in the plant community from one dominated by native perennial grasses to one dominated by exotic annual grasses and annual forbs. Continued work will allow us to determine a) whether the plant community is responding more strongly to the altered light or altered N conditions, b) whether the impact of Russian olive is the same throughout the riparian corridor or is greater in areas with higher water availability and c) whether Russian olive removal results in rapid restoration of a native perennial community or if its impacts are longer lived.

Methods:

General:

For the past three years (2010, 2011 & 2012) we have been collecting light, soil N, plant percent cover and other environmental variable data from 400 permanent, 1x1 sq. meter plots located in four sites along the South Fork of the Republican River (Picture 1). At each site, we placed 40 plots along two or three lines (transects) running perpendicular to the river and extending 100- 300 meters upland. The transects represent three treatments: no Russian olive removal, removal of Russian olive, removal with follow-up restoration (Picture 2). Plots were paired with one underneath Russian olive (Russian olive plots) and one at least 3 meters outside of Russian olive canopy (reference plots). In spring and summer 2012 the Russian olive removal treatments were completed at 2 of our study sites.

Picture 1: The red squares show the four sites along the South Fork of the Republican River.

Picture 2: The three red lines represent three transects running perpendicular to the river in one site.

Light and Soil N:

In April 2011 and again in June 2011 we used a LICOR LAI-2000 Canopy Analyzer to measure light intensity one meter directly above each plot. Light measurements consisted of averaging light intensity values in the four corners of the plot and the center. Each plot was then compared to light intensity values taken in full sun immediately before sampling in the plots following the methodology described by Nackaerts et al. 2000. To measure available soil N, we used ion exchange resin bags buried 5-10 cm in the corner closest to the nearest Russian olive tree in 12 of the 20 pairs of plots for two transects at each site. The 12 plots represent every other pair of plots along each transect plus the middle and last pairs. We buried for the bags for 4 month intervals (Aug.-Dec., Dec.-April, April-Aug). After bags were retrieved from the field, we measured ammonium and nitrate concentrations for each sample using the Alpkem Flow Solution IV Automated wet chemistry system (O.I. Analytical, College Station TX) at Colorado State University Natural Resource Ecology Laboratory.

Plant Community Structure:

In August 2010, 2011 & 2012 we collected data on percent cover of each plant species in each plot. We used Non-metric Multi-dimensional Scaling (NMS) on species cover data to examine changes in abundance on a finer scale. NMS allowed us to compare the plots based on the number of species each had in common and the percent cover of those species. We used Multi-Response Permutation Procedure (MRPP) to see if there was a statistically significant difference in plant community structure for plots under Russian olive and outside Russian olive canopy. Based on these results, we used a series of mixed-model ANOVAs to determine whether Russian olive presence significantly altered the abundance of each of six functional groups. Plants were

assigned to one of six functional groups (annual grass, annual forb, perennial C3 grass, perennial C4 grass, perennial forb & woody) and the percent cover of each was determine for each plot.

Effect of Russian olive Removal:
In summer 2012, Russian olive trees were removed from one transect at two sites. We then collected soil N and plant community structure data using the techniques described earlier. These data show us the immediate impact of removing the tree.

Results:
Light and Soil N:
As presented previously, we found that light is significantly lower under Russian olive than outside the tree's canopy, and Russian olive causes more shading than cottonwood (Fig. 1). We also found that there is higher plant available N underneath Russian olive than outside the tree's canopy throughout the year (Fig. 2).

