

Dream Tags Charitable Fund

Open Request for Proposal

Cover Sheet

Organization Name: The Nature Conservancy (TNC)		Office Use Only																									
Organization Type: 501(c)(3) EIN# 53-0242652		Date received:																									
Governmental entity? Y/N No		Project #																									
Address: 1 East 1st Street, suite 1007, Reno NV 89501		Grant Amount:																									
Project Name: New science tools to inform Bonneville cutthroat trout habitat restoration in Nevada Is this proposal being submitted as an Emergency funding request? (Circle one) Yes / No No																											
Amount requested: \$27,264.87		Website: www.nature.org/Nevada																									
Project start date (mm/yyyy): 4/15/2020		Projected completion date (mm/yyyy): 4/15/2021																									
This funding will be used to (complete this sentence with a max of 2 sentences): <small>Using 2010-2011 vegetation maps and simulations models created by TNC and Great Basin National Park staff, support the Park's Bonneville cutthroat trout (BCT) habitat restoration following the Strawberry fire by developing linked watershed tools that simulate fire and restoration actions, predict stream flow, sedimentation, and water temperature, and BCT habitat suitability.</small>																											
Key People:		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;">Director:</td> <td colspan="3">Mace Hack, Acting State Director</td> </tr> <tr> <td>Board Chair:</td> <td colspan="3">Joel Laub</td> </tr> <tr> <td rowspan="5">Project Contact:</td> <td>Name:</td> <td colspan="2">Dr. Louis Provencher</td> </tr> <tr> <td>Position:</td> <td colspan="2">Director of Conservation Ecology</td> </tr> <tr> <td>Phone:</td> <td colspan="2">775-322-4990 ext. 3120</td> </tr> <tr> <td>Fax:</td> <td colspan="2">775-322-5132</td> </tr> <tr> <td>Email:</td> <td colspan="2">lprovencher@tnc.org</td> </tr> </table>		Director:	Mace Hack, Acting State Director			Board Chair:	Joel Laub			Project Contact:	Name:	Dr. Louis Provencher		Position:	Director of Conservation Ecology		Phone:	775-322-4990 ext. 3120		Fax:	775-322-5132		Email:	lprovencher@tnc.org	
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Organization Mission: The mission of The Nature Conservancy is to conserve the lands and waters on which all life depends.																											
Project is on (check all that apply) <input checked="" type="checkbox"/> Public <input type="checkbox"/> Private land.																											
Are government permits or decision documents needed for the project? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No If so, are those permits and decision documents already secured? <input type="checkbox"/> Yes <input type="checkbox"/> No If permits and decision documents are needed but not yet secured, in #4 of the Narrative Requirements provide a list of permits and documents needed and a schedule for securing them.																											
Has your organization received other grants from the Dream Tags Fund? Yes/No Yes (use additional pages to list ALL funded projects)		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">If yes,</td> </tr> <tr> <td style="width: 30%;">Date awarded:</td> <td>10/2017 to 9/2018</td> </tr> <tr> <td>Project # & title:</td> <td>DT #46; Mapping mule deer habitat suitability for restoration planning</td> </tr> <tr> <td>Amount of Award:</td> <td>\$26,695.85</td> </tr> <tr> <td>Date awarded:</td> <td></td> </tr> <tr> <td>Project # & title:</td> <td></td> </tr> <tr> <td>Amount of Award:</td> <td></td> </tr> </table>		If yes,		Date awarded:	10/2017 to 9/2018	Project # & title:	DT #46; Mapping mule deer habitat suitability for restoration planning	Amount of Award:	\$26,695.85	Date awarded:		Project # & title:		Amount of Award:											
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Spring 2020 Dream Tags Charitable Fund

Open Request for Proposal

DESCRIPTION OF PROJECT UNDER CONSIDERATION

This **project fits under:** **(A)** Projects that improve, protect, or restore habitat; **(B)** Projects that embrace unique opportunities for advancing the mission of wildlife conservation in Nevada; and **(C)** Projects that address emergent needs.

1. Specific project goals and measurable outcomes. *How do these tie to the project description?*

Goals: We propose to develop the methodology to link existing state-and-transition simulation fire and vegetation management models created by The Nature Conservancy (TNC) for Great Basin National Park (Park) to Bonneville cutthroat trout (BCT; *Oncorhynchus clarki utah*) habitat suitability and project restoration for the burnt Strawberry Creek drainage using the Park's 2010 map created by TNC.

