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The Efficiency Gap

The underlying causes of America's health, climate, and infrastructure challenges are interconnected. Public systems across the United States are under sustained strain. Wildfire impacts are becoming more destructive, and suppression expenditures are projected to rise (Carlson et al., 2025). Health care spending continues to increase, with chronic conditions accounting for a large share of overall costs (Hartman et al., 2026). Workforce capacity is pressured by disability, long-term health conditions, and burnout that undermines sustained participation and performance (Dennett et al., 2025).

These challenges are typically treated as separate crises managed by different agencies and funding streams. Growing evidence suggests they share a common underlying cause rooted in chronic system stress, fragmented governance, and diminished recovery capacity rather than isolated sector-specific failures (Bennett et al., 2015; Grossi & Argento, 2022; Yu & Chaturvedi, 2025). This brief describes the common cause as an efficiency gap.

This is not primarily a problem of resource scarcity. Energy, land, labor, and public investment remain available. The problem lies in conversion, meaning the ability of public systems to translate inputs into stable, adaptive, long-term function. Community resilience research emphasizes that resilience failures frequently arise not from insufficient resources, but from weak coordination, institutional fragmentation, and an overreliance on short-term response rather than sustained recovery pathways (Federal Emergency Management Agency, 2025; Grossi & Argento, 2022).

This paper synthesizes existing evidence across public health, land management, and governance literature rather than presenting new empirical findings.

Purpose and Argument

This brief argues that human metabolic dysfunction and ecological degradation can be understood through the same systems lens. In both cases, chronic stress overwhelms recovery capacity, forcing systems into continuous compensation rather than regeneration (Bennett et al., 2015). When systems cannot restore function after stress, they require increasing inputs and repeated emergency interventions while delivering diminishing long-term stability.

Wildfire Resilient Landscapes advances an integrated resilience framework that treats people, landscapes, and communities as interconnected systems governed by shared principles: signal clarity, recovery capacity, and coordinated function. Addressing efficiency failures requires coordinated system design rather than isolated interventions, consistent with systems-based resilience research, planetary health scholarship, and federal recovery doctrine (Bennett et al., 2015; Federal Emergency Management Agency, 2025; Yu & Chaturvedi, 2025).

By reframing resilience as an efficiency and recovery challenge, this brief presents five policy recommendations that emphasize regeneration, preventive investment, cross-sector coordination, and upstream system design. Together, these strategies aim to reduce long-term public costs, stabilize system performance, and restore the human and ecological capacity necessary for sustained economic and democratic participation (Bennett et al., 2015; Federal Emergency Management Agency, 2025; Organisation for Economic Co-operation and Development, 2021).

Defining Efficiency in Systems

Efficiency is often misunderstood as austerity, cost cutting, or reduced consumption. In systems science and public governance, efficiency refers to how effectively inputs such as energy, resources, and effort are converted into stable, useful outcomes over time. Efficient systems are not those that maximize short-term output, but those that sustain function without excessive waste, strain, or degradation (Bennett et al., 2015; Federal Emergency Management Agency, 2025; Grossi & Argento, 2022).

Across disciplines, efficient systems share three core characteristics:

1. Clear signals that allow early detection of stress and imbalance
2. Built-in recovery capacity through rest, regeneration, and repair
3. Coordinated function across subsystems so that actions in one domain do not undermine stability in another (Bennett et al., 2015; Yu & Chaturvedi, 2025)

When these characteristics are weak, systems tend to substitute throughput for stability. They increase activity to manage symptoms while underlying drivers remain unchanged. Over time, this pattern increases long-term costs and vulnerability across sectors (Bennett et al., 2015; Federal Emergency Management Agency, 2025).

What These Characteristics Look Like in Practice

Characteristic 1: Clear Signals

Clear signals allow systems to detect rising stress early and reduce escalation into crisis. In health care, integrated pathways and information sharing across primary care, specialty care, and preventive services support early risk identification and reduce delays in diagnosis and fragmented treatment. Fragmented care pathways correlate with increased emergency service utilization and poorer long-term outcomes (Dennett et al., 2025; Hartman et al., 2026).