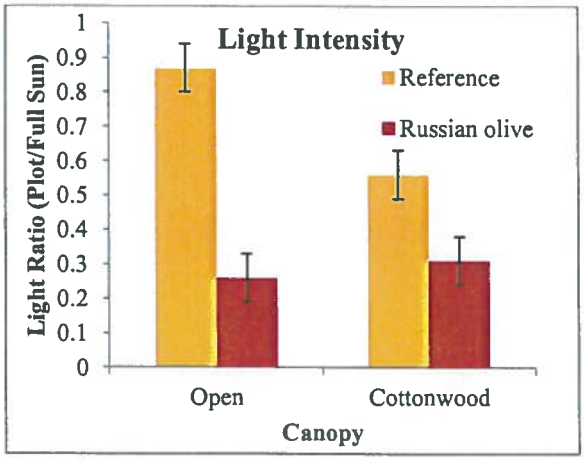


Figure 1 Light Intensity of plots as a function of setting (Open vs.Cottonwood) and Russian olive (Russian olive vs, Reference) within each setting. Settings were: underneath cottonwood canopy (Cottonwood) and outside cottonwood canopy cover (Open)), Russian olive impact was assessed as: under Russian olive canopy (Russian olive) and outside Russian olive canopy cover (Reference). The difference between the yellow bar in the Open canopy and Cottonwood canopy represents the shading due to cottonwood alone. The difference between the red bar and the yellow bar in the Open canopy represents the shading due to Russian olive alone. Note that the shading due to Russian olive is greater than the shading due to cottonwood.

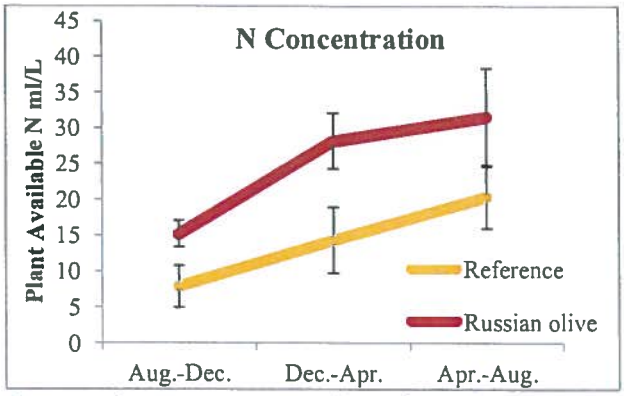


Figure 2 Soil N concentration from August 2010 to August 2011. Note that plots under Russian olive (Russian olive) have consistently higher soil N concentrations than plots outside Russian olive canopy (Reference).

Plant Community Structure:

From the NMS analysis, we found that there is a distinct grouping between plots under Russian olive and plots outside its canopy (Fig. 3). Our MRPP analysis showed that this pattern was statistically significant (Table 1). This means that plant community structure is different between the Russian olive and reference plots. To better understand how the plant communities differ, we compared exotic, native and functional group cover between the Russian olive and reference plots, while taking into account the influence of the different sites and transects would have on these measures. We found that in both 2010 and 2011 there was greater exotic and forb cover and less perennial grass cover in plots under Russian olive than in reference plots (Fig 4).

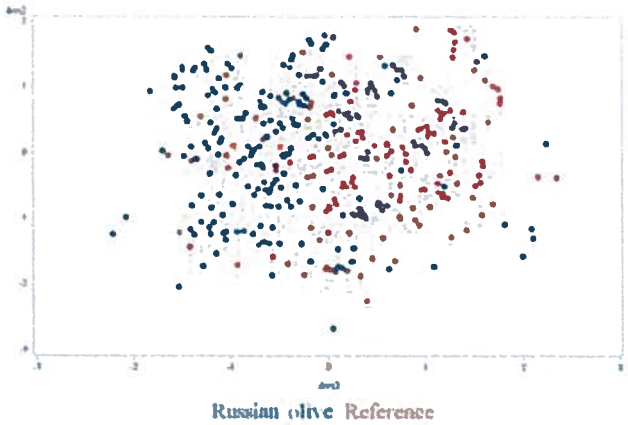


Figure 3 The results from the NMS analysis shows how similar each plot (one point) is to the others based on plant cover. Points that are far apart means that those plots have few species in common. Note that Russian olive plots are generally separated from reference plots. This means that Russian olive and reference plots generally do not have many plant species in common.

