



**CROSS-BOUNDARY, MULTI-STAKEHOLDER LED WATERSHED RESTORATION AND MANAGEMENT OF MOUNTAIN FORESTS-GRASSLAND MEADOW WORKING LANDSCAPES**  
**An Organizational Approach<sup>1</sup>**  
**April 2023**

**Watershed restoration program framework.** Enabled through a grant from the Walton Family Foundation, Solutions from the Land is distilling from emerging research and on-the-ground cross-boundary multi-dimensional private-public convenings, lessons learned **to develop organizational approaches and programming recommendations to guide large scale, cross-boundary collaborations that are designing and implementing watershed restoration and management of mountain forests-grassland meadow working landscapes to anticipate and adapt to changing climatic and land use conditions.**

In Phase One of this project, we identified key processes driving ecosystem change and explored various forest and grazing management and forest and wet meadow restoration approaches to improving watershed health and climate resilience. This report offers a recommended organizational approach and program for cross-boundary, public-private, multistakeholder led watershed restoration and management of mountain forests-grassland meadow working landscapes.

**WORKING LANDSCAPES AND CROSS-BOUNDRY MULTI-STAKEHOLDER COLLABORATIONS**

Given the diversity and complexity of working landscapes and cross-boundary multi-stakeholder collaboratives, the first step is to define their attributes.

**Working lands** are privately owned farms, ranches and forests that produce food, energy and fiber and a host of ecosystem services that are the backbone of rural communities with multiple benefits to larger society (USDA 2022). **Working landscapes** are the geophysical topographies and living land covers in which privately owned farms, ranches and forests are managed in support of rural livelihoods and often co-exist in a matrix with public lands, parks and national monuments. The successful implementation of watershed management and conservation agendas must integrate private and public protected areas in these working landscapes. This requires collaborative engagement among public natural resource managers and private landowners in the setting of shared goals; the collection and free exchange of

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data among landowners, natural resource managers and scientists; and opportunities to work together in the design, restoration and climate adaptations to their shared landscape (Miller et al. 2012).

**Intermountain West landscapes** are a matrix of ranches, primarily mixed-species animal, perennial grassland and forest production systems that are privately owned working lands and publicly owned and managed forests, wetlands, alpine meadows and natural preserves. These landscapes are widely recognized as multi-benefit ecosystems that buffer naturally dry landscapes, add fertility to soil, retain soil moisture, manage invasive species, reduce fuel loads and provide flexible conservation-production systems (Nair 2014; Mugnier et al. 2020). Working ranches have the capacity to safeguard ecosystem services, protect water and soil resources, ensure open space vistas, strengthen biodiversity and provide food and agricultural products of benefit to ranching families and society (Brunson and Huntsinger 2008).

In this region soil dryness has increased over the past few decades and an occasional abundant snowpack seldom is sufficient to recharge soil moisture and ensure spring runoff that refills reservoirs and returns stream and river flows to normal (Coppock 2020; Gilbert 2022; Williams et al. 2022). Drier soils and reduced stream flows increase risk of wildfires, limit available water (Ong et al. 2014), hydropower, and recreational uses, and increase the vulnerability of this grassland-forested ecosystem, cattle and sheep ranchers, as well as public lands. Both natural and human systems are impacted by drought. Synchronistic solutions can address impacts on all systems-wildlife benefit from the same management practices that are sound livestock husbandry, and co-management is part of the solution.

As the climate continues to change and becomes increasingly variable, ranchers more than ever need drought and flood management and a variety of climate smart strategies for conserving this unique landscape, home of the Sage Grouse, the Mountain Bluebird, the Broad-tailed Hummingbird, the Evening Grosbeak and a wide variety of plant and animal communities. The seasonality of elevations from sagebrush steppes, high plateaus, and 6,000 ft valleys to high elevation pastures under 13,000 ft mountain peaks influence rancher decisions about livestock species and breeds, forage mixes and management, public land permits, stocking rates, locations of ranch stock ponds and reservoirs, timing of breeding and herd mobility. Managing this complex forest-grassland region of private and public grazing lands under variable local weather and a changing climate is no easy task and an urgent priority. **There is a need to better integrate ranch scale and landscape scale decision making and adaptive management using a system-wide cross-boundary approach that accounts for vegetation, temperature, and precipitation seasonalities across rangeland elevations and livestock nutritional needs and physiological cycles while simultaneously conserving and protecting against wildfire, restoring mountain forest-grassland ecosystems post-wildfire, and sustaining watershed functionality.**

Holechek et al (2020) summarize environmental and socio-economic climate change risks and impacts on US ranching systems and propose sustainable strategies to mitigate these impacts. Two of their most powerful recommendations for achieving sustainable strategies are: 1) the building of public-private partnerships to develop and implement system level adaptive management at larger scales; and 2) increasing awareness of ecosystem services that working ranches produce for society. They further stress that “all adaptation is local and no single adaptation approach works in all settings” (Holechek et al 2020, p. 15).

