Draft Grant Narrative compiled by Working for Rivers for:
NRCS 2010 CIG National Grant Proposal
Tamarisk and Russian olive Biomass Utilization Sub-Project
May 17, 2010

1. Project Description

a. Project narrative: (formatted to address each of the "merit review criteria")

Purpose, approach, and goals: This project is intended to demonstrate innovative yet practical conservation technologies which will facilitate the utilization of raw woody biomass generated in the process of controlling tamarisk (*Tamarix spp*.) and Russian olive (*Elaeagnus angustifolia*); two aggressive, non-native woody plants. Both species are widespread in the western United States, have a range of negative environmental impacts, and are costly to control. The proposed project involves testing of both species as alternative feedstocks for (1) pelletization and (2) conversion to biogas via gasification.

Innovative technology or approach: This project focuses on tamarisk and Russian olive as untapped sources of woody biomass, sustainable and available in large quantities. To facilitate adoption of these conservation approaches, this project only involves technologies which are currently commercially available. The processes of pelletization and combustion in pellet stoves, and conversion to biogas via the BioMax25® are tested and proven (demonstrated) technologies, ready to utilize alternative (new) feedstocks which are widespread, abundant, and sustainable. If tamarisk and Russian olive are shown to be suitable fuels for these technologies, land owners and managers will have new (innovative) options for offsetting the costs of tamarisk and Russian olive control, and achieving their conservation goals. In addition, private sector contractors and entrepreneurs will have the option of working with land managers and owners to harvest these species and utilize this technology in a business application.

This project will generate important technical information on the feasibility of utilizing two abundant sources of "waste" biomass for conversion to heat and energy- an innovative approach to a conservation challenge faced by landowners and land managers on a local, regional, and national level.

Project Management: The Working for Rivers Foundation promotes large-scale, cost-effective river restoration focused on job creation, building workforce capacity, and connecting people to funding, expertise, and a qualified workforce to accomplish their riparian restoration goals. In addition, we are committed to researching alternative uses for tamarisk removed during the restoration process and distributing these findings to others to help offset the costs of restoration work.

- Building workforce capacity: We coordinate experts to provide complete riparian restoration training workshops, and then connect land managers with a skilled workforce that has the capacity to accomplish their restoration projects.
- Connecting people and resources: We help land managers plan and find funding resources to coordinate labor-intensive restoration that is focused on removing invasive species and replanting natives.
- Recycling Tamarisk: To offset the costs associated with riparian restoration, we are researching biomass utilization options for tamarisk and Russian olive. Ultimately, the

Working for Rivers website will become a clearinghouse of information on ways to convert waste material to energy or value-added products.

Working for Rivers staff includes Tillie Walton (Founder), Mike Boyle (Director of Operations), and Jamie Nielsen (Restoration and Outreach Coordinator), with over 25 years combined experience in riparian and ecological restoration and consulting, and invasive plant public education, prevention, and management.

Transferability: The information generated will benefit local, state, federal and private land managers involved in tamarisk and Russian olive control work, seeking to offset the costs of control and restoration, restore wildlife habitat and ecosystem function, and reduce wildfire threat posed by standing dead tamarisk biomass created by the tamarisk biocontrol beetle. This project will also lead to the transfer of conservation technologies, management systems, and innovative approaches to the private sector (heating, energy and power generation) seeking alternative sources of biomass feedstock. The information generated will be well-suited to all forms of NRCS technology transfer materials. Upon completion of the project the WfR website will become a clearinghouse for information on ways to convert waste material to energy and value-added products.

Tamarisk and Russian olive are non-native, invasive species which spread aggressively and without regard for geo-political boundaries. Both species are now abundant on federal and state lands, private lands, and tribal lands, where traditionally underserved Native American communities experience negative impacts to water resources, wildlife habitat, and important cultural resources due to tamarisk and Russian olive infestations.

b. Project background:

Tamarisk and Russian olive are untapped sources of woody biomass, sustainable and available in extremely large quantities. In the course of a tamarisk control project, slash can be piled and burned on site, generating air pollution, or shipped to landfills- a costly alternative.