Russian olive group mean distance	Reference group mean distance	N (per group)	T-statistic	P-value
0.887198	0.884393	200	-27.880	<0.0001

Table 1: The results from MRPP analysis confirm what Fig. 3 indicates. It shows that plots underneath Russian olive have a significantly different plant community structure than plots outside Russian olive canopy.

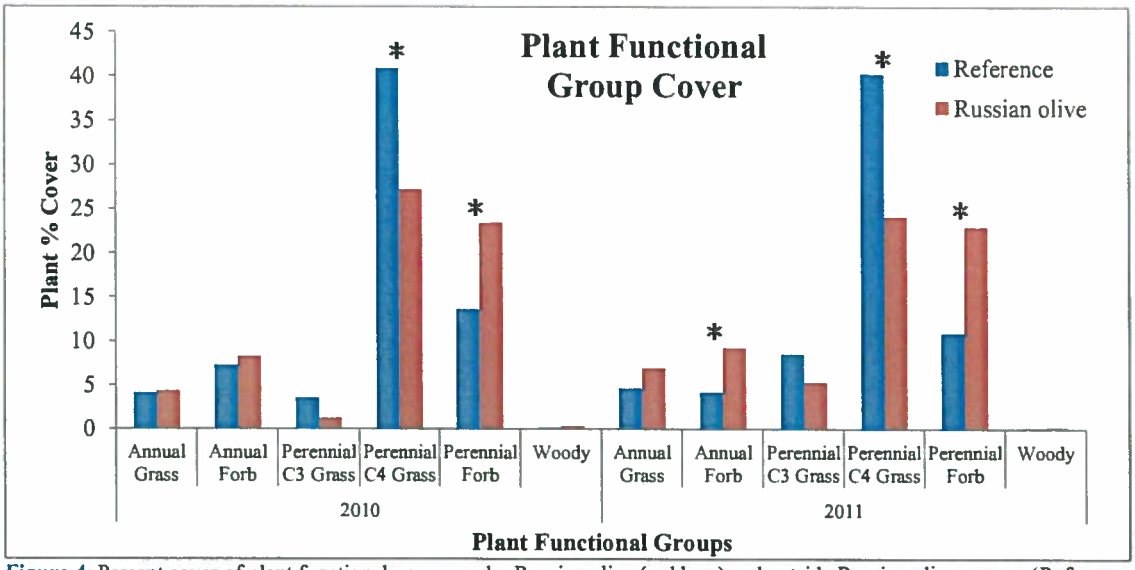


Figure 4: Percent cover of plant functional groups under Russian olive (red bars) and outside Russian olive canopy (Reference, blue bars). Asterisks indicate statistically significant difference in percent cover between Russian olive and reference plots. This graph shows that there is a higher percent cover of perennial forbs and lower C4 grass cover under Russian olive than in reference plots in both 2010 and 2011. For 2011, there was also significantly higher cover of annual forbs in Russian olive plots.

Effect of Russian olive Removal:

As can be seen by pictures 3 & 4 below and figure 5, the removal process greatly reduced total plant cover. We attribute the dramatic decrease in total plant cover in 2012 to mostly the disturbance of removal machinery but also to the fact that 2012 was an exceptionally dry year. Although these short term changes are pronounced, it will be important to see how the system responds to the removal procedure and to the absence of Russian olive's influence on soil N and light over the next few years. Since many riparian plant species are adapted to frequent disturbances, we believe the system will quickly be restored.

Picture 3: Prior to the trees' removal (August 2011), Russian olive are common underneath the Cottonwood canopy and grass grows densely.

