

# Building Colorado's Forest Restoration Economy: A Roadmap for a Resilient Future

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### Executive Summary

This document is presented as a working policy framework for Colorado's next generation of leadership, providing a strategic vision and potential actionable steps for the governor and legislature to establish a forest restoration economy as a pillar of Colorado's prosperity, resilience, and environmental stewardship. The framework reflects input from practitioners, industry leaders, researchers, policymakers, and other stakeholders, while recognizing that many of the concepts will require further refinement, feasibility analysis, and implementation planning.

Colorado stands at a pivotal moment. Its forests, watersheds, and rural communities face increasing pressure from prolonged drought, climate-driven stress, repeated Mountain Pine Beetle outbreaks, decades of wildfire suppression, and catastrophic wildfires. These interacting forces have degraded millions of acres, heightened risk to communities and infrastructure, and strained water supplies, ecosystems, and rural economies. At the same time, the scale of restoration needed to address these risks far exceeds what current approaches can deliver.

Research consistently shows that the full economic costs of wildfire, including impacts to water supplies, public health, infrastructure, insurance markets, and regional economies, can be several times higher than suppression costs alone. For Colorado's East Troublesome Fire, costs for structures, debris removal, and watershed restoration alone exceeded suppression costs by a ratio of 35 to 1. For the 2018 California wildfire season, the ratio of total costs to suppression costs reached 153 to 1.<sup>1</sup>

Over the past several decades, Colorado and its partners have made substantial investments in forest health through federal and state grants, disaster appropriations, and agency-led programs. Recent funding through the Bipartisan Infrastructure Law, Inflation Reduction Act, and state programs such as COSWAP and FRWRM has enabled important progress. However, these efforts remain largely episodic, short-term, and fragmented across agencies, jurisdictions, and funding streams. As a result, restoration activities are often reactive rather than strategic, constrained by annual funding cycles, limited infrastructure, inconsistent feedstock supply, and chronic workforce shortages. Even where funding is available, the absence of stable markets and long-term investment mechanisms prevents restoration from scaling or sustaining momentum. In addition, limited use of long-term agreements and predictable supply commitments creates uncertainty for investors and manufacturers, making it difficult to attract capital, build infrastructure, retain workforce capacity, and scale restoration-driven industries.

**This Roadmap argues that Colorado's forest and watershed challenges are not solely a resource management problem, but an economic systems problem.** Forests are predominantly managed as stewardship landscapes, where land managers must pay for treatment rather than rely on timber revenues,

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<sup>1</sup> Troy, A., Pusina, T., Romsos, S., Moghaddas, J., & Buchholz, T. (2022). The True Cost of Wildfire in the Western U.S. Western Forestry Leadership Coalition / Spatial Informatics Group. <https://www.frames.gov/catalog/55945>.

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despite the presence of significant volumes of merchantable material in overstocked stands. Policy, regulatory, and risk constraints have limited utilization of this material, driving up treatment costs and perpetuating a cycle in which biomass is burned or hauled long distances instead of supporting local industries. At the same time, economic development, energy, housing, and climate programs that could support restoration-based industries remain insufficiently connected to forest health goals.

The Forest Restoration Economy framework proposes a different approach: treating restoration as a long-term economic engine rather than an emergency expense. By aligning policy, procurement, financing, workforce development, and market demand, Colorado can convert restoration byproducts into high-value, carbon-smart materials such as mass timber (engineered timber buildings produce roughly 36–48% less embodied carbon than concrete or steel alternatives, making Colorado-sourced mass timber a quantifiable climate investment, not simply a building material), biochar, wood-fiber insulation, and engineered composites. In addition to wood-product markets, restoration can generate measurable environmental benefits including carbon storage, watershed protection, avoided wildfire impacts, soil health improvements, ecosystem resilience, and other public benefits that may support future market mechanisms and investment models.

Doing so would reduce long-term public costs, stabilize rural employment, support housing affordability, protect watersheds, and attract private investment into restoration infrastructure and innovation. These investments can also provide benefits to Colorado agriculture by protecting water supplies, improving watershed function, supporting soil health, and creating new markets for restoration-derived products.

This strategy also recognizes the continued importance of traditional forest products and dimensional lumber markets. Mass timber and other wood product innovations are not separate from these industries. Mass timber is made from traditional lumber products, including standard dimensional components such as studs, that are engineered into higher-value structural panels and systems. Sustaining long-standing sawmill and lumber industries while expanding markets for mass timber and other innovative wood products will be essential to creating the full range of outlets needed to support restoration, utilization, and rural economic resilience.

The scale of this opportunity is significant: **Colorado currently imports an estimated \$7.5 billion in wood products annually, roughly 88% of total consumption, representing one of the largest economic leakages of any natural-resource-based sector in the state.** At the same time, Colorado's existing wood processing facilities are estimated to operate at only a fraction of available capacity, suggesting that market and supply constraints, not simply the absence of infrastructure, are limiting growth. Recapturing even a modest share of that market through in-state production would generate substantial rural employment and revenue.

Even with expanded markets and infrastructure, achieving landscape-scale restoration will require integrating these economic strategies with the use of prescribed and managed fire, which currently remains the most effective and cost-efficient tool for maintaining forest conditions over time.

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Achieving this vision will also require substantial upfront public and private investment, likely at a scale comparable to other major economic transitions such as clean energy, as well as sustained funding over time.

This Roadmap builds on, rather than duplicates, recent state actions, including Executive Order B 2025 001 establishing the Ponderosa Mountain Pine Beetle Task Force and initiatives underway such as the Colorado Forest and Timber Industry Restoration Plan<sup>2</sup>. While the Task Force provides essential coordination for outbreak response, the Roadmap addresses the broader structural system gaps that persist across funding, markets, and governance. It outlines a phased, bipartisan strategy to create predictable investment mechanisms, integrate economic development leadership, modernize procurement and building standards, and establish the infrastructure and workforce needed to sustain restoration at scale.