In infrastructure, monitoring technologies and preventive maintenance programs enable early detection of wear, overload, or imbalance and reduce catastrophic failure and emergency repair costs (Huang et al., 2025). In ecosystems, intact feedback loops, including changes in vegetation structure, soil condition, and species composition, signal stress and enable recovery before collapse. Disrupted signals are associated with increased wildfire severity and ecological instability (U.S. Forest Service, 2022).

Characteristic 2: Recovery Capacity

Recovery capacity is the ability to restore function after stress. In health systems, this includes prevention, rehabilitation, and effective chronic disease management. Poor control of metabolic and chronic conditions increases acute care use, disability, and long-term costs (Hartman et al., 2026; Hu et al., 2025).

In workforce systems, insufficient recovery support contributes to prolonged work absence, reduced labor force participation, and persistent productivity losses following illness or injury (Dennett et al., 2025). In land management, suppression of recovery processes such as low-intensity fire and ecological regeneration has contributed to fuel accumulation and more severe wildfires, increasing suppression and disaster response costs (California Department of Forestry and Fire Protection, 2023; U.S. Forest Service, 2022).

Characteristic 3: Coordination Across Subsystems

Coordination ensures that actions in one system do not increase strain in another. Fragmented systems increase duplication, conflicting interventions, and downstream burden, while coordinated design improves long-term performance across sectors.

Public governance research shows that lack of coordination across institutional, social, and ecological subsystems often shifts risk rather than reducing it. Integrated approaches that align policy, infrastructure, health, and environmental management improve system efficiency by reducing counterproductive interactions and reinforcing shared recovery goals (Grossi & Argento, 2022; Yu & Chaturvedi, 2025).

Human Metabolic Inefficiency as a Systems Signal

One of the clearest indicators of systemic efficiency breakdown in the United States is the prevalence of metabolic dysfunction, particularly insulin resistance. Longitudinal analyses show rising rates of metabolic disease over the past two decades, reflecting a growing share of the population experiencing impaired metabolic regulation, including individuals not yet formally diagnosed with diabetes (Hu et al., 2025).

In metabolic dysfunction, fuel is present but not effectively converted into usable energy. Glucose circulates in the bloodstream, yet cellular uptake and utilization are impaired. Systems-based research characterizes this condition as a failure of metabolic signaling and regulation, leaving the body in a functional state of scarcity despite abundant inputs (Bennett et al., 2015).

The body compensates through stress-mediated and regulatory pathways. When these compensatory responses persist, they increase inflammatory load and regulatory strain rather than resolving the underlying dysfunction (Bennett et al., 2015). Population-level analyses link metabolic dysfunction to fatigue, chronic pain, mood disturbance, delayed recovery, and reduced physical and cognitive capacity. These impairments increase reliance on medical care and reduce sustained workforce participation, generating long-term strain across health and labor systems (Dennett et al., 2025; Hartman et al., 2026; Hu et al., 2025).

From a systems perspective, this pattern reflects signal disruption, impaired recovery processes, and feedback loops that fail to produce stable outcomes. As a result, the system consumes increasing resources while delivering diminishing functional return, a pattern consistent with systems analyses in public governance and infrastructure contexts (Bennett et al., 2015; Grossi & Argento, 2022).

Recognizing metabolic dysfunction as a systems signal rather than an individual behavioral failure reframes policy responses. It shifts attention from individual compliance to upstream design, recovery capacity, and coordination across health, labor, and environmental systems. In this context, supporting metabolic health functions as an infrastructure investment that stabilizes human capacity and reduces long-term public costs.

Ecological Parallels in Land Management

The same efficiency breakdown observed in human metabolic systems is visible across land and climate systems. Across many regions of the United States, landscapes are subjected to chronic stress while being deprived of the mechanisms that allow recovery. Rather than functioning as adaptive systems, these environments operate in a near-constant state of compensation, relying on suppression and emergency response rather than regeneration and long-term stabilization (U.S. Forest Service, 2022).

Common expressions of this pattern include prolonged fire suppression without sustained fuel management, urban heat islands without adequate green infrastructure, degraded soils without recovery periods, and fragmented habitats without ecological connectivity. Research in land and fire management demonstrates that these conditions disrupt ecological feedback loops, suppress regeneration, and reduce resilience to disturbance over time (California Department of Forestry and Fire Protection, 2023; Yu & Chaturvedi, 2025).