## CROSS-BOUNDARY PARTNERSHIPS/COLLABORATIONS AND STRATEGIC VALUE

Solutions from the Land, through on-the-ground projects and the formation of multi-stakeholder action-oriented alliances, has demonstrated the benefits of managing working lands in ways that improve the resilience of agricultural and forestry ecosystems and the economic and public health of their surrounding communities (figure 1).

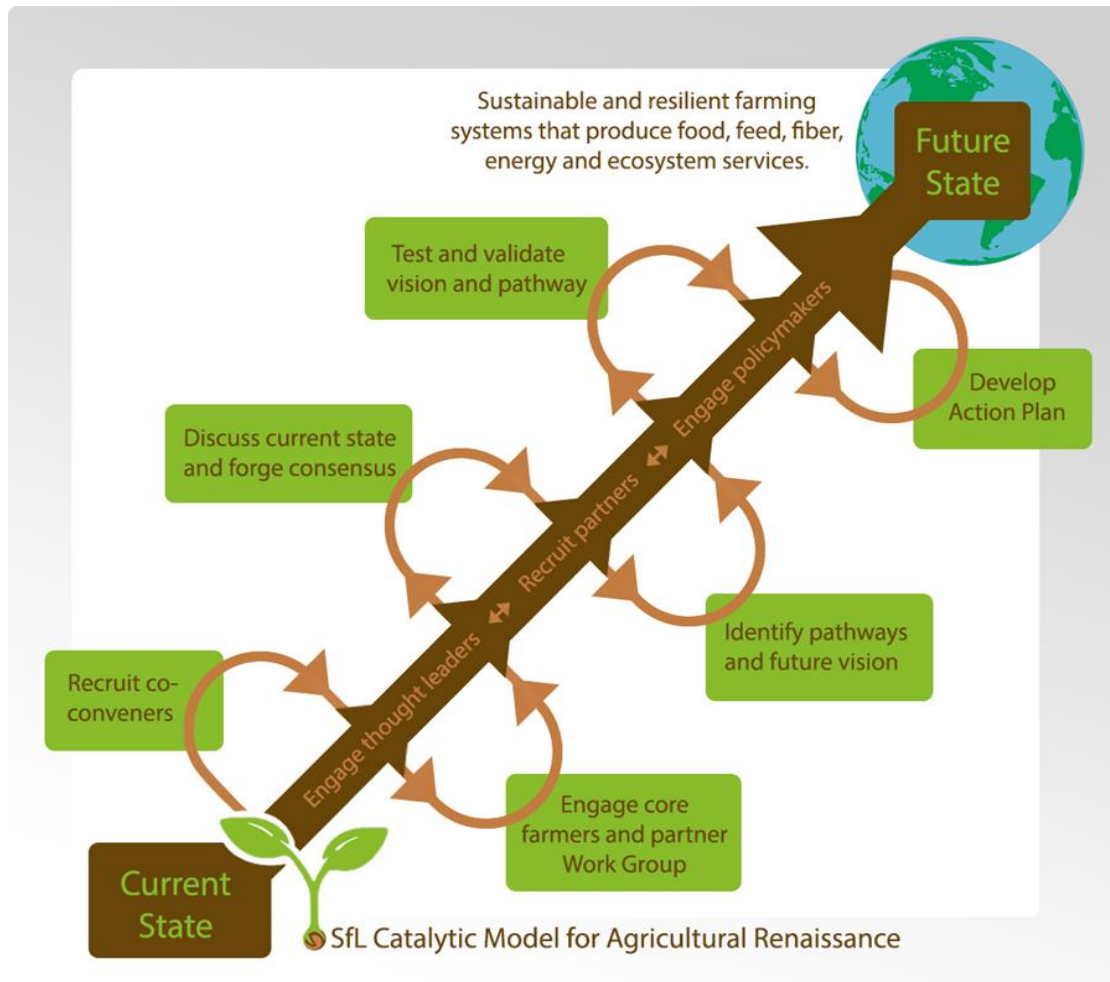


Figure 1. Solutions from the land Catalytic Model for Agricultural Renaissance  
21<sup>st</sup> Century Agriculture Renaissance