The abundance of standing dead tamarisk, in particular, is being augmented by a biological control beetle. After nearly a decade of laboratory and field testing, the tamarisk leaf beetle (*Diorhabda* spp.) biological control was approved by USDA APHIS for open release in 2001. Populations were subsequently released in six states, and *Diorhabda* is now widely dispersed in the western United States. A population of *Diorhabda* released in Lovelock, Nevada has periodically defoliated approximately 30,000 hectares of tamarisk, killing an estimated 75% of the tamarisk present in the Humboldt Basin. Four distinct species of *Diorhabda* are now defoliating tamarisk in Arizona, California, Colorado, Nevada, Texas, and Utah. Predictive models based on the beetle's native habitat and range indicate that *Diorhaba* species can expand as far north as Wyoming, and as far south as the deserts of Arizona and southern California. Little is known about long-term impacts of the biocontrol beetle, but large areas of standing dead tamarisk biomass are creating new conservation challenges for land managers. Information on the properties of beetle-killed tamarisk biomass and its suitability as a feedstock for conversion to energy may be critically important for land managers seeking to offset the costs of tamarisk control, restore wildlife habitat and ecosystem function, and reduce wildfire threat posed by standing dead tamarisk biomass.

Some analyses of basic wood chemistry for tamarisk and Russian olive have been done, but methodology, quality, and availability of results are extremely varied. No testing of beetle-killed tamarisk biomass has been conducted. A broad range of technologies for conversion of woody

biomass to heat and energy have been developed, but information is needed on how beetle-killed tamarisk, green tamarisk, and Russian olive will perform as feedstocks for these technologies.

- Pelletization: "Pellet fuel is a renewable, clean-burning and cost stable home heating alternative currently used throughout North America. It is a biomass product made of renewable substances – generally recycled wood waste. There are approximately 800,000 homes in the U.S. using wood pellets for heat, in freestanding stoves, fireplace inserts and even furnaces. Pellet fuel for heating can also be found in such large-scale environments as schools and prisons. Pellet fuel is a way to divert millions of tons of waste from landfills and turn it into energy." (Pellet Fuels Institute, www.pelletheat.org)
  Portable pellet mills have been developed and are available to land managers today. Transporting a finished product like pellets off-site is much more fuel-efficient and cost-effective than transporting raw woody biomass off-site.
- Gasification: Tamarisk and Russian olive may be ideal feedstocks for biomass-to-energy conversion via the BioMax® system. The BioMax® (trademark Community Power Corporation) is a renewable energy system that converts biomass to a renewable fuel gas that can then be converted into other forms of energy including mechanical, electrical, thermal, chemical, or liquid fuels. The BioMax® is designed to compete against engine generators, and renewable systems such as photovoltaics and wind, and propane. Potential commercial customers include the US Army, agricultural producers, farm cooperatives, lumber-processing operations, greenhouse operations, and Utilities. (Community Power Corporation, http://www.gocpc.com/index.html) Several BioMax® units have been purchased by the USDA Forest Service, for power generation and biomass utilization demonstration projects. (USDA Forest Service Utilization of Southern Forest Resources, http://www.srs.fs.usda.gov/usfr/)

c. Project objectives:

- Basic Information on properties of Beetle-Killed vs. Green Tamarisk, and Russian olive (Alternative Feedstock) Biomass: Wood chemistry comparing beetle-killed tamarisk, green tamarisk, and Russian olive (Hazen Research, Inc.)
- Conversion to Pellets (**Promising Conservation Technology/Approach #1**): Suitability for pelletization and pellet stove outputs (BTUs generated, ash volume, and analysis of smoke/emissions), in pure form and combined with other feedstocks (Yankee Pellet Mill, NH)
- Conversion to Biogas (**Promising Conservation Technology/Approach #2**): Suitability of beetle-killed tamarisk, green tamarisk, Russian olive for conversion to biogas via the BioMax25® gasification system (USDA Forest Service Utilization of Southern Forest Resources, Pineville, LA)
- Economic Feasibility (**Affordability and Usefulness in the Field**): Summary of associated costs (on-site processing, transport, pelletization, BioMax® system)
- Dissemination of Information (**Transfer of conservation technologies, management systems, and innovative approaches**): Via a central web "clearinghouse" of results, links to processors, pelletizer and gasifier providers, and general biomass utilization resources at www.workingforrivers.org, and quarterly and semi-annual progress reports, and final project report to NRCS, through the Missouri River Watershed Coalition.

d. Project methods:

Biomass collection tools and processes: Tamarisk will be collected at two sites adjacent to the Colorado River near Moab, Utah. WfR will coordinate these efforts with the Bureau of Land Management Moab Field Office. Collection sites will be chosen based on availability of green (live) tamarisk, as well as standing dead tamarisk that has been impacted by the tamarisk leaf beetle biological control agent. Collection will occur with the use of a professional clearing crew composed of at least three crew members and a supervisor from WfR. Chainsaws will be used to fell the trees and a 12" chipper will be used to chip the material to the size required for testing. Chips will be collected in heavy duty (.006 mil) plastic bags, sealed with duct tape, and labeled. Each sample, green or dead, will be labeled and color coded using different colors of duct tape. Each bag will contain approximately 50 – 60 pounds of chipped material. Bags will be secured to pallets with a plastic wrap for shipping. One thousand pounds of dead and 2,000 pounds of green material will be shipped to the USDA Forest Service lab in Pineville, LA using a freight carrier based in Moab (Old Dominion Freight Line). Thirty pound samples of the same material will be bagged, labeled, and shipped via UPS to Yankee Pellet Mill in New Hampshire, and a gallon-sized ziplock bag of each sample will be mailed to Hazen Research Inc., in Colorado for elemental and constituent analyses.

Russian olive samples will be collected at a site selected by the Goshen County Weed and Pest Control District in Torrington, WY. These trees have been felled and chipped already. A site inspection of the chipped material will be conducted to determine the suitability of the chipped biomass for project specifications. If the Russian olive samples are not adequate, a crew will be hired to fell and chip the material to the desired consistency. If the samples are adequate, chips will be collected, sealed, labeled, and secured to pallets, following the same protocol described above. A 1,000 pound sample will be shipped to the USDA Forest Service lab in Pineville, LA using a locally-based freight carrier. A 30 pound sample of the same material will be bagged, labeled, and shipped via UPS to Yankee Pellet Mill in New Hampshire, and a gallon-sized ziplock bag will be mailed to Hazen Research Inc., in Colorado for elemental and constituent analyses.

On-going record keeping will document all costs associated with on-site processing, equipment and labor, and shipping.

The BioMax® downdraft gasifier was developed by Community Power Corporation in Littleton, CO, with funding from the U.S. Department of Energy. The process involves feeding woody biomass into the BioMax®, which converts the feedstock to a usable syn-gas (synthetic gas), which fuels an internal combustion engine, which in turn operates a generator producing electrical power. The energy stored in the feedstock by the photosynthesis process is released for conversion to other forms of energy by means of computer controlled thermochemical reactions in the downdraft gasifier. For woody biomass the clean fuel gas typically has an energy content of about 120 to 165 Btu/cu ft. The fuel gas is composed of about 20% CO, 20% H2 and 2% CH4. The clean gas can also be converted to a liquid fuel, or to thermal energy using a burner.

e. Location and size of project area:

Results applicable in: Southwestern United States, Colorado Plateau and Rocky Mountain Regions, Central United States.

Biomass harvest sites: Utah, Wyoming, Montana

Biomass project management: Arizona

Biomass analysis and testing: New Hampshire, Louisiana

g. Project action plan and timeline
Fall 2010

- Chip, bag, & ship beetle-killed tamarisk and green tamarisk from Moab, UT. Ship pre-determined volumes (specific to testing, pellet, and biogas facilities) to Yankee Pellet Mill, USFS Utilization of Forest Resources, and Hazen Research, Inc.
- Chip, bag, and ship Russian olive from Goshen County, WY. Ship pre-determined volumes (specific to testing, pellet, and biogas facilities) to Yankee Pellet Mill, USFS Utilization of Forest Resources, and Hazen Research, Inc.

Winter 2010/2011

- January, 2011: Quarterly progress and financial reports.
- Hazen Research, Inc., Golden, CO: Perform fuel analyses on samples of raw material (green tamarisk, beetle-impacted tamarisk, Russian olive, plus one sample of herbicide-treated tamarisk from Missouri River Watershed).
- Yankee Pellet Mill: Pelletize and test BTUs, ash volume, particulates/compounds in smoke for pure samples and combination pellets. Mail pre-determined volumes of ash from each type of pellet to Accutest Laboratory, for analysis of heavy metals toxicity of the ash and pH.
- USFS lab in Pineville, LA: Test each feedstock (green tamarisk, beetle-impacted tamarisk, Russian olive) in the BioMax25 downdraft gassifier.
- Accutest Laboratory in Wheat Ridge, CO: Analyze toxicity of ash from gasification process and from pellet burning, to generate information on suitability of byproduct (ash) as a soil amendment. (Heavy metals leaching and pH)
- April, 2011: Quarterly progress and financial reports.