Colorado does not need to build this system from scratch. Existing state economic development, workforce, energy, and natural resource programs already provide tools to support many elements of a forest restoration economy. The opportunity is to better align these tools, particularly those within OEDIT, the Colorado Energy Office, the Colorado Department of Agriculture, and partner agencies, and establish clear pathways that connect restoration projects to investment, markets, and implementation.

By reframing forest restoration as a durable economic system that delivers public safety, water security, climate resilience, affordable housing, and rural prosperity, Colorado can move from fragmented, short-term response to a cohesive, long-term solution. This Roadmap offers a practical framework for the next generation of state leadership to turn recurring forest crises into a lasting foundation for resilience and economic growth. It advances a set of coordinated bipartisan policy actions to shift forest restoration from a short-term, grant-driven activity to a durable economic system:

- 1. Align State Leadership and Economic Development**

Leverage Executive Order B 2025 001 and formally integrate forest restoration priorities into the Office of Economic Development and International Trade (OEDIT), ensuring markets, workforce, infrastructure, and investment strategies are treated as core economic development functions rather than ancillary environmental programs, and establishing clear pathways to move priority projects from concept to implementation

- 2. Create Predictable, Multi-Year Financing Mechanisms**

Move beyond episodic grants by establishing pooled financing tools, such as green-bank-style intermediary, that aggregate public, philanthropic, utility, and private capital to support restoration and wood utilization infrastructure, workforce continuity, and innovation at scale.

- 3. Establish a Restoration Material Utilization Standard (RMUS)**

Create stable, measurable demand for restoration-derived materials by aligning state procurement,

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<sup>2</sup> Led by the Economic Restoration Institute <https://economicrestoration.org/>

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building codes, and publicly funded projects to prioritize Colorado-sourced wood products and bio-based materials where feasible.

### 4. **Invest in Processing Infrastructure and Market Access**

Support development of sort yards, small-log mills, transportation hubs, and regional restoration centers, while partnering with federal agencies and other land managers to advance long-term agreements and predictable feedstock supply commitments that reduce investment risk, improve feedstock reliability, and unlock private investment in wood-based manufacturing.

### 5. **Build and Retain a Year-Round Restoration Workforce**

Invest in training pipelines, credentialing, and workforce housing solutions that enable stable, year-round employment for restoration crews, contractors, and manufacturing workers.

### 6. **Standardize Carbon and Environmental Benefit Accounting**

Position Colorado's forests and wood products as verified environmental assets, creating opportunities to quantify and monetize carbon, watershed health and resilience, insurance, soil health, biodiversity, and other restoration benefits.

### 7. **Pilot and Scale Through Innovation**

Launch a Colorado Wood Products Innovation Hub to test, certify, and commercialize restoration-based products, and use pilot procurement projects to de-risk early adoption and accelerate market growth.

Colorado has the resources, the precedent, and the political momentum to make this happen; this Roadmap provides the framework to do so.

### Introduction

Colorado stands at a pivotal moment. Its forests, watersheds, and rural communities face unprecedented pressures from wildfire, drought, climate change, repeated Mountain Pine Beetle epidemic outbreaks that interact with changing environmental conditions and shifting economic landscapes.

Yet within this challenge lies a remarkable opportunity to transform forest and watershed restoration from a cost burden into a cornerstone of the state's future economy. **A forest restoration economy would unite ecological health, water security, affordable housing innovation, carbon-smart technology, and rural revitalization into a single statewide vision.**

Statewide stakeholders identify inconsistent funding, feedstock supply, limited infrastructure, and workforce shortages as major obstacles to scaling restoration. Additionally, obtaining public support for fuels treatment and increasing public awareness about the importance of forest management further contribute to these challenges. Overcoming these barriers is crucial for reducing risk and establishing a sustainable forest restoration economy. This roadmap addresses these issues by detailing policy, market, and investment changes needed to make restoration a lasting economic driver.

By aligning with Colorado's bipartisan tradition of environmental leadership and economic ingenuity, this initiative positions the state as a national model for restoring natural systems while building durable industries, supporting housing affordability, and safeguarding critical water and forest resources.

### Context

Colorado's forests and watersheds are under unprecedented strain. Years of drought, insect infestation and changing environmental conditions, decades of wildfire suppression, and catastrophic wildfires have degraded millions of acres, threatening the state's water supplies, wildlife habitat, recreation economy, and rural livelihoods. Historically, Colorado's forests were shaped by frequent, low- to moderate-intensity fire, and decades of fire suppression have disrupted these natural processes and have resulted in dense overstocked forests. Restoring forest health at scale will require the reintroduction and management of fire as a fundamental ecological process, alongside mechanical treatments, thinning and other interventions. Prescribed and managed fire are often the most cost-effective tools available for reducing surface and ladder fuels and maintaining treated conditions over time. As a result, any long-term restoration strategy must pair market-based approaches with a broader effort to increase the pace, scale, and social acceptance of beneficial fire on the landscape.

Despite steadfast efforts by federal, state, and local partners, the pace and scale of restoration remain far below what is needed to protect communities and watersheds. Federal and state funding sources are significant but increasingly time-limited, episodic, and uncertain, requiring a new model that treats restoration as a long-term economic engine rather than an emergency expense.