<https://www.solutionsfromtheland.org/reports/renaissance-report>

This catalytic model can be scaled up to cross-boundary large scale watershed projects that engage private working lands owners, natural resource managers and lease holders of public lands, conservationists, environmentalists, and scientists as core partners. **Cross-boundary is multi-dimensional, entailing collaborative relationships across multiple political jurisdictions; across geographic landforms and watershed reaches; across social, economic and ethnic cultures, ideas and perspectives; across sectors and disciplines.** What these partners have in common is the desire to share in decision making, work hard, bridge differences and build strong relationships that give collective

capacity to address difficult and complex landscape level challenges and find solutions. (McKinney and Johnson 2009).

**The strategic importance** of ranchers, foresters, and farmers of working landscapes co-creating with public lands managers and other sectors and stakeholders a cross-boundary multi-dimensional collaboration should not be underestimated (Tait and Brunson 2021; Weber 2003). Vast expanses of Western forests across the United States, numbering in the tens of millions of acres, are damaged, diseased and in some cases dead. This came about through a perfect storm of neglect, misguided litigation, strained management budgets, flawed public policy, lack of science as a foundation for decision making, and most directly, climate change. For decades, multiple federal, state, and local governments and private sector stakeholders have been pursuing laudable land management outcomes but doing so often by managing in silos. It's time for a new way forward defined by integrated working lands management and multi-stakeholder cross-boundary collaboration to achieve shared goals at a large landscape scale. To achieve sustainable, resilient landscape outcomes at scale, adoption of new and proven approaches must be accelerated. The policies and practices of the past will not meet the needs and challenges of tomorrow.

**Cross-boundary design teams composed of agricultural, conservation, environmental, academic, government and business stakeholders** are critical partners in the development of large-scale comprehensive multi-year plans of work. These collaborative teams are needed for large scale **watershed restoration and management of mountain forests-grassland meadow working landscapes that anticipate and have capacities to adapt to accelerating changes in climatic and land use conditions**. The design phase of this kind of cross-boundary multidimensional collaboration entails:

- Baseline inventory of current conditions/challenges via data and drone video footage;
- Strategies to secure forest health, wildlife, water management, ecosystem resilience and economic goals;
- State of the art science in association with accelerating changes in climatic and land use conditions;
- Mapping and delineation of watershed restoration and adaptation best practices and evaluation of alternative scenarios;
- Clear and concise set of project metrics, economic impact, and performance measures, milestones and deliverables, including:
  - o Key Performance Indicators (KPIs) or performance metrics and how those will be measured
  - o An analysis and/or description of program/project economic impacts
  - o Timelines and milestones for deliverables
- Clear description of a cost-efficient budget;
- Partnerships in place to support phase II (implementation);
- Necessary permits identified/secured to perform restoration work.

## KEY PROCESSES DRIVING ECOSYSTEM CHANGE IN WESTERN US FOREST-GRASSLAND ECOSYSTEMS, RANCHING, FORAGE AND WATER BASIN VULNERABILITY

The SfL team utilized peer-reviewed scientific publications, grey literature, and reports; attended professional conferences; and interviewed experts to define the processes driving ecosystem change in the Upper Colorado River Basin.

The two primary drivers of ecosystem change in the Colorado River Basin are: 1) rapidly changing local weather patterns and global climate change, and 2) population growth with increased water demand and consumption. Accelerated variability, unstable and extreme local and regional weather events and longer-term global climate change has led to complex shifts in basin-wide hydrology due to warming temperatures and reduced snowpack; increased mortality from insect and disease outbreaks; and large, high-severity wildfires. Concurrently, population growth and competing social, economic and cultural values have increased demands across multiple sectors for water and forest resources.

### A Rapidly Changing Climate

**Drought.** The Western United States is in the midst of a “millennium drought,” a 23-year period of low flows, dwindling reservoir supplies, and changing hydrology across the West. Leading scientists, their agencies, and associated academic institutions are conducting research on warming temperatures, changes in precipitation, water shortages and the cumulative effects on hydrological, socio-economic, and ecological systems.