Measurable Outcomes: (a) The primary outcome is mapped and budgeted proposed prescriptions of restoration actions of BCT habitat for the Strawberry Creek drainage laid out over several future years. (b) To design these prescriptions, important by-products will be (i) a new BCT habitat suitability model built with experts, (ii) spatial state-and-transition simulation models, (iii) a spatial hydrologic water balance models for the Park, (iv) and a spatial water temperature model for the Park.

2. Project location: Great Basin National Park (see Figure 1) because we have existing maps and models.

3. Project description. *Include site map and aerial photos if applicable/possible. Maps and photos must fit on 8-1/2" x 11" paper and may be attached at the end of your proposal after the budget.*

Background: The state of Nevada has a special responsibility in the conservation of native BCT because of fish reintroductions in its historic habitat of eastern Nevada in the watersheds of Snake Valley. The species' small historic range included where the Pleistocene Lake Bonneville overlapped western Utah, eastern Nevada, southeast Idaho, and southwest Wyoming (Figure 2). The species was believed to be extirpated from Nevada in 1953, the year of the last observation. The primary suspected causes of extirpation were introductions of non-native trout, over-fishing, livestock grazing, and water diversions.

Pure strains of the species were believed extinct, but a few isolated populations were discovered in Utah in the 1970s. Fish from only six pure-strain BCT populations discovered in Utah by 1978 were reintroduced to historic streams. Later in 1999, Great Basin National Park (Park) discovered a pure strain of BCT in Mill Creek (Figure 1) as part of a species reintroduction program and historic stream inventory¹. Subsequently, pure strains of BCT were also found in Pine and Ridge Creeks on the western side of the Park but outside the historic range. In Nevada, the only other stream discovered to contain pure-strain BCT was Hendry's Creek on the eastern slope of Mt. Moriah of the northern Snake Range. Successful reintroductions of pure strains from Mill Creek to three other historic BCT streams and from Hendry's Creek outside the Park to the upper Snake Creek of Great Basin National Park played a role in the decision not to list the species as endangered by the US Fish and Wildlife Service; thus, the Park's special responsibility.

From August 5th to August 19th, 2016, the Strawberry Fire burned most of Strawberry Creek's drainage while sparing the upstream reaches (Figure 3). Eighty-five percent of BCT in Strawberry Creek died from direct heat or elevated water temperatures because the species is sensitive to warmer water temperatures. Only trout in the headwaters survived. To this day, spawning habitat in Strawberry Creek

¹ Baker, G., N. Darby, T. Williams, and J. Wullschleger. 2008. Bonneville cutthroat trout restoration project—Great Basin National Park. Natural Resource Report NPS/NRPC/NRR—2008/055. National Park Service, Fort Collins, Colorado.

remains buried under sediment resulting from the fire and subsequent precipitation events. Other fires have burned in Hampton Creek (2014) of the north Snake Range (north of the Park's boundary) and Goshute Creek (2018) in the Cherry Creek Range. Both streams had populations of reintroduced BCT. The high-severity fire in the Hampton Creek drainage killed all BCT. The Strawberry and Hampton fires triggered heightened concern for the health of the BCT population in the Snake Range and a great urgency to propose new habitat restoration.

TNC staff have closely worked with Park staff since 2005 and, starting in 2010, have implemented a Landscape Conservation Forecasting™ project that consisted of mapping the Park's ecological systems with high resolution satellite imagery and modeling the effects and return-on-investment of alternative management scenarios on the future condition of ecological systems using state-and-transition simulation models (computerized probabilistic box-and-arrows models)².

Outline of Proposed Work: Conservancy staff can build on their recent experience with spatially modeling habitat suitability of greater sage-grouse, Utah prairie dog, and mule deer, each as a component of various Landscape Conservation Forecasting projects where simulation models “talk” to habitat suitability models. The work proposed here involves a novel expansion of this experience to habitat suitability for aquatic species.