Picture 4: After the trees' removal (August 2012), Russian olive no longer grows under cottonwood (although a few trees remain for our control transect) and the heavy use of machinery has removed all

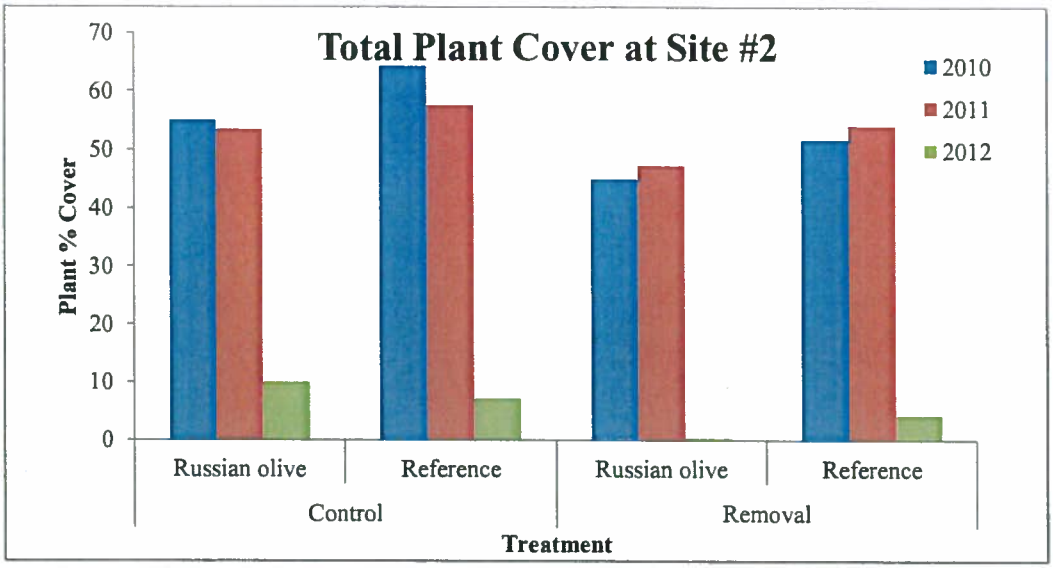


Figure 5: This graph shows that total plant cover at one site was very similar between 2010 and 2011 (blue and red bars, respectively) for all treatments, but decreased dramatically after Russian olive removal (green bars). Plots were paired up with one plot under Russian olive canopy (Russian olive) and one plot outside the tree's canopy (Reference). Those pairs were located in either areas where the tree was removed in 2012 (Removal) or areas where the tree is still intact (Control). Notice that all plots treatment types had reduced plant cover because removal machinery drove over all plots including those in the control transect.

Proposed work:

Now that Russian olive is being removed from our study sites we are able to look at the effects of the removal process and the absence of the tree's impacts on light and soil N. Over the next few years, we will be able to see how the ecosystem responds to the removal of this tree and the disturbance caused by the removal process.

Over the past year, we have been collecting additional environmental variable data to better understand what conditions lead to the largest impacts of Russian olive on soil N and plant community structure. We have data on soil texture, flooding history and stand structure to better describe the environmental conditions in each plot. This December, we will finish collecting high accuracy elevation data to measure how far (distance and height above) each plot is from the river. Once we have these final data, we will be able to better describe where Russian olive is having the biggest impacts and should, therefore, be targeted for removal.

Literature Cited:

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PROJECT FINAL REPORT THROUGH DECEMBER 2013

CWCB Tamarisk and Russian-olive (TRO) Cost Sharing Grant Program

Final Project Report

For

Republican River Watershed Riparian Restoration Project (RRWRRP)

Description of Project

Restoration and maintenance of the native riparian communities of the Republican River by controlling the non-native woody species, tamarisk and Russian-olive. The project will be completed using the cut stump method of control with ground crews and equipment to remove non-native woody species.

North Fork of the Republican River

Tamarisk and Russian-olive removal started on properties along the North Fork of the Republican River, and the tributaries that are related to the North Fork of the Republican River, in January of 2009. To date, 315 acres of Russian-olive have been removed along the North Fork of the Republican River and the tributaries related to the North Fork of the Republican River. The Russian-olive was removed using a cut stump method of control with Garlon 3A. JLB oil with dye was used with the herbicide combination to mark the treated stumps. The removed Russian-olive was then piled in slash piles out of the riparian zone. The slash piles can either be burnt by the landowner or left for wildlife habitat. Yuma County Pest Control District is currently looking into a mulcher/chipper that could be used to grind the piles into mulch and the biomass can then be used for numerous possibilities.