The Upper Colorado River Basin contributes 85-90% of the total water year runoff in the Colorado River Basin (McCabe & Wolock 2020). Streamflow originates as baseflow, a proxy for groundwater discharge to streams and is vital to sustaining surface water (Miller et al. 2016). More than half of the decreasing runoff trend is associated with unprecedented warming, which has reduced snowpack and increased plant water use (Xiao et al. 2018).

Forested headwaters systems are critical sources of abundant and high quality water downstream. High-elevation watersheds rely on snowpack and snowmelt to sustain agricultural, recreational, industrial, environmental, and other community sectors. Evaluations of headwater systems reveal that they are essential sources of high-quality water, diluting nutrient and other contaminant and sediment inputs, and key for ecosystem function and connectivity (Kaule 2021; Wohl 2017) to strategically target associated treatments within an adaptive management framework.

**Fire.** In addition to shifts in basin-wide hydrology, the interactions among historic fire suppression policies, increased insect and disease outbreaks, and catastrophic wildfires have exacerbated the vulnerability of the western forest-grassland ecosystem. The mountain pine beetle (MPB) populations in the Rocky Mountain region are at epidemic conditions (Man, 2012). Recent studies document the correlation between MPB-caused tree mortality, altered hydrologic processes, and source water contributions to streamflow (Wehner and Stednick 2017). Bark beetle activity is increasing in western forests due to climate change, drought, and warmer winter temperatures (Raffa et al., 2008). The combined effects and shifting forest disturbance regimes place considerable stress on forest ecosystems, leading to the potential for undesirable social and ecological outcomes (Morris et al., 2016).

MPB infestation affects forest characteristics that are known to impact accumulation and ablation of snow, which in turn affect the water balance of entire drainage basins (Bales et al., 2006).

Wildland fire is part of the natural process of forest regeneration. Native Americans routinely burned sections of this landscape. However, historic fire suppression policies and changing fire regimes have resulted in massive wildfires across the Western mountain forest-grassland landscape. Large scale wildfires have altered the composition of forest and grassland species, made the forest floor impassable in many places, and have reduced available forage for livestock grazing.

Severe wildfires often affect watershed processes that regulate sediment, streamflow and nutrient responses (Venable et al. 2017). These fires impact soil, causing erosion due to the removal of vegetation and reducing rates of infiltration of water into the soil. Hyper-dry conditions can lead to runoff that transports nutrients and organic pollutants into water supplies, increasing the likelihood of flooding and debris. Delivery of post-fire nutrients, sediments and pollutants to surface waters also have implications for aquatic biota, fisheries, recreation, water supply infrastructure and treatment (Venable et al. 2017).

Despite increases in fire activity, many forested areas in the West face a fire deficit (Parks et al. 2015), with an accumulation of areas in need of treatment and entire fire-adapted landscapes likely becoming “endangered” (Stephens et al. 2016). Recommendations highlight the need for more controlled, ecologically beneficial fires and fewer uncontrolled wildfires that lead to negative ecological and social impacts (Stevens et al. 2017).

## **Population growth**

**Population growth and competing demands for water** and forest resources is a second primary driver of ecosystem change and watershed vulnerabilities. With highly erratic and declining water supplies, and growing demands on the Colorado River, there is an urgent need to re-evaluate storage and distribution systems which have been built over the past century (Kwon and Gimbel 2021). Access to and sharing of water by users and beneficiaries is a key priority and challenge for agriculture producers, water conservancy and conservation districts, basin roundtables, environmental protection interests, Tribes, courts, government agencies, and compacts between states.

**Local communities in the headwaters.** In addition to the value of water, local communities view the national forests and connection to private irrigated valley bottoms as working lands that sustain community economies. Maintaining the character of the West with agriculture and grazing allotments, timber production, recreation and tourism, energy, and other industries is of vital importance in this forested headwater region.

In the headwaters of the Colorado River, Native Americans traveled through mountain passes across elevational gradients in cycles and circuits following game with butchering sites, hunting camps, and vision-quest areas (Benedict 1992). Bitterroot, cattail, and other wild plant foods were harvested in June and early July. Waterfowl were abundant in wetlands. They used signal fires to identify buffalo migration routes. The Tribes in this region were the Utes, Shoshone, Crow, and in later years, the Sioux.