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Colorado's forests cover approximately 24 million acres, including extensive conifer, hardwood, lodgepole pine, mixed conifer, ponderosa pine, oak shrublands and spruce fir<sup>3</sup>. An estimated 22 percent of standing tree volume is dead, driven primarily by insect outbreaks (approximately 65 percent of standing dead) and disease (approximately 23 percent), underscoring the scale and persistence of forest health stressors statewide<sup>4</sup>. Statewide, salvageable standing dead timber totals an estimated 7,458 million cubic feet exceeding both the small-diameter and non-merchantable categories of live timber, representing both an urgent fire risk and a near-term utilization opportunity before further deterioration reduces its market value.<sup>5</sup> However, the condition of standing dead timber varies widely across regions, and in many areas, deterioration has progressed to a point where material is no longer suitable for higher-value utilization. This variability underscores the importance of timely treatment and a diversified set of management approaches.

The implications extend well beyond forest lands. According to the Colorado State Forest Service's 2023 Wildfire Risk Assessment, more than half of Colorado residents now live in the wildland–urban interface, where forest conditions directly affect public safety, infrastructure, and water supplies<sup>6</sup>.

Colorado's 2020 wildfire season illustrates the true scale of these costs. The Grizzly Creek Fire generated an estimated \$116 million in transportation infrastructure repair, an \$8 million state loan for Glenwood Springs water treatment, and an estimated \$45 million in watershed recovery, on top of suppression costs. Interstate 70 closures drove restaurant revenues down roughly 25% and lodging nearly 50%. The East Troublesome Fire produced \$543 million in insured losses, watershed restoration costs potentially reaching \$136 million, and as of early 2022 only 25% of destroyed homes had received building permits.

Wildfire smoke adds a further, often uncounted economic burden: nationally, smoke reduces annual labor income by an estimated \$93 billion, with Colorado among the states most susceptible to worsening smoke-related health and economic impacts in coming decades.<sup>7</sup>

### Learning from Colorado's Renewable Energy Transformation

Colorado's clean energy leadership offers valuable lessons. Beginning with the 2004 voter-approved Renewable Energy Standard (RES) and later strengthened by House Bill 10-1001<sup>8</sup>, the state created clear targets and market incentives that spurred massive private investment. The same alignment of vision, policy, and incentives could build a thriving forest restoration economy, transforming how the state manages its lands while generating rural jobs, and climate benefits and supporting affordable housing.

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<sup>3</sup> <https://csfs.colostate.edu/forests-trees/forest-types/>

<sup>4</sup> [https://csfs.colostate.edu/wp-content/uploads/2025/09/2025\\_StateBiomassAssessment\\_Section2\\_091725.pdf](https://csfs.colostate.edu/wp-content/uploads/2025/09/2025_StateBiomassAssessment_Section2_091725.pdf)

<sup>5</sup> Prentice et al. (2025), CSFS Statewide Biomass Assessment Section 3

<sup>6</sup> <https://csfs.colostate.edu/2023/09/28/1-million-coloradans-live-in-areas-with-elevated-risk-of-wildfire/>

<sup>7</sup> Borgschulte et al. (2018) and Liu et al. (2016)

<sup>8</sup> <https://legiscan.com/CO/text/HB1001/2010>

### Leadership Transition and Bipartisan Framing

Colorado will soon experience a change in executive leadership as the current governor reaches term limits. This transition presents an opportunity for any incoming administration, regardless of party, to champion a signature initiative that unites economic growth, public safety, and environmental stewardship. Forest and watershed resilience have long enjoyed bipartisan support across Colorado's political spectrum. This roadmap is designed to be nonpartisan and enduring, offering the next governor and legislature a ready framework for measurable impact, statewide collaboration, and a unifying narrative that bridges urban and rural priorities.

### Defining a Forest Restoration Economy

A forest restoration economy envisions an interconnected system where ecological and economic goals reinforce each other. Wood removed through thinning or wildfire recovery, often small-diameter or low-value material, becomes feedstock for existing and new, carbon-smart industries such as mass timber, biochar, and wood-fiber insulation, biofuel for electric generation or renewable aviation fuels. These industries would store carbon, reduce wildfire risk, and create durable employment opportunities in rural areas that have suffered economic decline over the years. Each treated acre would yield both public benefits (reduced risk, cleaner water, carbon storage) and market value (feedstock, carbon credits, avoided costs).

### Core Challenges to Address

To succeed, Colorado must overcome eight interconnected challenges that currently limit the pace, scale, and sustainability of forest and watershed restoration. While these challenges are interconnected, predictable, long-term supply is foundational. Without reliable feedstock volume and duration, private investment, infrastructure development, and workforce stability cannot scale effectively.

#### 1. Sustainable and Predictable Funding

Most restoration efforts are funded through short-term grants, one-time disaster appropriations, competitive federal programs such as the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act (IRA). At the state level, funding often comes from programs such as the Colorado Statewide Wildfire Mitigation Program (COSWAP)<sup>9</sup> and the Forest Restoration and Wildfire Risk Mitigation (FRWRM)<sup>10</sup> grant program). While these programs provide essential resources, their short-term, episodic nature fundamentally limits their effectiveness, and funding levels are insufficient to meet the needs. Reliance on annual or one-time funding cycles constrains long-term planning, undermines the ability to retain and grow a skilled workforce, and prevents financing of durable infrastructure. In practice, this forces restoration efforts to remain reactive and fragmented rather than strategic and scalable, driving up long-term costs as capacity, expertise, and momentum are repeatedly lost between funding rounds.

The establishment of financial intermediaries capable of efficiently aggregating public, private, philanthropic, and federal capital is essential, akin to the functions performed by green banks or restoration finance hubs. Such entities use limited public dollars to leverage significantly larger private investment in priority projects by reducing risk, lowering financing barriers, helping to minimize transaction costs and enhancing investor confidence.

