Project Title: Landscape Conservation Design in the High Divide. An Analysis of Future Landscape Scenarios and Their Viability – Phase 1

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Non-governmental Organizations:
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Headwaters Economics, Bozeman, MT 59715
Bitter Root Land Trust, Hamilton, MT 59840
The Conservation Fund, Sun Valley, ID 83353
Five Valleys Land Trust, Missoula, MT 59801
Gallatin Valley Land Trust, Bozeman, MT 59771
Lemhi Regional Land Trust, Salmon, ID 83467
Salmon Valley Stewardship, Salmon, ID 83467
Prickly Pear Land Trust, Helena, MT 59624
Teton Regional Land Trust, Driggs, ID 83422
The Trust for Public Land, Bozeman, MT 59715
 Wood River Land Trust, Hailey, ID 83333

Rocky Mountain Elk Fdtn, Missoula, MT 59808
Vital Ground Foundation, Missoula, MT 59804
The Nature Conservancy in Montana, Helena, MT 59624; Missoula, MT 59801
The Nature Conservancy in Idaho, Hailey, ID 83333; Coeur d'Alene, ID 83816
Central Idaho Rangeland Network, Salmon, ID 83467
Wildlife Conservation Society, Bozeman, MT 59715
Greater Yellowstone Coalition, Bozeman, MT 59715
Trout Unlimited, Hailey, ID 83333; Bozeman MT 59715
Wolverine Institute, Ennis, MT 59729

Federal and State Partners:
U.S. Forest Service, Region 4 Lands, Ogden, UT 84401**; Caribou-Targhee NF,** Idaho Falls, ID 83401; **Salmon-Challis National Forest**, Salmon, ID 83467
U.S. Forest Service, Region 1, Lands, Missoula, MT 59807**; Beaverhead-Deer Lodge National Forest**, Dillon, MT 59725; **Gallatin National Forest,** Bozeman, MT 59771
Bureau of Land Management, Idaho Falls, ID; Dillon, MT; Salmon, ID; Challis, ID
U.S. Fish and Wildlife Service, Montana Acquisition Office, Great Falls, MT 59404; **Red Rock Lakes National Wildlife Refuge**, Lima, MT; **National Wildlife Refuge System**, Portland, OR 97232
National Park Service, Yellowstone National Park, Mammoth, WY**; Craters of the Moon National Monument,** Arco, ID 83213; **Big Hole National Battlefield**, Wisdom, MT 59761
Natural Resources Conservation Service, ID and MT
Idaho Department of Fish and Game, Boise, ID 83712; Idaho Falls, ID 83401; Salmon, ID 83467
Montana Department of Fish, Wildlife and Parks, Helena, MT 59620; Bozeman, MT 59718

Project Summary: The Heart of the Rockies Initiative (HOTR), on behalf of its High Divide Collaborative partners, seeks support to identify and evaluate future landscape configurations that address the needs of local communities while conserving the High Divide's unique landscape resources. In this landscape we emphasize wildlife connectivity between large protected core areas: Yellowstone, the Crown, and central Idaho (See attached map). This project builds on our prior GNLCC-funded project to

deliver the latest science in connectivity and climate response and earlier stakeholder identification of lands of high conservation value (HOTR 2010). This project takes the next step by coupling socio-economic data and trends with conservation modeling in a holistic landscape conservation design process.

Project Category: C Applying Science to Management

NEED

When asked what conservation success looks like, a group of ranchers at the recent (February 2015) High Divide Collaborative Meeting unanimously responded, conservation success is: sustainable working lands; viable, vibrant local communities; and healthy ecosystems across the landscape. One of the biggest challenges for conservation in the High Divide is reconciling the economic needs of the local communities with conservation of wildlife habitats, river corridors, and linkage areas that depend upon both the productive lower elevation private lands and the vast public lands. Different stakeholders have different perspectives and goals for the landscape. Coalescing growth and conservation values in the High Divide will allow for long-term successful coexistence of humans, wildlife, and natural communities under land-use and climate change. We need to evaluate future scenarios to inform on-the-ground decision making, and understand the outcomes management and conservation actions would have on the long-term stability of the system; we need a Landscape Conservation Design.