The headwaters of the Colorado River Basin serve as a source of refuge for migratory birds traversing the Pacific Flyway. The Basin is also a recreational magnet for skiing, hunting, fishing, hiking, camping, and important to enthusiasts from around the world. The diversity of forested, riparian, sagebrush, and wetland habitats attract thousands of big game species, such as mule deer, pronghorn, and elk, as well as Greater sage-grouse, Columbian sharptail grouse, black bears, lions, multiple endangered fish species, and an array of migratory birds.

### STATE OF READINESS FOR A CROSS-BOUNDARY COLLABORATIVE

While several successful cross-boundary conservation collaboratives have been documented (McKinney and Johnson 2009), private/public **working land collaboratives** at the scale Sfl envisions are rare and those that are operating typically do so under a strong government centric construct. For this reason, the goal of this Sfl project was to explore interest and readiness in the headwaters area to discern whether conditions were favorable for launching this novel approach to managing land for multiple desired outcomes. A database with more than 100 public and private candidate partners was developed to engage stakeholders in this two-state initiative. Partners ranged from private landowners, state and federal government agencies, universities, and county organizations within the project area to organizations that have a conservation mission in restoration and management to coalitions that work on water policy issues in the West to scientific entities that will be key to consult and connect with in the future. From this database, the Sfl Project Leadership Team identified a cross-section of private and public partners and conducted 15 informal interviews.

**Readiness and capacity.** Key informant interviewees welcomed the opportunity to discuss this approach and the challenges associated with returning the region to a functioning forested watershed. Five central issues that will influence the effective capacity of a headwaters forest project to succeed were noted by interviewees:

- **Relevance:** As a headwaters forest of the Colorado River Basin, the project is highly important and there is a critical need to demonstrate collaboration and cooperation by multiple stakeholders.
- **Resilience:** Forest resilience, in ecological and social terms, is central to the shared purpose.
- **Agriculture & Local Community Values:** Maintaining the ranching heritage, community sustainability, and support of local industry are high priorities for stakeholders in this landscape.
- **Jurisdictional Complexity:** Working across two states and the associated bureaucracy will be a major challenge *and* opportunity.
- **Adaptive Lens & Management:** This project will require shifts in paradigms and will need to address challenges in restoration and management through learning and experimentation.

### Overview of what we learned from the interviews.

Potential partners have a shared interest in creating a resilient headwaters forest with land health and hydrological function central to the vision of the future. The driving aspiration is to see a functioning ecological and social system driving community sustainability. Additional aspirations include: addressing fuels through restoration and management, sustaining family ranching as a way of life and profitable

business, generating community-led solutions, taking advantage of the current increases in conservation funding, and creating a scaled system of community awareness, engagement, and ecosystem connection in this important region.

**Primary concerns of key informant interviewees** were: climate change, especially as evidenced by pine beetle kill; the changing social landscape, conflict in uses, and loss of agriculture; drought, streamflow, and water security; and catastrophic wildfire. These potential partners identified *capacity* as being the gap between the current state and the aspiration of creating a resilient forest for the future. After capacity, responses varied with respect to the barriers that will need to be overcome. Informants referenced challenges associated with the scale of this initiative, bureaucracy, and process issues; competing views and values; funding; legal and policy concerns given the relationship to the Colorado River Basin; and loss of industry.

Unfortunately, while there is purposeful and strong support for cross-boundary, public-private, multistakeholder led watershed restoration and management of mountain forests-grassland meadow working landscapes in the headwaters area, readiness to engage is uneven. In addition the infusion of substantial new federal funding from multiple sources for restoration projects has diverted attention from pre-project collaborative design and planning to a desire for immediate, short-term “fixes” and implementation activities.

We were encouraged to find an emerging willingness to address drivers of change through defining desired management and restoration objectives within an adaptive framework for implementation and monitoring of ecological and social outcomes. Importantly, if the Basin continues to stay in drought conditions due to climate change, renegotiation of water allocation and active forest management will be needed for adaptation. Shared decision making and collaboration throughout the headwaters will be key to building adaptation capacity to understand and renegotiate supply and water/forest use over time.