Existing tools such as the CSFS Wildfire Risk Mitigation Loan Fund, OEDIT business incentives, circular economy grants, workforce training programs, and CEO industrial decarbonization incentives should be evaluated as part of a coordinated set of funding and financing tools to support forest restoration and related industries. A coordinated approach can help project sponsors identify eligible programs, sequence funding sources, and address gaps where existing tools are insufficient.

In addition to coordinating funding sources, a practical next step is to create clear pathways for project development and investment. This includes identifying priority project types, aligning them with existing incentives, and supporting project sponsors in moving from concept to implementation so funding can be

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<sup>9</sup> A Colorado Department of Natural Resources grant program that supports local and regional wildfire mitigation planning, fuels reduction, and community preparedness projects across the state. <https://dnr.colorado.gov/colorado-statewide-wildfire-mitigation-program>

<sup>10</sup> Colorado grant program that funds forest restoration and wildfire risk reduction projects on public and private lands, emphasizing cross-boundary collaboration and community protection. <https://csfs.colostate.edu/funding-assistance/grants/>

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deployed efficiently at scale. Without a clear link between available funding tools and investable projects, capital will remain difficult to deploy at the scale needed to support restoration.

### 2. Limited Markets for Small-Diameter and Low-Value Wood

Colorado's forests are largely managed as stewardship forests, where land managers must pay for restoration treatments rather than rely on timber sale receipts. Many high-elevation forest types such as lodgepole pine, spruce-fir, and mixed conifer, often yield smaller-diameter, lower-grade, or beetle-affected material that can be challenging for traditional lumber markets. At the same time, these forests are significantly overstocked and contain substantial volumes of commercially viable timber that are underutilized due to policy, permitting, and risk considerations that shape project design and material offerings.

The absence of robust downstream markets and processing capacity for the full range of material removed during restoration drives up treatment costs, as significant volumes must be piled and burned or hauled long distances. Expanding utilization pathways is essential to closing this economic loop. This can be achieved through two distinct approaches: developing existing technologies such as mass timber, biochar, wood-fiber insulation, and engineered composites; and fostering innovation in emerging solutions like nanocellulose, biopolymers, and spaceboard. Not all material removed through restoration will be economically recoverable or suitable for higher-value product pathways, and utilization strategies must be tailored to forest type, condition, and logistics.

With about 88% of current timber consumed in Colorado being imported (i.e., from areas with subsidized forestry, large-scale clearcuts, and/or high tree growth rates, etc.), representing approximately \$7.5 billion in annual wood products consumption sourced from out of state, out of an estimated \$8.57 billion total consumed in Colorado in 2022<sup>11</sup>, coupled with Colorado's current suppressed industry capacity, Colorado timber and forest products producers are at a high competitive disadvantage globally. Notably, Colorado's existing processing facilities currently operate at an estimated 44% of annual production capacity, suggesting that feedstock reliability and market development constraints, not absent infrastructure alone, are limiting utilization<sup>12</sup>. This is a foundational challenge that will be very difficult to overcome without some state management to shift the competitive advantage back to Colorado producers. Precedent from other Colorado industries in a similar position (e.g., Colorado wine) and from other states provide several policy examples of shifting competitive advantages back to in-state industries while creating new revenue sources for the state.

### 3. Fragmented Policy and Regulatory Frameworks

Forest restoration, watershed protection, and biomass utilization are governed by multiple agencies and statutes that operate on different time horizons, metrics, and mandates.

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<sup>11</sup> Baral et al. (2025), RMRS-GTR-445

<sup>12</sup> Irely et al. (2025), RMRS-RB-41

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- Forest management is primarily overseen by the U.S. Forest Service (USFS) under federal authorities such as the National Forest Management Act (16 U.S.C. §1604) and the Multiple Use Sustained Yield Act (MUSYA) while state and local entities manage adjacent lands under different permitting and funding systems.
- Watershed and water-quality programs are managed through the Colorado Water Conservation Board (CWCB) and the Colorado Department of Public Health and Environment (CDPHE), each with its own eligibility rules, grant cycles, and evaluation criteria.
- Economic-development and energy programs that could support biomass industries, within the Office of Economic Development and International Trade (OEDIT) or the Colorado Energy Office (CEO), have not yet been systematically linked to forest health goals.
- Building codes and procurement standards differ across jurisdictions, slowing the adoption of wood-based construction products such as mass timber.
- Clean air regulations currently treat planned prescribed burn smoke with the same restrictions as unplanned wildfire smoke, creating a counterproductive incentive that makes proactive risk reduction harder to permit than the catastrophic fires it is designed to prevent.<sup>13</sup>

The result is a patchwork of policies that lack a unified framework for planning, financing, and measuring outcomes. A Forest Restoration Economy strategy would bridge these silos by creating consistent incentives, shared targets, and integrated permitting pathways.

In December 2025, the Governor issued Executive Order B 2025 001, designating the Ponderosa Mountain Pine Beetle Task Force as the State's primary body for coordinating the response to the expanding Front Range outbreak. The Task Force will address market development, workforce, infrastructure, and financing strategies, highlighting both the progress made and the ongoing fragmentation in Colorado's forest restoration efforts. While this represents an important step, it also highlights a broader challenge: forest restoration policy, economic development, and market formation continue to advance through issue-specific, time-limited initiatives rather than a unified, statewide framework capable of sustaining markets, workforce, and investment over time.

### 4. Lack of Measurable Carbon, Watershed, and Environmental Benefit Accounting

Although forest restoration and wood-product innovation have the potential to deliver clear climate benefits, Colorado currently lacks standardized methods to quantify and monetize those outcomes. Between 2012 and 2019, Colorado's forests were on average a slight net source of carbon, disturbances from insects, disease, and wildfire outpaced tree growth, underscoring both the urgency of restoration investment and the potential for managed forests and long-lived wood products to shift that balance<sup>14</sup>.