Conservation Design is one of the elements of the US Fish and Wildlife Service Strategic Habitat Conservation Plan (USFWS 2006) where the goal is to assess the ability of landscapes to support populations, and determine the best strategies for attaining desired conservation outcomes. We propose to create future landscape configurations based on stakeholder (e.g. local communities, conservation organizations, agencies) input and evaluate their long-term stability. This evaluation will identify the effects of potential on-the-ground conservation actions on the overall health of the landscape and the projected resilience of local communities. This will allow us to help stakeholders identify which future landscape configuration is more desirable and where conservation actions should be prioritized.

At this point conservation practitioners have a limited vision of what long-term conservation success looks like on the ground. We need assessment of probable long-term outcomes for different on-the-ground actions (e.g county growth policies). Understanding how current decisions affect the viability and long-term stability of the landscape and the communities within it will allow land managers, policy makers, and local communities to evaluate the necessary trade-offs to attain desired future conditions, sustain ecosystem function, and achieve stakeholder goals. We propose to assess current and anticipated future conditions in the High Divide to provide stakeholders with information on the stability of future scenarios and which type of scenario provides a long-term stable state (including development, conserved land, wildlife population conditions, human population growth) in the High Divide.

What is the need within the Great Northern landscape? One of the goals of the GNLCC Strategic Conservation Framework is to conserve and sustain a permeable landscape with connectivity across aquatic and terrestrial ecosystems. Privately owned lands in the High Divide play a key role in maintaining connectivity between the large public land blocks in the region. Many public lands are also vital to local community goals and landscape integrity. However, it is not known how much conservation and restoration action is needed in this landscape to avoid the collapse of wildlife populations and maintain genetic connectivity in the face of climate change. We propose to model current and future landscape conditions to evaluate landscape stability under different future scenarios. Understanding the feasibility of different future conditions across the landscape and their long-term stability will help land managers and conservation practitioners understand the pace and scope of conservation action needed to achieve a healthy and thriving landscape. This will also allow local communities to understand what growth policies provide long-term resilience to them and the landscape in general.

<u>What landscape-level issue is this work related to and how? Why is it important?</u> This project seeks to identify levels of development and human footprint on the High Divide that would maintain a long-term functional landscape that supports local communities and their economy while maintaining permeability for species connectivity between large intact blocks across private lands.

The High Divide region provides nationally significant habitat connectivity and landscape integrity. This project will develop models of current conditions (biological and socioeconomic) and model the long-term stability of the landscape. Additionally, this project will model future conditions (biological and socioeconomic) taking into account stakeholder input to assess the viability and stability of those conditions. Based on the stability of the conditions this project will suggest which stressors are most significant to determining future outcomes and which scenarios provide long-term landscape stability and resilience. These scenarios will inform on-the-ground conservation practitioners, land managers, and local communities on desirable futures. These scenarios can catalyze the conversation among stakeholders on how to achieve those desirable futures as well as provide a common goal for all involved. This approach maximizes stakeholder buy-in by integrating important community related values and will be valuable not only for the High Divide, but could then be scaled up or transferred to other regions within the GNLCC.

<u>What science products will be provided, problem addressed, or what information or other</u>
<u>needs will your project provide? What is the science product or direct management application?</u>
This project will produce broad and fine-scale models of current and future conditions taking into account different stakeholder visions for this landscape. Products will include:
- Predict future changes in water, vegetation, and human development based upon projecting current trends and climate change predictions. Vegetation type distribution models will help us predict response (e.g. Beltan et al. 2014).
- Develop alternative future development scenarios based on statistical analyses of trends and desired community outcomes.
- Identify fine-sale conservation priorities based on present and predicted landscape conditions.
These models will inform and direct conservation decision making toward long-term community and ecological sustainability. This information can be applied to identify management, restoration, and protection strategies that can be implemented to address the identified resource concerns and obtain the desired future conditions.