Urban Heat and Public Health Connections

Urban heat islands provide a clear example of ecological inefficiency translating into human health risk. Neighborhoods with limited tree canopy, high impervious surface coverage, and minimal green infrastructure experience elevated temperatures, reflecting the loss of ecological buffering capacity described in resilience and planetary health research (Yu & Chaturvedi, 2025).

Heat exposure interacts with metabolic and cardiovascular strain, reducing the body's ability to regulate temperature and recover from exertion. Large-scale analyses associate extreme heat events with increased emergency department utilization, lost workdays, and preventable mortality, with disproportionate impacts on communities already experiencing structural vulnerability (Dennett et al., 2025; Hartman et al., 2026). Rather than moderating stress through shade, evapotranspiration, and soil moisture, these environments amplify physiological strain and shift costs into health care, emergency response, and labor systems.

California-Specific Context

California illustrates how ecological inefficiency compounds across systems. Decades of fire suppression, land fragmentation, and development in the wildland-urban interface have increased fuel loads and wildfire severity, while urban expansion has intensified heat exposure in many communities. Areas with degraded vegetation structure and limited recovery mechanisms experience higher fire intensity and escalating suppression costs over time (California Department of Forestry and Fire Protection, 2023).

At the same time, urban regions across California, including parts of Los Angeles, the Central Valley, and the Inland Empire, exhibit overlapping patterns of low tree canopy, elevated heat exposure, and increased health and economic vulnerability. Analyses link chronic health burden and environmental stress to higher medical utilization, reduced workforce participation, and sustained pressure on public health, housing, and labor systems, particularly in communities already facing structural disadvantage (Dennett et al., 2025; Hartman et al., 2026; Yu & Chaturvedi, 2025).

When fire is suppressed without long-term fuel reduction, vegetation accumulates beyond historical norms, increasing fire intensity when ignition occurs. When urban areas lack tree canopy and permeable surfaces, heat and drought stress intensify. When soils are compacted or degraded without recovery periods, water retention declines and vegetation weakens. When habitats are fragmented, ecological adaptation is constrained. Together, these conditions create landscapes that are brittle rather than resilient (U.S. Forest Service, 2022).

From a systems perspective, wildfire and extreme heat are not failures of nature but signals of prolonged efficiency breakdown. Landscapes that cannot regenerate stress accumulate until failure becomes inevitable. Research in forest and fire science demonstrates that systems with intact recovery mechanisms, including prescribed fire, diverse native vegetation, healthy soils, and connected habitat corridors, experience lower disturbance intensity and recover more rapidly following shock. In contrast, systems optimized for short-term control rather than long-term function accumulate risk that is ultimately released catastrophically (Bennett et al., 2015; California Department of Forestry and Fire Protection, 2023).

Throughput Without Recovery

Many public systems in the United States are designed and evaluated around throughput. Success is measured by activity levels, services delivered, acres treated, patients seen, or cases processed. These metrics capture short-term output, but they rarely measure whether systems are regaining stability or reducing future demand.

Across resilience, disaster management, and systems engineering research, sustained performance does not result from uninterrupted output. It depends on the ability of systems to absorb stress, adapt, and restore function after disturbance. When recovery is excluded from system design, efficiency declines even as activity increases (Bennett et al., 2015).

In the absence of recovery capacity, systems compensate. They respond to rising strain by increasing throughput rather than reducing underlying causes. Emergency responses expand, service utilization rises, and workloads intensify while the conditions generating demand remain unchanged. Resilience engineering shows that these compensatory responses can temporarily maintain performance but increase fragility by masking accumulating stress and delaying restoration (Huang et al., 2025).

Quantitative resilience research confirms that recovery time is often a dominant determinant of long-term system performance. Systems that delay repair or operate continuously without recovery experience compounding performance loss and higher failure risk over time (Huang et al., 2025). In this context, constant activity is not a sign of strength but a signal of unresolved strain.