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<sup>13</sup> Troy et al. (2022)

<sup>14</sup> Vorster et al. (2024), *Colorado Forest Carbon Inventory*, Colorado State Forest Service

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The absence of consistent Measurement, Reporting, and Verification (MRV) protocols prevents projects from participating in carbon or resilience markets that could generate ongoing revenue. Key gaps include:

- Baseline data on carbon flux from forest treatments and post-fire recovery are incomplete or inconsistent across regions.
- Life-cycle analysis (LCA) for wood-based products (mass timber, biochar, engineered composites) is not standardized or recognized within existing carbon-offset registries.
- Market access barriers: Few verified carbon pathways exist for small projects, and transaction costs remain high without aggregation platforms or state-level quality assurance.
- Co-benefit valuation: Restoration yields multiple benefits (reduced sedimentation, avoided fire suppression costs, improved water yield) but these are not yet captured in financial instruments like pay-for-performance bonds or insurance incentives.

Creating a state-supported carbon and environmental benefit accounting framework, like those used in renewable energy and clean-heat programs, would enable Colorado to attract private investment and validate climate, watershed, and economic outcomes. Standardized methodologies could also support integration with emerging industrial decarbonization, low-carbon construction, and environmental market initiatives.

### 5. Infrastructure and Industry Capacity

A major challenge to developing biomass markets is the absence of sufficient processing infrastructure, such as sort yards, mills, and transportation systems, which frequently leads to valuable resources being wasted. State investment in these assets, along with support for emerging industries, is essential to unlock the full economic potential of forest restoration. However, future investment is dependent on maintaining the existing industrial capacity and infrastructure existing across the landscape today. Existing mills, loggers, truckers, and related businesses provide the workforce, equipment, supply-chain relationships, and market confidence needed to justify new capital investments in biomass utilization, mass timber, and other expanded wood-product markets. Without a stable base of traditional industry capacity, new markets may have more difficulty attracting financing or achieve the scale necessary to support restoration objectives over time. Transportation and logistics represent a critical cost component, particularly given Colorado's dispersed forest resources and limited existing processing infrastructure.

Surveys of stakeholders indicate that limited access to sort yards, adequate milling facilities capable of handling large amounts of biomass, and cost-effective transportation, especially around the Front Range, are major hurdles for biomass utilization and market expansion. To move products efficiently and at a reasonable cost from forests, it is crucial to make targeted investments in infrastructure. These investments should build from, rather than bypass, the existing businesses and facilities that already anchor the forest products supply chain. Maintaining this capacity is a necessary driver for future investment because it reduces risk for new entrants, creates dependable outlets for material generated through restoration, and

demonstrates that expanded markets can rely on an experienced industrial base rather than starting from scratch.

### 6. Long-Term Agreements and Predictability

Short-term stewardship contracts deter investment in forestry innovation. Attracting private capital and scaling restoration require long-term agreements and reliable supply commitments. Unpredictable feedstock remains a major obstacle for industry leaders, underscoring the need for stable deals and regional planning to lower risk. Aggregated landscapes and extended commitments are necessary to unlock market growth. Establishing long-term, landscape-scale agreements is critical not only for securing supply, but for enabling investment, reducing risk, and supporting the development of markets and infrastructure over time.

### 7. Limited Technology for Steep and Complex Terrain

A significant portion of Colorado's highest-risk and ecologically important forested landscapes occurs on steep, rugged, and operationally challenging terrain, where the use of conventional mechanical equipment is either impractical, or prohibitively expensive. In many forest types and terrain conditions across Colorado, prescribed fire is the primary and most cost-effective tool for reducing fuels and sustaining restoration outcomes, often following initial mechanical treatment where needed to prepare conditions for safe and effective burning. However, prescribed fire is not feasible everywhere, particularly in some high-elevation forest types and other areas where terrain, fuel conditions, weather windows, smoke management, or escape risk narrow the opportunities for safe implementation. As a result, some steep-slope treatments must still rely on labor-intensive hand crews, helicopter operations, or staged mechanical entry followed by pile or broadcast burning, which can limit pace and scale and increase costs.

While technologies for steep-slope forest restoration continue to advance, including systems widely used in Europe and other regions, adoption in Colorado remains limited. Operational, contracting, and economic constraints often prevent the deployment of existing or emerging tools at scale. The primary constraint is not the absence of technology, but the limited deployment and adoption of appropriate tools under current project design, contracting structures, and cost constraints.

Without advances in use of more sophisticated technology, mechanization, and operational efficiency, large portions of the landscape will remain difficult to treat at the scale required to reduce long-term risk and support restoration outcomes.

### 8. Project Scale and Cost Barriers

High stewardship costs (often exceeding \$3,000/acre<sup>15</sup>) and small project sizes limit economic viability and deter private investment. State policy should incentivize the aggregation of projects to achieve economies of scale and support cost-reduction strategies, including regional planning and pilot programs. Project

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<sup>15</sup> Mackes et al. (2025), CSFS Statewide Biomass Assessment Section 4

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aggregation should be applied strategically, grouping similar treatment types and geographies to improve efficiency, while maintaining opportunities for smaller contractors and specialized crews to participate where appropriate.

### 9. Workforce Development and Capacity

Workforce shortages and capacity constraints are a major barrier to scaling up forest restoration. Investment in training, recruitment, and workforce development should be a core component of the strategy, with state-supported programs and partnerships to build a skilled, year-round workforce. A significant hurdle identified statewide is the shortage of affordable workforce housing for restoration crews, contractors, and mill employees. This constrains scaling even when funding is available.