Summer, 2011

- Working for Rivers project management, coordination with partner organizations, compile and process information (economic feasibility, technologies, field work, photo documentation, pellet and biogas reporting, wood chemistry, etc), information transfer, update website design, and reporting.
- July, 2011: Quarterly progress and financial reports.

Fall, 2011

- Working for Rivers information transfer: post project results plus related information and links onto the tamarisk and Russian olive biomass utilization web-based information clearinghouse. Information transfer and reporting.
- October, 2011: Quarterly progress and financial reports. Submit materials for final project report to Center for Invasive Plants Management, Montana State University.

i. Benefits or results expected and transferability:
Working for Rivers will disseminate all information generated through this project to the general public, state and federal land managers, and the private sector via a tamarisk and Russian olive biomass utilization "information clearinghouse" on our website: www.workingforrivers.org. The NRCS and partner organizations, including the Center for Invasive Plants Management and the Missouri River Watershed Coalition, will receive all information generated in the form of

quarterly and semi-annual progress reports, and final project reports. In addition, all results will be available for NRCS technical manuals, guides, and reference material.
The beneficiaries of the information generated include local, state, federal and private land managers involved in tamarisk and Russian olive control work, seeking to offset the costs of control and restoration, restore wildlife habitat and ecosystem function, and reduce wildfire threat posed by standing dead tamarisk biomass created by the tamarisk biocontrol beetle. This project will also lead to the transfer of conservation technologies, management systems, and innovative approaches to the private sector (heating, energy and power generation) seeking alternative sources of biomass feedstock.

j. Project evaluation: Semi-annual progress reports, quarterly financial reports, and final project report to the Center for Invasive Plants Management, Montana State University, for submission to NRCS.

Biomass Harvesting
WfR has identified two sites to collect or harvest woody biomass and ship it to the designated testing facilities. Russian olive will be collected from the Goshen County Weed and Pest Control District near Torrington, Wyoming. Beetle-killed (standing dead) tamarisk and green tamarisk will be harvested from Bureau of Land Management lands near Moab, Utah. Sample collection at both sites will require equipment rental and transportation to the collection site, hiring a local subcontractor (professional restoration crews) to fell, chip, package, and load the biomass, and coordinating with freight carriers to ship the biomass to the designated testing facilities. (See section 1.d. "Project Methods" for a description of tools, equipment and methods.)
Testing
Four testing facilities have been identified that, in combination, will provide a comprehensive evaluation of the basic wood chemistry for each biomass sample, suitability as a feedstock for pelletization or gasification, and information on the suitability of the bi-product from each technology (ash) for a soil amendment. Each facility will receive a sample of each type of harvested biomass: green tamarisk, beetle-killed (dead) tamarisk, and Russian olive.

- Yankee Pellet Mills in Effingham, New Hampshire will conduct tests to determine the usefulness of the biomass in the manufacture of wood pellets for the wood pellet stove industry.
- The USDA Forest Service Utilization of Southern Forest Resources Station in Pineville, Louisiana will evaluate suitability as a feedstock in the BioMax25® (a trademark of Community Power Corporation) gasification machine.
- Hazen Research, Inc. in Golden, Colorado will conduct elemental and constituent analyses on each type of biomass.
- Accutest Laboratory, Inc. in Wheat Ridge, Colorado will analyze bi-product (ash) from each feedstock, generated by both technologies (pellet combustion and gasification), to provide information on suitability as a soil amendment. Ash will be tested for leaching of heavy metals and pH.

All data will be included in progress reports and the final project report, as well as website postings.

Transfer of Information

WfR will post the results of the project on our website (www.workingforrivers.org) to allow any interested parties access to the information at no charge. CIPM and MRWC participants will also receive copies of all information generated. Information will also be distributed to the WfR network of partners, land managers, and restoration specialists through a series of workshops, lectures, and presentations. In addition all data will be available for NRCS technical manuals, guides, and reference material as well as publications from the USDA.