<u>Is the need identified in other conservation, management, or other plans?</u> The US Fish & Wildlife Service Strategic Habitat Conservation Plan identified gaps in knowledge, and information generation to address those gaps as a critical part of their Strategic Habitat Conservation process. The information generated by addressing the knowledge gap can then be used to inform and refine decision-making. In this proposal we have identified a knowledge gap (lack of understanding of the viability of future conditions in the High Divide) and we plan to produce knowledge that can inform and refine decision-making at the landscape scale to achieve a desirable future with vibrant communities in a healthy landscape.

OBJECTIVE
<u>What will you accomplish?</u> The goal of this project is to address a lack of knowledge about the sustainability of future landscape conditions created by current policy and conservation decisions. By addressing this knowledge gap we expect to provide an understanding of the cumulative effects of different stressors and decisions and influence decision-making and conservation action.

<u>Define how this project will support LCC objectives and functions:</u>
The High Divide partners intend to benefit from developing future landscape scenarios to inform conservation and restoration actions in the region. The task at hand is to provide information to stakeholders to guide decision-making and on-the-ground conservation. The High Divide is important both as a stand-alone landscape for fish and wildlife and a vital and vast linkage area of importance to

function of the entire Great Northern landscape. HOTR will track the effectiveness of this project by monitoring the conservation actions that result and through ongoing engagement of the High Divide Collaborative to refine and adapt conservation decisions to achieve desirable futures.

METHODS   HOTR will create a spatial assessment of current conditions (biological and socioeconomic) and evaluate the stability of the system. Furthermore, HOTR in collaboration with partners and stakeholders will create future scenarios and evaluate the stability of these to suggest desirable futures with vibrant local communities and a healthy landscape. In this first year, we expect to evaluate scenarios for at least three focal areas within the mapped area.

1. Spatial assessment of current and future conditions
    a. Biological Conditions (with Holocene Wildlife Services, Wolverine Institute)
        i. Target groups
            1. Intact landscape blocks (public and private)
                a. Based on Human Modification Index (HMI) (Theobald, 2013)
                b. Three connectivity scenarios for each time period:
                    i. Montane/Alpine to Montane/Alpine
                    ii. Grassland/Shrub-steppe to Grassland/Shrub-steppe
                    iii. Montane/Alpine to Grassland/Shrub-steppe
            2. Focal species (Sage Grouse, Wolverine, Mule Deer, headwaters salmonids)
            3. Ecosystem process:
                i. Natural wildfire and fire mitigation
                ii. Invasive weeds
        ii. Map broad-scale core habitat and connectivity needed for species survival and movement (use existing models if possible)
        iii. Generate fine-scale models of movement pathways and habitat cores within broad-scale linkages based on stressor landscapes.
        iv. Deliver these products through our existing Conservation Atlas housed on databasin.org
    b. Socioeconomic Conditions (with Headwaters Economics)
        i. Current Population levels and trends
        ii. Population footprint on the landscape.
        iii. What are the impacts of current population on natural resources (land development [urbanization and energy], and human infrastructure).
        iv. Current economic conditions and trends of the overall population
        v. Intersection of current economy and population well-being and natural resources and conservation
2. Desired future conditions (this will be constructed with stakeholder input, e.g. county growth policies, partner workshops)
    a. Wildlife and human population desired conditions/levels
        i. Likely human population/land use trends (would inform scenarios tested)
        ii. Wildlife targets (Sage Grouse, Wolverine, Antelope, Mule Deer)
    b. Future conditions under different scenarios (climate, stressors influenced by human population)
        i. Scenario – current conditions (baseline inventory and conservation priorities)
        ii. Scenario – X% residential development of existing parcels (no new subdivision)
        iii. Scenario – X% conversion of ranchland to residential (new subdivision scenarios)
        iv. Scenario – Change in land cover and surface water due to climate change