The pioneered methodology should directly apply to Lahontan cutthroat trout, relict dace, bull trout, and other endemic or rare fish species of Nevada where high-resolution satellite imagery for the managed watershed was interpreted by remote sensing. The proposed tasks are as follows:

- a) We will use the map layers from the original project of 2010. The name of ecological systems (for example, montane riparian) and their internal state classes (named *vegetation class*; for example, incised creek with exotic forbs and a floodplain of willows) will be cross-walked to our most current standardized state-wide classification. The old 2010 ecological system and vegetation class description (an MS Word document) will be revised to current state-wide classification.
- b) We will conduct an extensive literature review and convene an expert workshop on BCT to extract Resource Selection Functions, which are mathematical functions relating the trout's habitat suitability, a measure of the population's condition, to physical features in the watershed and the streams. The functions are the most important components to estimate of habitat suitability. This workshop will inform the structure of updated state-and-transition simulation models. Elements of tasks #3 and #4 below estimating stream flow and water temperature are key variables needed for trout habitat suitability.
- c) We will update TNC's non-spatial 2010 state-and-transition simulation models (the PI was the modeler in 2010) in six important ways: (i) The maps layers for ecological systems, vegetation classes within systems, and ownership (not entirely NPS) from 2010 will be uploaded in the simulation software ST-Sim (www.apexrms.com) and the state-and-transition models will be run spatially from these maps; (ii) all the models' coding and ecological processes coded in an older simulation software will be “modernized” by recreating models in the latest ST-Sim version with standard codes recently developed from our latest projects; (iii) a new type of class will be added to the montane riparian system and subalpine lakes called “sedimentation” that is only expressed when this system burns as fire moves from upland vegetation to streams (this is simple and inexpensive method to track sedimentation without conducting an expensive sedimentation analysis); (iv) Models will be simulated from 2010 to 2020 while forcing fires to only burn three areas that burned since 2010

² Provencher, L., T. Anderson, G. Low, B. Hamilton, T. Williams, and B. Roberts. 2013. Landscape Conservation Forecasting™ for Great Basin National Park. *Park Science* 30: 56-67.

(shape files from MTBS) and then models will be allowed to burn anywhere according to general model fuels constraints after 2020; (v) we will run three budget-limited management scenarios for the Park that included no special management, management as proposed in 2010, and management that included the 2010 actions in addition to actions specifically benefiting BCT; and (vi) the state-and-transition simulation models will be dynamically coupled to the BCT habitat suitability model coded in R (an advanced menu of ST-Sim) such that the habitat suitability code will return a raster map to ST-Sim that will focus restoration actions to areas yielding the greatest benefit to BCT.

- d) For every year of simulation, we will output vegetation maps of systems and their classes for hydrologic analysis. The ability to link upland vegetation condition to the water column characteristics important to trout requires quantification and predictions of stream properties with a hydrologic model. In early December 2019, TNC's science staff received training to use the US Geological Survey's (USGS) Basin Characterization Model (BCM; <https://ca.water.usgs.gov/modeling-software/basin-characterization-model.html>). BCM allows estimation of flows calibrated to gauged streams (from Strawberry Creek or adjacent creeks for flow calibration) using input data of mapped vegetation, soil properties, time series of precipitation, minimum and maximum air temperatures, and published actual evapotranspiration. We are proposing to convert our detailed vegetation maps appropriate for land management to a map of percent Leaf Area Index that is compatible with the format of BCM's input files and to run the BCM for all watersheds. The main result for trout from the BCM is flow, although BCM delivers many useful hydrological results.
- e) Water temperature is already known to be the most important characteristic affecting BCT in habitat where non-native fish species are not a threat and sport fishing is absent or very limited. While different habitat features influence water temperature, flow is the greatest determinant of temperature. Therefore, stream water temperature will be estimated from flows obtained from the BCM model using another model of water temperature that is process or statistically-based. Several existing models of water temperature have already been developed for this purpose. We propose to screen the pros and cons of various existing models that have documentation by reading the literature and consulting with experts. Once the model is selected, we will estimate water temperature for all historic BCT streams of the Park, including Strawberry Creek, and calibrate model results against the Park's water temperature data.
- f) BCT habitat values and other measures of general ecological system condition (see footnote #2) will be compared among proposed management scenarios and spatial project designs for the active restoration scenario with the greatest ecological Return-on-Investment will be mapped for Park staff.