### **WATERSHED RESTORATION PROGRAM FRAMEWORK**

These findings suggest that any program-of-work for cross-boundary (e.g., private-public), multi-stakeholder led watershed restoration and management of mountain forests-grassland meadow working landscapes must encompass and enable the successful attainment of three overarching goals:

1. Local ranchers, at the core of developing a cross-boundary private-public partnership, work together with other stakeholders to develop a shared vision and design a climate smart watershed program;
2. Short- and long-term forest-grassland private and public lands adaptive management strategies are developed concurrently with plans put in place to finance and implement;
3. Local and external stakeholders, environmentalists and conservationists, and recreational and tourist users of the forest-grassland region increase their understanding of the ecosystem services working ranches can provide.

**To achieve success**, landscape scale projects require strong partnerships with research scientists and environmental consulting specialists to address the transformational changes (Stevens et al. 2017;



Wollstein et al 2021) occurring in the headwaters area including changes in temperature, precipitation, hydrology, plant and animal species and genomes to name a few. From this planning and review, conservation and restoration objectives can be developed to strategically target associated treatments within an adaptive management framework. Approaches and best practices that worked in the past may not be effective today or in the future. This is demonstrated by Hill et al. (2023) research on low-elevation conifers in California's Sierra Nevada that finds the conifers are out of equilibrium with climate. Climate warming over the last 100 years have led to observable shifts in the spatial organization of dominant tree species. Warming not only directly primes forests for easier wildfire ignition but also affects vegetation species composition at different elevations leading to vegetation climate mismatch. This climate mismatch has critical implications for ecosystem restoration efforts and long-term land management decisions as areas that are likely to transition to different habitat suitability must be distinguished from those that are expected to remain stable in the near future.

The key to success will be the ability to **engage a cross-boundary, integrated collaborative group of stakeholders to jointly design a bottom-up program of restoration work that reflects scientific and local indigenous knowledge and experience, and proposes practical, flexible climate smart adaptive management strategies that public and private landowners can co-jointly embrace and invest in. This is not easy to do as “jointly designing” requires multiple stakeholders, each possessing unique assets, needs, biases, and priorities, to come together and co-create. Often, stakeholders that could and should align and co-create, trip over the quest for credit or control, and lose sight of the fact that the shared desired outcomes they seek, requires close communication, collaboration and shared decision making. We call this “uncommon collaboration”.**

## **NEXT STEPS**

In Phase Two, Solutions from the Land is creating a data base of experienced large-scale cross-boundary multi-stakeholder collaborative teams and interviewing a subset to distill leadership, farmer, rancher, forester and other stakeholders' lessons learned in assembling state-of-the-art science based research to propose and evaluate alternative scenarios that guide the design and implementation of plans that address mountain forest-grassland working landscape restoration and adaptation projects in response to accelerated and increasingly variable climatic conditions.

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## ABOUT SOLUTIONS FROM THE LAND

Across the nation a new and powerful model for agricultural and forestry landscapes is emerging: Farmers, ranchers, and foresters are showing how to manage their lands to produce the food, fiber and energy required to support a growing population and economy, while also protecting and enhancing biodiversity, the environment, and public health. To achieve these outcomes at scale, adoption of these new approaches must be accelerated. **The policies and practices of the past will not meet the needs and challenges of tomorrow.** Together with our partners, *Solutions from the Land* (SfL) is advancing and demonstrating a new land management model through which public and private stakeholders join forces to improve the resilience of agricultural and forestry landscapes and deliver multiple goods and services. Using our unique producer-led platform to mobilize a wide array of stakeholders around an innovative vision for the future, **SfL is helping landowners and managers discover examples of innovation across the nation and adopt best practices that deliver multiple solutions from the land.**

Through on-the-ground projects and the formation of multi-stakeholder action-oriented alliances, SfL has demonstrated the benefits of managing land in a way that improves the resilience of agricultural and forestry ecosystems and the economic and public health of their surrounding communities. Now this transformative work is ready to be scaled up to reach the rest of the country.

*Solutions from the Land is a nonprofit corporation focused on land-based solutions to global challenges. Its mission is to identify and facilitate the implementation of policies, practices, and projects at a landscape scale that will result in land being sustainably managed to produce food, feed, fiber, and energy while protecting and improving critical environmental resources and delivering high value solutions to combat climate change. The president is Ernie Shea ([eshea@solutionsfromtheland.org](mailto:eshea@solutionsfromtheland.org)) For more information, [www.solutionsfromtheland.org](http://www.solutionsfromtheland.org)*