This pattern is visible across public systems. In wildfire management, suppression-focused strategies that prioritize immediate control without sustained fuel reduction allow ecological stress to accumulate, leading to larger and more severe fires and escalating suppression costs (U.S. Forest Service, 2022). In health systems, repeated acute encounters without upstream stabilization are associated with rising emergency utilization and long-term cost growth (Bennett et al., 2015; Hartman et al., 2026). In governance and social service systems, crisis-oriented delivery without stability and recovery goals increases churn while long-term vulnerability deepens (Grossi & Argento, 2022).

This is not a failure of effort or commitment. It is a design problem. Systems optimized for constant throughput without recovery will consume more resources to produce diminishing returns. Over time, emergency responses become the dominant mode of governance rather than an exception.

WRL's Integrated Resilience Framework

Wildfire Resilient Landscapes approaches resilience as an integrated system spanning land, people, and communities. At this stage, WRL functions as a conceptual and analytical framework rather than an implemented program. Its purpose is to synthesize existing research across environmental management, public health, housing, and workforce systems into a coherent way of understanding systemic efficiency and recovery.

The framework is grounded in the observation that challenges often treated as separate, such as wildfire risk, chronic illness, housing instability, and workforce attrition, share structural features. WRL proposes that these challenges reflect breakdowns in recovery capacity rather than isolated failures within individual sectors. This framing is consistent with resilience and planetary health scholarship that emphasizes interconnected ecological and human systems and the cascading effects of suppressed recovery across domains (Bennett et al., 2015; Yu & Chaturvedi, 2025).

Core Theoretical Principles

Regenerative land management as recovery infrastructure

WRL draws on land and fire science to argue that landscapes function more efficiently when managed for regeneration rather than continuous suppression or extraction. Practices such as prescribed fire, native vegetation restoration, soil recovery, and habitat connectivity restore ecological feedback loops, improve adaptive capacity, and reduce long-term risk. Research shows that landscapes with intact recovery mechanisms experience lower fire severity, greater post-disturbance regeneration, and reduced long-term suppression costs compared to systems optimized for short-term control (California Department of Forestry and Fire Protection, 2023; U.S. Forest Service, 2022).

Community-scale stress reduction as a resilience strategy

WRL extends resilience thinking beyond ecological systems to include chronic stress exposure in human environments. Systems-based research in disease prevention and public health indicates that sustained exposure to heat, pollution, housing instability, and environmental degradation increases physiological stress, disrupts metabolic regulation, and reduces recovery capacity over time. These conditions contribute to chronic illness and diminished workforce participation, particularly in communities facing cumulative environmental and socioeconomic burdens (Bennett et al., 2015; Dennett et al., 2025; Hu et al., 2025).

The framework treats community-scale interventions, including green infrastructure, urban canopy expansion, and place-based resilience design, as upstream strategies that reduce cumulative stress rather than relying solely on downstream emergency response (Huang et al., 2025; Hartman et al., 2026).

Interdependence of ecological and human health

A central assumption of WRL is that ecological health and human health are interdependent components of the same system. Degraded landscapes amplify heat, pollution, and disaster risk, which can worsen chronic disease burden, increase disability, reduce labor participation, and elevate public costs. Conversely, healthier ecosystems support environmental conditions that improve physical, mental, and social well-being. Systems-based research emphasizes that when recovery mechanisms are disrupted in either ecological or human systems, compensatory processes dominate and long-term vulnerability increases across domains (Bennett et al., 2015; Yu & Chaturvedi, 2025).

Why an Integrated Framework Matters

WRL proposes that siloed approaches limit public effectiveness because they address symptoms within individual systems while leaving underlying stressors intact. Wildfire suppression without land recovery, health care delivery without environmental stability, or housing services without attention to environmental exposure may meet immediate needs while perpetuating long-term inefficiency and rising demand.

The integrated resilience framework offers a way to align analysis and policy thinking across sectors without requiring institutional consolidation. It provides a lens for evaluating whether systems regain stability, reduce repeat crises, and restore functional capacity over time. Synthesized research across resilience engineering, planetary health, and public systems analysis indicates that integrated, recovery-oriented approaches have greater potential to reduce cumulative risk and long-term cost than isolated interventions (Huang et al., 2025; Yu & Chaturvedi, 2025).

Policy Recommendations

The following policy recommendations do not propose new programs or institutions. They translate existing evidence into design principles that prioritize recovery, efficiency, and long-term system stability.