4. **Permitting.** Not applicable as no permit is required.

5. **If future phases of the project will be needed, identify anticipated sources of funding.**

While this project will be a complete project of management utility, Park staff and TNC are seeking funding to (i) remap the Park's vegetation from internal NPS fuels management sources (PIs are Meg Horner of NPS and Louis Provencher of TNC) and (ii) remap the Park and about 300,000 acres around the Park to compare effectiveness of management scenarios with state-and-transition simulations designed to improve focal ecological systems, bighorn sheep habitat and BCT habitat in and beyond the Park boundaries with funding from the Eastern Nevada Landscape Restoration Project (ENLRP of Ely BLM) ultimately obtained from SNPLMA funding.

6. **Principals involved in leading or coordinating the project or activity:** Dr. Louis Provencher (TNC); Jon Sjoberg (NDOW); Jonathan Reynolds, Ben Roberts, and Meg Horner (Great Basin National Park)

7. **Number of staff positions involved in project:** 0 Fulltime; 4 Part-time – Alpha order: Dr. Kevin Badik, Sarah Byer, Dr. Louis Provencher, Dr. Laurel Saito

8. **Number of volunteers involved in project and an estimated number of volunteer hours:** None

9. **Timeline of Project.** List key dates and include project milestones. *Note: Be realistic in your estimate of dates and milestones. List any factors that may cause a delay in implementing and/or completing the project.*

Assuming two months are needed to negotiate grant paperwork if the proposal is funded:

- A. Recode 2010 map layers and supporting description document. 04/15/2020 to 06/01/2020.
- B. Literature review and expert workshop for development of BCT Resource Selections Functions. 05/15/2020 to 09/30/2020. Possible **delay** to get BCT experts at the Park's workshop during the field season.
- C. Update state-and-transition simulation models: 04/15/2020 to 09/30/2020.
- D. Derive hydrologic stream properties by (a) populating and coupling BCM hydrologic model to ST-Sim software to estimate flow and (b) estimate water temperature. 09/30/2020 to 12/30/2020. Possible **delay** possible obtaining one important layer from USGS about downscaled actual evapotranspiration. We are working now to obtain layer for another project requiring a NV-wide data layer.
- E. Run spatial simulations to select best BCT habitat restoration scenario and quantify/map restoration prescriptions. 12/30/2020 to 4/15/2021

10. **Success.** *Tell the committee how we will know you succeeded in what you proposed to do.*

Success will be measured by delivering to the Park and NDOW several spatially-explicit prescriptions of landscape-wide restoration actions that are expected to increase BCT habitat within a limited annual budget. Delivery of a BCT habitat suitability model in R code with documentation to NDOW and the Park will also be important. A few wildlife staff at NDOW are R experts.

11. **Grant match.** *All applicants must provide a match of at least 25 percent for dollars requested. The match may be with funding and/or in-kind services. Complete the Grant Match section of the application.*

Grant Match

Match amount to be provided:	\$11,444.20				
Match details:	<p>Please provide the form of your matching funds. If match is made up of both cash and in-kind, fill in both sections.</p> <p>Match is:</p> <table border="1"> <tr> <td>Cash</td><td>\$ 0.000</td></tr> <tr> <td>In-kind</td><td>\$ 11,444.20 (= \$7,150.25 + \$1,283.45 + \$3,010.50) Note: Provide an itemized breakdown of volunteer match in your budget with rationale.</td></tr> </table> <p>For the cash portion of your match, is the funding already being held by the applicant for this project? Yes___ No___ Not applicable</p>	Cash	\$ 0.000	In-kind	\$ 11,444.20 (= \$7,150.25 + \$1,283.45 + \$3,010.50) Note: Provide an itemized breakdown of volunteer match in your budget with rationale.
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In-kind	\$ 11,444.20 (= \$7,150.25 + \$1,283.45 + \$3,010.50) Note: Provide an itemized breakdown of volunteer match in your budget with rationale.				
Description of matching funds/in-kind donations:	In-kind match is from three sources: (i) Louis Provencher's (PI) salary time for project management, technical activities, and ICR amounts to \$7,150.25; Great Basin National Park is offering 3 days of staff time amounting to \$1,283.45 (see attached letter of support); and (iii) NDOW is offering up to \$3,010.50 of staff support (see attached letter of support).				