The North Fork of the Republican River still has approximately 30 acres of Russian-olive waiting for removal. During the first six (6) months of 2013 Yuma County Pest Control District, Colorado Parks and Wildlife, United States Fish and Wildlife, and private landowners have begun the process of removing Russian-olive from Chief Creek which flows into the North Fork of the Republican River just west of Stalker Ponds west of Wray, Colorado. Yuma County Pest Control District and the other partners of this project continue to educate landowners within the North Fork of the Republican River drainage that have not yet committed to the removal project.

During the spring of 2013 and into early summer Yuma County Pest Control District treated any re-growth. A survey of the treated area, in the winter of 2010, showed that the control percentage was around 95%. Native grasses and shrubs have started to replace the Russian-olive over the past two growing seasons. Yuma County Pest Control District will continue to monitor the areas of control.

Funds spent on the North Fork of the Republican River since 12/31/2012 to 12/20/2013 (non-CWCB funds)

$45,000

Arikaree River

Many of the landowners on the Arikaree River, and the tributaries to the Arikaree River, have decided to remove the tamarisk and Russian-olive without the assistance of this project. Yuma County Pest Control District has help with technical assistance and herbicide. Three Rivers Alliance has help with funding options and set up a meeting with many of the landowners in the Arikaree River drainage. Yuma County Pest Control District and Three Rivers Alliance was able to get a project put together on the Beecher Island Battlefield site. The control method was the same as the North Fork of the Republican River.

Funds spent on the Arikaree River since 12/31/2012 to 12/20/2013 (non-CWCB funds)

$0 – No project took place during this time frame.

South Fork of the Republican River

Russian-olive and tamarisk removal started on the South Fork of the Republican River in the spring of 2010. To date 1,150 acres of Russian-olive and 7 acres of tamarisk have been removed along the South Fork of the Republican River from four (4) miles within Kit Carson County, Colorado to the Kansas state line. This includes the tributaries on the South Fork of the Republican River below Bonny Reservoir. The control method is the same as the North Fork of the Republican River. The Russian-olive and tamarisk removal project will continue on the South Fork of the Republican River as all the landowners from the Yuma/Kit Carson County line to the Kansas state line have agreed to participate in the project. The project is still projected to be finished by December 2016 depending on the availability of the contractor and funding.

The RRWRPP has expanded as Yuma County Pest Control District has brought in more partners. The project of removing Russian-olive and tamarisk is now only one phase of the project. Yuma County Pest Control District and Three Rivers Alliance have partnered with Colorado State University and Appalachian State University to conduct a study on the impact of Russian-olive. The overview of the study from Dr. Gabrielle Katz, Appalachian State University, and Dr. Andrew Norton, Colorado State University, can be found as an attachment to this final report. Yuma County Pest Control District has partnered with the Colorado Parks and Wildlife to start controlling the monoculture of cattails that are found in areas along the South Fork of the Republican River. The project was completed in June of 2013 using a helicopter to apply herbicide on 208 acres of cattails. This project is being monitored and results should be seen in the spring of 2014.

The collaboration of partners on the RRWRRP has also been in discussion with the Army Corp of Engineers and the Colorado Department of Transportation to discuss a silt mitigation plan for the stretch of the South Fork of the Republican River that U.S. Highway 385 crosses over. Local NRCS offices have allowed landowners to enroll in certain programs to help offset some of the removal and restoration costs. Funds spent on the South Fork of the Republican River Russian-olive and tamarisk removal (non-CWCB funds)

$200,000

Funds spent on the cattail mitigation

$40,000

Russian-olive impact study 2013

$15,000