### Strategies

#### 1. Restoration Material Utilization Standard

A Restoration Material Utilization Standard (RMUS) would function like the Renewable Energy Standard by creating clear, measurable demand for restoration-derived materials. For example, state construction projects could be required to consider mass timber or bio-based materials where feasible, and state-funded watershed projects could prioritize Colorado-sourced biomass products such as mulch, wattles, or biochar. This policy would provide market certainty and unlock investment in processing capacity.

Stakeholder surveys show that reliable procurement specifications and stable material demand are essential for expanding mass timber, biochar, and bio-based industries. An RMUS offers the policy certainty needed for industry growth.

#### 2. Colorado's Wood Products Innovation and Market Opportunities

Developing robust wood-product markets is essential to create large-scale forest restoration economically viable. Colorado's forests, dominated by small-diameter, beetle-affected, and fire-killed trees, require creative utilization strategies that turn low-value biomass into high-value products. The following five pathways offer the most promising opportunities:

1. **Mass Timber & Engineered Wood:** Cross-Laminated Timber (CLT) and other engineered products can use small-diameter logs and support in-state manufacturing for public construction.<sup>16</sup>
2. **Wood-Fiber Insulation:** Converts chipped fiber into insulation materials that align with green building goals.
3. **Biochar & Biocarbon:** Supports watershed and soil restoration, erosion control, and carbon sequestration markets. Additional emerging markets include the use of biochar for PFAS remediation, which could be a promising driver of private-sector investment.
4. **Engineered Panels & Composites:** Uses mixed species for building products and furniture.
5. **Sustainable Aviation Fuel (SAF):** Converts woody biomass into renewable fuels through pyrolysis and upgrading processes. (Note: standalone biomass power generation has faced significant economic headwinds in Colorado. Co-location with wood products manufacturing, combined heat and power, and non-energy product markets may offer more promising near-term economics than standalone power generation.<sup>17</sup>)

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<sup>16</sup> Peer-reviewed research demonstrates that engineered timber buildings produce roughly 36% less embodied carbon than reinforced concrete and 48% less than steel, making Colorado-sourced mass timber a quantifiable climate asset. Buildings and construction account for approximately 40% of global CO<sub>2</sub> emissions making material choice in construction one of the highest-leverage climate interventions available. Hart et al. (2021) and WEF (2022), both cited in Baral et al. (2025), RMRS-GTR-445

<sup>17</sup> Blevins, J. (2024). Colorado's first biomass energy plant closed. *Colorado Sun*, December 4, 2024; and Irey et al. (2025)

## Building Colorado's Forest Restoration Economy:

6. Near-term markets requiring no new infrastructure should be pursued concurrently. Colorado already has functioning markets for firewood (564,000 cords annually, valued at \$158 million, over 99% Colorado-sourced), landscape mulch (over 80% Colorado-sourced), animal bedding, excelsior, and wood straw for post-fire erosion control (100% Colorado-sourced). These represent immediate revenue pathways that can support restoration economics while longer-term markets mature<sup>18</sup>.

To accelerate these opportunities, Colorado should establish a Wood Products Innovation Hub, an applied research and development center that connects scientists, engineers, entrepreneurs, and forest managers. The hub would:

- Test and certify new materials for performance and safety.
- Conduct life-cycle carbon assessments to validate climate benefits.
- Map feedstock supply chains and optimize transport logistics.
- Pilot products in state procurement (e.g., timber buildings, biochar erosion projects, insulation retrofits).
- Provide technical support and finance navigation for early-stage projects.

Other states provide useful models: Oregon's TallWood Design Institute, Maine's FOR/Maine and TimberHP, and the USDA's Wood Innovations Program, all combine applied R&D, industry services, and targeted funding to scale sustainable wood industries. Colorado can adapt these models to fit its unique forests, markets, and geography.

**Steep-Slope Restoration Technology:** Support applied R&D and pilot deployment of new tools and systems, including advanced cable-assisted equipment, lightweight mechanized harvesters, drone-based planning and monitoring tools, and remote or semi-autonomous technologies, to reduce costs, improve safety, and expand restoration feasibility on steep and complex terrain.

### 3. Incentive Framework: Tax and Financial Tools

From an investment perspective, avoided wildfire damages represent material, quantifiable value. Studies indicate that the "true economic costs" of wildfire frequently far exceed suppression expenditures, creating a strong rationale for preventative investment through resilience finance, insurance-aligned capital, and infrastructure funding.<sup>19</sup> Colorado already has a range of economic development, workforce, and energy programs that can support a forest restoration economy. The opportunity is to better align and apply these existing tools to restoration-related industries and investments before creating new ones.

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<sup>18</sup> Baral et al. (2025), RMRS-GTR-445

<sup>19</sup> <https://www.frames.gov/catalog/55945>

## Building Colorado's Forest Restoration Economy:

Financial and tax-based incentives were instrumental in building Colorado's renewable energy sector (such as...). Comparable tools could stimulate a forest restoration economy:

- Align existing state incentive programs, including OEDIT business incentives, Advanced Industries Accelerator, Enterprise Zone tools, Colorado Energy Office programs, Colorado Department of Agriculture programs, workforce training programs, and circular economy funding, with priority forest restoration economy project types.
- Restoration Infrastructure Tax Credit for investments in small-log mills or wood product facilities.
- Targeted, transitional subsidies may be appropriate to address early-market barriers and first-of-kind risks, and to offset structural competitive disadvantages against imported wood products, provided they are time-limited, performance-based, and paired with clear pathways to market sustainability.
- Develop a Colorado Environmental Benefit Market Strategy backed by a state MRV program, to create a Colorado Environmental Credit Market and supporting accounting framework to quantify and monetize carbon, watershed, resilience, biodiversity, soil health, insurance, and other restoration benefits of forest restoration and long-lived wood products.
- Low-Carbon Construction Rebate for builders using certified Colorado-sourced materials.
- Green Bank 'Forest Resilience Finance Facility' to de-risk loans for restoration-based businesses.
- Insurance and utilities sectors increasingly recognize the avoided costs of wildfire and watershed damage. Financial tools that quantify and monetize avoided losses, such as resilience credits or risk-reduction bonds, can attract these sectors as investors in restoration industries.
- A statewide or regional pooled funding structure, similar to RESTORE, could blend federal, state, philanthropic, and private capital to fund infrastructure, workforce, and innovation projects, and by combining these different sources, provide greater flexibility and stability than any single funding stream alone.
- A key structural barrier is the timing mismatch between project implementation and reimbursement-based grant funding, which creates cash flow constraints for project sponsors and limits participation. Bridging mechanisms, such as short-term financing tools, reimbursement bridge loans, or revolving capital structures, are needed to enable projects to move forward at scale.

Additional tools include accelerated depreciation, property tax abatements, and standardized carbon-credit protocols.

### 4. Rural Economic Diversification and Community Resilience

Many rural Colorado communities are transitioning from historic reliance on mining, coal, oil and gas, or tourism. Developing a forest restoration economy offers a new foundation rooted in local landscapes and skilled trades. Restoration hubs, biomass and wood product facilities can anchor year-round employment, revitalize industrial sites, and support the state's Just Transition framework for coal-impacted regions. This strategy directly supports economic diversification, workforce stability, and long-term rural resilience.

## Building Colorado's Forest Restoration Economy:

Colorado's outdoor recreation economy generates approximately \$65.8 billion in annual economic output and supports more than 400,000 direct jobs<sup>20</sup>. Forest health plays a foundational role in sustaining this sector, particularly through impacts to watersheds, recreation access, air quality, and community safety.

Workforce and infrastructure investments should be recognized as core drivers of local economic development.

### 5. Affordable Housing

Colorado's housing crisis intersects directly with the forest restoration economy. Restoration-derived wood products can support housing affordability, energy efficiency, resilience, and local economic development. Beyond structural materials, products such as mass timber, wood-fiber insulation, engineered panels, acoustic materials, and other building-envelope systems can create new markets for small-diameter and low-value forest material while reducing lifecycle housing costs. In wildfire-prone wildland-urban interfaces, housing solutions must also be fast to construct, durable, fire resistant, energy efficient, insurable, and well-suited to local environmental conditions. Many of these products also align with Colorado's building decarbonization and energy efficiency goals, creating opportunities for coordination with existing Colorado Energy Office programs.

#### **Mass Timber and Modular Construction**

Lightweight, fast-to-assemble modular units built with Colorado-derived mass timber can reduce construction timelines and labor costs, anchor manufacturing jobs in rural regions, provide workforce housing near restoration hubs, and store carbon in long-lived buildings.

#### **Wood-Fiber Insulation and Building Envelope Systems**

Wood-fiber insulation, panels, sheathing, and other building-envelope products can improve energy efficiency, reduce operating costs, and support resilient housing design while stimulating in-state manufacturing and creating demand for forest restoration-derived materials.

#### **Reduced Construction Costs Through Local Supply Chains**

A stronger in-state forest products economy can reduce transportation costs, improve supply-chain stability, and increase the availability of Colorado-sourced building materials for housing projects.

#### **Public Procurement and Housing Innovation**

State-funded housing initiatives can pilot Colorado-sourced materials through procurement preferences, incentives, demonstration projects, and technical assistance, helping to accelerate market adoption and reduce risk for developers and manufacturers.

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<sup>20</sup> <https://www.colorado.gov/governor/news/governor-polis-colorado-parks-and-wildlife-announce-new-data-showing-continued-growth-economic>

## Building Colorado's Forest Restoration Economy:

Together, these pathways create a powerful nexus between housing affordability, rural economic development, forest restoration, and resilient community design.

### 6. Alignment with State Policies and Programs

This vision aligns closely with existing statewide policy frameworks that emphasize forest and watershed resilience, rural vitality, and climate adaptation:

| Existing Policy or Program                                                                         | Alignment with Forest Restoration Economy Vision                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Executive Order B 2025 001                                                                         | Establishes cross-sector coordination to address forest health, public safety, and economic impacts of beetle outbreaks, including consideration of markets, workforce capacity, infrastructure, and financing needs that align with a forest restoration economy. |
| Colorado State Forest Service (CSFS) 2020 Forest Action Plan                                       | Prioritizes forest products, watershed protection, and working landscapes.                                                                                                                                                                                         |
| Colorado Forest Resilience Planning Guide (2025)                                                   | Calls for coordinated, landscape-scale planning and shared investment strategies.                                                                                                                                                                                  |
| Colorado Water Plan (2023 Update)                                                                  | Recognizes forest health as integral to long-term water security.                                                                                                                                                                                                  |
| Colorado Office of Just Transition                                                                 | Supports economic diversification for rural and coal-impacted communities.                                                                                                                                                                                         |
| Colorado Energy Office and Green Bank Initiatives                                                  | Provide models for financing innovation and carbon-smart industries.                                                                                                                                                                                               |
| Health and Climate Policy Agenda (Colorado Health Institute)                                       | Links wildfire, drought, and air quality to public health outcomes.                                                                                                                                                                                                |
| Colorado Department of Agriculture Healthy Soils Program and Climate-Smart Agriculture Initiatives | Supports development of biochar markets, carbon sequestration, soil health, drought resilience, watershed protection, and other restoration-derived products that provide agricultural, environmental, and economic benefits.                                      |
| Colorado Proud and Agricultural Economic Development Programs                                      | Provide models for strengthening in-state markets, supporting value-added production, and increasing demand for Colorado-sourced products.                                                                                                                         |
| Colorado Energy Office Industrial Decarbonization and Building Decarbonization Programs            | Support development and deployment of low-carbon building materials, including mass timber, wood-fiber insulation, and other restoration-derived products that reduce embodied and operational emissions.                                                          |
| Colorado Green Bank and Clean Energy Financing Initiatives                                         | Provide models and financing mechanisms that could be adapted to support restoration infrastructure, manufacturing, and market development.                                                                                                                        |

### Implementation Roadmap

The roadmap is designed to be nonpartisan and enduring, offering the next governor and legislature a ready framework for measurable impact, statewide collaboration, and a unifying narrative that bridges urban and rural priorities.