ORIGINAL PROJECT BUDGET					REIMBURSEMENT REPORT	
Budget Item Description	DT \$	Other Funding Name	Match \$	Total \$	Expenditures to Date DT	Expenditures to date (other sources)
Labor--Project Management ^{&}	0.00	Own organization	1,916.85	1,916.85		
Labor--Updating vegetation description and map codes	3,119.02	Own organization		3,119.02		
Labor--Bonneville trout habitat suitability	1,640.16	Own organization		1,640.16		
Labor--BCM model coupling to ST-Sim	5,822.69	Own organization		5,822.69		
Labor—Updating and running ST-Sim models & workshop	4,545.79	Own organization	3,833.71	8,379.50		
Labor—Workshop		National Park Service	1,283.45	1,293.45		
Labor—Workshop		NDOW	3,010.50	3,010.50		
Labor--Final report & model description appendix	4,340.02	Own organization		4,340.02		
Materials	0.00		0.00	0.00		
Other—4 days travel for 2 TNC staff to Great Basin National Park*	1,260.00	Own organization	0.00	1,260.00		
Contractual – ApexRMS ST-Sim software support**	1,200.00	Own organization	0.00	1,200.00		
Indirect Cost recovery (24.34%)*	5,337.20	Own organization	1,399.69 [#]	6,736.88		
TOTAL	27,264.87		11,444.20			

[&] Assumed 50% with 2020 hourly salary rates and 50% with 2010 hourly rates.
^{*} Travel: 4 days of rental car @ \$75/d; 2 staff and 3 days of meals @ \$40/d/staff; and 2 staff and 3 days of hotel @ \$90/d/staff.
^{**} Minor software support by ApexRMS Ltd to guarantee correct use of advanced menu for external programs.
^{***} NICRA rate
[#] ICR only applied to TNC's match.