Landscape resilience to stressors will be evaluated using Monte Carlo simulations. For each stressor, a probability layer will define areas where a given land use/land cover (stressor) change could potentially occur and, where applicable, estimate the probability the change will occur at a given pixel relative to other potential pixels. Multiple computer trials will simulate a given scenario. Scenarios will be based on likely (following current projections) or desired (based on stated community objectives) outcomes. Each trial will measure changes in measures of landscape integrity (e.g. number of linkage pathways, landscape resistance, total core habitat area) compared with a benchmark of current conditions. Mean and variability of change in measures of landscape integrity indicate landscape resilience. Highly resilient landscape will exhibit little or no negative mean change in landscape integrity with low variance while vulnerable landscapes will show an average loss of landscape integrity or have high variability; the latter indicating that outcomes are sensitive to the actual spatial pattern of stressors. Simulations will be run for individual stressors to determine which stressors are likely to be most detrimental to landscape integrity, or in combination to test resilience to cumulative effects.

Stakeholder Involvement　　Stakeholder engagement is vitally important to this project – for learning from one another and for community ownership of results. The High Divide Collaborative has established itself as a credible platform for a broad group of stakeholders and is the venue for project engagement. We have formed subcommittees to address landscape scale sage grouse conservation, forest restoration and fire, aquatic resource management, and connectivity for wildlife. Early in the process we will conduct stakeholder workshops to present spatial assessment of current conditions and identify desired future conditions. We will present spatial results and refine analyses through stakeholder engagement in a follow-up workshop in the final months of the project.

DELIVERABLES　　This project will develop future landscape scenarios for use by on-the-ground conservation practitioners, decision-makers, and local communities. The primary deliverables will be GIS data layers of desirable future scenarios and stressor levels acceptable to achieve a resilient landscape under land use and climate change. These layers will be made available to our partners through our existing Conservation Atlas housed on databasin.org. HOTR will provide a final narrative report on the modeling results a year from the initial award date.

STATEMENT OF COMPLIANCE　　HOTR Coordinator Michael Whitfield, and the PI(s) Bray J. Beltrán Brent Brock, and Ray Rasker have read the Great Northern Landscape Conservation Cooperative Information Management, Delivery, and Sharing Standards and agree to comply with those standards if the proposal is selected. Michael Whitfield will direct HOTR employees and/or contractors that are involved in this project to meet these standards.

SCHEDULE
The project will begin August 2015 and be this Phase I will be completed August 2016.

Projected Workflow	A	S	O	N	D	J	F	M	A	M	J	J	A
Identify landscape stressors and species data	▓	▓	▓										
Spatial assessment of current conditions *			▓	▓									
Workshops with stakeholders				▓	▓	▓	▓			▓			
Spatial assessment of future conditions							▓	▓	▓				
Refine scenarios based on feedback											▓	▓	
Final Report to GNLCC													▓

ATTACHEMENTS

Key activities/tasks	Target date	Milestone	Comments
Identify landscape stressors and species data	August 31, 2015		
Spatial assessment of current conditions	November 1, 2015	Current condition assessment completed.	Collaboration with Headwater Economics
Stakeholder workshops to identify desired conditions and develop future scenarios	November 2015 through February, 2016	Inform and engage stakeholders	Iterative process informed by stakeholders.
Spatial assessment of future conditions	April 1, 2016	Complete Spatial Analysis	
Workshop with stakeholders to present spatial assessment of future conditions	May 1, 2016	Present desirable futures results	Stakeholder review
Final Narrative report to GNLCC	August 1, 2016	Final Report	Project completion

Citations

Beltrán, B.J., J. Franklin, A.D. Syphard, H.M. Regan, L.E. Flint, and A.L. Flint. Effects of Climate Change and Urban Development on the Distribution and Conservation of Vegetation in a Mediterranean Type Ecosystem. International Journal of Geographic Information Science 28 (8): 1561 – 1589.

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Theobald, David M. 2013. A general model to quantify ecological integrity for landscape assessments and US application. Landscape Ecol (2013) 28:1859–1874.

USFWS. 2006. Strategic Habitat Conservation. Final Report of the National Ecological Assessment Team. 48pp.