#### 1. Phase 1: Establish the Vision and Foundations (First 100 Days)

- Elevate the development of a Forest Restoration Economy as a strategic statewide priority by assigning clear leadership and accountability at the cabinet or senior agency level. This leadership role should coordinate across economic development, natural resources, energy, workforce, and water agencies to align policies, programs, and investments and drive implementation.
- Establish a project development and investment support function within OEDIT to identify priority projects, align them with existing incentives, and connect sponsors to funding and financing opportunities, working across agencies and programs to coordinate implementation.
- Leverage and align with Executive Order B 2025 001 and the Ponderosa Mountain Pine Beetle Task Force, in coordination with the Office of Economic Development and International Trade (OEDIT), to ensure that Forest Restoration Economy priorities (markets, workforce, infrastructure, financing, and business development) are embedded in the Task Force's scope, analysis, and implementation pathways recommendations.
- Integrate and leverage work being done under the Colorado Forest and Timber Industry Restoration Plan expected spring 2027.
- Establish a Forest Restoration Economy Implementation Working Group co-chaired by DNR and OEDIT, that complements the EO task force. Its scope would focus on statewide infrastructure, workforce and market development and investment pathways beyond the Front Range outbreak zone, economic systems, investment readiness, and market scalability rather than outbreak-specific forest management actions.
- Launch the Colorado Wood Products Innovation Hub with university, state, federal, industry, local government partners, federal laboratories and applied research.
- Commission feasibility studies for mass timber, wood-fiber insulation, and wood product facilities.
- Form the Workforce Development Task Force; begin housing-linked workforce assessments.
- Convene a Restoration Economy Funders Table to coordinate public, philanthropic, utility, insurance, and private-sector capital around shared investment priorities.
- Direct the Forest Restoration Economy Working Group to develop a public engagement and communications strategy as a foundational first-year deliverable, recognizing that public understanding of active forest management is a prerequisite for sustained investment, permitting, and market development.

## Building Colorado's Forest Restoration Economy:

- Establish a statewide forest feedstock inventory and market signaling platform that provides transparent, up-to-date information on available volumes, material types, geographic distribution, and treatment timelines to support industry recruitment and investment decisions.
- Conduct a statewide supply–demand alignment analysis building on existing work (e.g., ERI gap analysis) to identify regions where restoration need and underutilized processing capacity overlap.

### 2. Phase 2: Build the Framework and Launch Programs (6–12 Months)

- In coordination with the Forest Health Council, draft legislation establishing the RMUS and associated incentives.
- Align state procurement, building codes, and restoration specifications.
- Establish an applied research and commercialization program through the Innovation Hub.
- Establish a Forest Innovation Challenge Fund modeled on OEDIT's Advanced Industries Program.
- Launch workforce training programs with housing-sector integration.
- Initiate MRV pilot projects including housing materials pathways.
- Launch pilot housing and building demonstration projects utilizing restoration-derived materials, including mass timber, wood-fiber insulation, wall systems, sheathing, acoustic panels, and retrofit assemblies, to evaluate performance, reduce market barriers, and support broader adoption in affordable housing and community development.
- Identify pilot procurement projects to test Colorado-sourced materials in public infrastructure.
- Initiate pilot aggregation studies and identify candidate regions.
- Evaluate opportunities to integrate restoration-derived products, including biochar and other soil amendments, into agricultural conservation, soil health, and drought resilience programs.
- Develop a statewide communications blueprint framing restoration as essential to safety, housing, and economic development.
- Assess workforce housing requirements in key areas and test co-located modular housing or public–private workforce housing models that promote year-round employment, repurposing seasonal workforce accommodations, or collaborating with private-sector partners.
- Complete a statewide infrastructure feasibility assessment identifying priority locations for sort yards, mills, and transport hubs, aligned with feedstock availability and potential industry clusters. This assessment should include analysis of why existing processing facilities, currently estimated to operate at 44% of annual production capacity, are underutilized, and whether feedstock aggregation and supply reliability interventions may offer faster returns than greenfield facility development.

### 3. Phase 3: Scale, Institutionalize and Sustain (Years 2–5)

- Stand up early pilot facilities for innovative wood products, insulation, and mass timber manufacturing.
- Stand up restoration hubs in high-priority regions.
- Expand access to green-bank financing for forest product businesses.
- Develop a Measurement, Reporting, and Verification (MRV) framework for carbon and watershed benefits.
- Launch statewide communications positioning restoration as a core economic and climate priority.
- Create long-term offtake markets for restoration-based materials and fuels.
- Embed forest product innovation into state climate, water, and economic plans.
- Support mass timber and wood-fiber insulation adoption in affordable housing programs.
- Institutionalize long-term stewardship agreements and aggregation standards.

### From Crisis to Catalyst

Colorado has a chance to turn its forest and watershed challenges into a defining economic, housing, and environmental achievement. By blending restoration, carbon innovation, and rural prosperity with housing affordability, the state can create a model for the nation that honors its landscapes, strengthens its communities, and invests in a resilient future for all.