Great Basin National Park

Eastside Streams

U.S. Department of the Interior
National Park Service

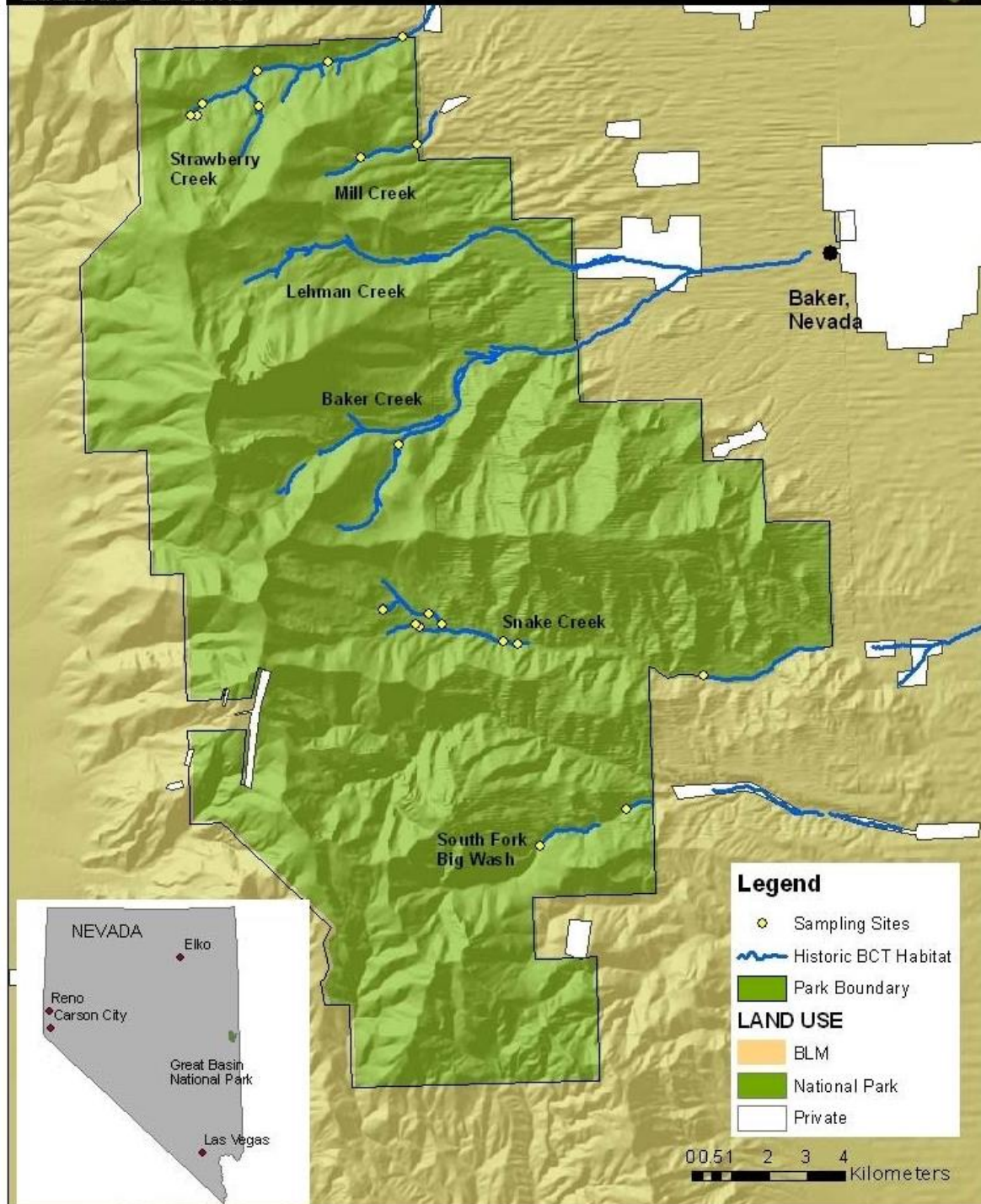


Figure 1. Creeks of Great Basin National Park showing the historic habitat of Bonneville cutthroat trout. From: Baker, G., N. Darby, T. Williams, and J. Wulschleger. 2008. Bonneville cutthroat trout restoration project—Great Basin National Park. Natural Resource Report NPS/NRPC/NRR— 2008/055. National Park Service, Fort Collins, Colorado.

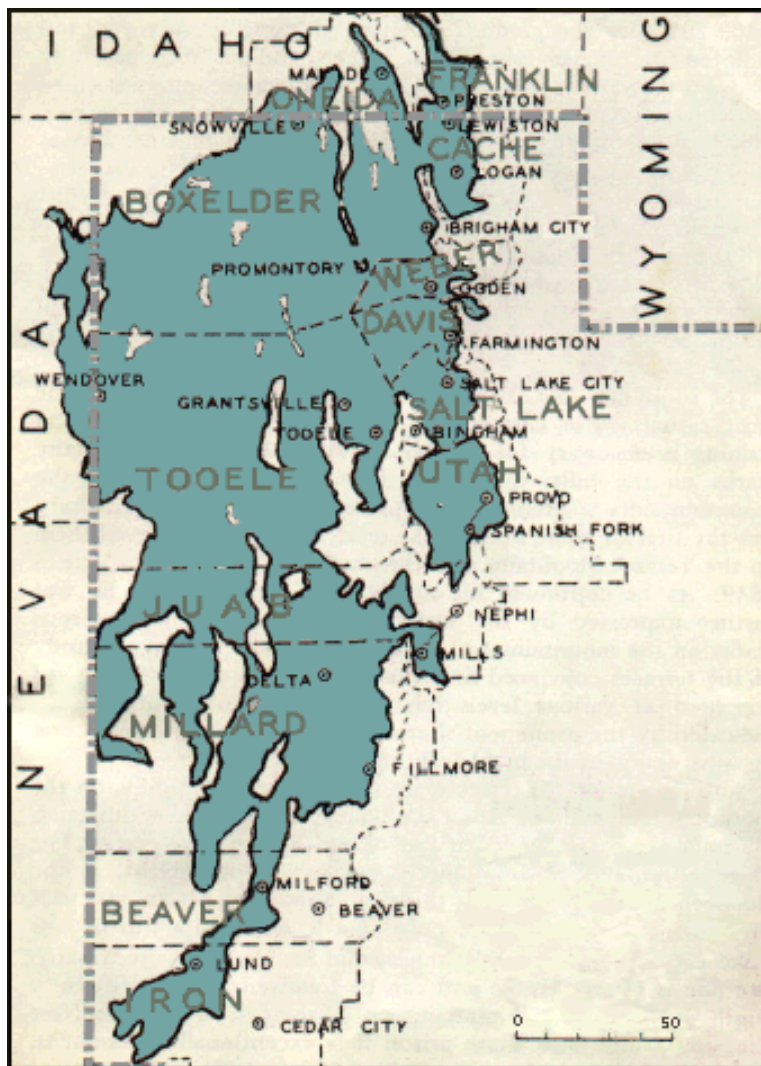


Figure 1. Lake Bonneville.



Figure 3. Strawberry Creek after the August 2016 Strawberry Fire at Great Basin National Park. Photo credit: RGJ.



United States Department of the Interior

NATIONAL PARK SERVICE
Great Basin National Park
100 Great Basin National Park
Baker, Nevada 89311-9700

01/24/2020

Memorandum

To: Director of Conservation Ecology, The Nature Conservancy

From: Natural Resource Program Manager, Great Basin National Park

Subject: Spring 2020 Dream Tags Charitable Fund Proposal: New science tools to inform Bonneville cutthroat trout habitat restoration in Nevada

Great Basin National Park fully supports creating a Bonneville cutthroat trout habitat suitability model and developing the methodology to link it to existing fire and vegetation models as proposed in The Nature Conservancy's Spring 2020 Dream Tags Charitable Fund proposal. As a signatory of the 2019 Bonneville Cutthroat Trout Rangeland Agreement, Great Basin National Park is dedicated to continually advancing the science behind Bonneville cutthroat trout restoration and conservation. This project, if funded, will produce prescriptions of restoration actions for Bonneville cutthroat trout in the Strawberry Creek drainage. It will also serve as a useful restoration tool for any drainage containing Bonneville cutthroat trout that is affected by wildland fires in the future.

Great Basin National Park is happy to host and attend the habitat suitability workshop mentioned in the proposal. The Park's Fish Biologist is willing to commit 3 full days to this workshop representing a contribution equivalent to \$1,283.45.

Great Basin National Park enjoys an excellent working relationship with our partner agencies and organizations, and we look forward to the opportunity to collaborate with NDOW and The Nature Conservancy on this innovative proposal.

Ben Roberts
Natural Resource Program Manager



STEVE SISOLAK
Governor

STATE OF NEVADA
DEPARTMENT OF WILDLIFE

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TONY WASLEY
Director

LIZ O'BRIEN
Deputy Director

JACK ROBB
Deputy Director

27 January 2020

Louis Provencher, Ph. D.
Director of Conservation Ecology
The Nature Conservancy
Nevada Field Office
1 East First Street, Suite 1007
Reno, NV 89501

RE: Spring 2020 Dream Tags Charitable Fund Proposal: New science tools to inform Bonneville cutthroat trout habitat restoration in Nevada

Dear Louis

The Nevada Department of Wildlife (NDOW) is fully supportive of The Nature Conservancy's proposal to develop a Bonneville cutthroat trout habitat suitability model and methodology to link it to existing fire and vegetation models as described in your above referenced 2020 Dream Tags Charitable Fund proposal. NDOW in cooperation with the National Park Service and other partners has been directly involved in the restoration of Bonneville cutthroat trout to Great Basin National Park and other waters in Nevada within its historic range, and we believe that the products of this proposal will be invaluable in informing and addressing restoration needs for Bonneville cutthroat trout within Strawberry Creek and other waters of the Park. We further believe that the developed methodology will have important application to other restoration and recovery efforts for rare and endemic fish species in Nevada including Lahontan cutthroat trout, bull trout and relict dace.

NDOW is able to contribute in-kind services and technical assistance for the proposed habitat suitability workshop and other project elements including six days of staff time and associated agency travel costs equivalent to \$3,010.50.

We look forward to this opportunity for collaboration with The Nature Conservancy, the National Park Service and other partners to develop this innovative conservation project benefitting Bonneville cutthroat trout and other endemic fishes of Nevada.

Sincerely

A handwritten signature in blue ink that reads "Jon C. Sjöberg".

Jon C. Sjöberg
Fisheries Division Administrator