Policy Recommendation 1

Measure Recovery Capacity, Not Only Output and Throughput, in Public Systems

Action

Expand performance metrics to include recovery and regeneration indicators that reflect long-term system stability, rather than relying solely on short-term output measures. This recommendation focuses on performance measurement reform, not program expansion, and can be implemented within existing agency structures.

Rationale

Many federal and state programs ultimately absorb the same long-term costs, even though they operate separately. Disaster response systems manage repeated emergencies, public health systems absorb the burden of chronic illness, and workforce and disability programs address lost productivity and labor force exit. When recovery does not occur, these costs accumulate across systems, regardless of which agency first encounters the problem.

The core issue is not organizational fragmentation, but how success is defined and measured. Systems engineering and resilience research shows that performance regimes focused exclusively on throughput obscure latent risk and delay corrective action. In contrast, recovery-focused metrics improve coordination across systems, reduce cumulative strain, and strengthen long-term stability without increasing organizational complexity (Dekker et al., 2008; Huang et al., 2025).

Recovery-Focused Indicators

Recovery capacity can be assessed by examining whether systems stabilize after stress rather than repeatedly returning to crisis conditions. In wildfire and land management, indicators such as vegetation regrowth, soil stability, and post-fire fuel load trends are associated with reduced wildfire severity and lower suppression costs over time (U.S. Forest Service, 2022; California Department of Forestry and Fire Protection [CAL FIRE], 2023). In public health systems, sustained reductions in emergency department utilization following preventive and community-based interventions signal improved system efficiency and lower long-term expenditure (Centers for Disease Control and Prevention [CDC], 2022). In workforce and labor programs, workforce retention, reduced work absence, and sustained labor force participation reflect restored functional capacity and improved long-term system stability (Dennett et al., 2025). Taken together, these indicators shift evaluation away from short-term activity counts and toward long-term system performance.

Feasibility Within Existing Infrastructure

Implementing recovery-based metrics does not require restructuring agencies or creating new institutions. Existing federal and state reporting systems already collect much of the relevant data through grant reporting, budget analysis, and performance management frameworks. Aligning a limited set of recovery indicators across agencies through grant criteria and performance reporting can improve coordination and long-term system performance without institutional restructuring (Huang et al., 2025).

Supporting Evidence

Quantitative resilience research demonstrates that recovery time and post-disturbance stabilization, rather than volume of activity, are the dominant determinants of long-term system performance. Systems designed to restore function after stress experience lower cumulative degradation and greater durability under repeated disturbance, while systems optimized for continuous throughput exhibit compounding performance loss over time (Huang et al., 2025).

Policy Recommendation 2

Invest in Regenerative Land Management That Reduces Chronic Ecological Stress

Action

Prioritize funding toward land management practices shown in the literature to restore ecological recovery capacity and reduce long-term wildfire risk, including prescribed fire, native vegetation restoration, soil recovery, and habitat connectivity.

Rationale

Many wildfire-prone landscapes in the United States are not failing because of isolated catastrophic events, but because of prolonged exposure to ecological stress without adequate recovery. Decades of fire suppression, land fragmentation, invasive species spread, and altered hydrology have reduced ecosystem resilience and increased fuel accumulation. As a result, when fire occurs, it is more severe, more destructive, and more costly to suppress (U.S. Forest Service, 2022).

Current funding structures emphasize emergency response and suppression rather than long-term landscape recovery. This approach treats wildfire as an episodic event rather than as a chronic system failure. When ecological recovery does not occur, wildfire risk escalates, and suppression costs recur across fire seasons, placing sustained pressure on public budgets (California Department of Forestry and Fire Protection [CAL FIRE], 2023). The solution is not increased suppression capacity alone, but sustained investment in land management practices that reduce background ecological stress and restore natural recovery processes.

Mechanism: How Regenerative Land Management Improves System Efficiency

Regenerative land management improves wildfire outcomes by addressing the underlying conditions that drive fire severity. Practices such as prescribed fire, native vegetation restoration, soil recovery, and habitat connectivity reduce excessive fuel loads through ecological processes rather than emergency intervention, improve soil health and moisture retention, increase vegetation diversity and structural complexity, and restore natural fire regimes that limit fuel accumulation over time.

By restoring these functions, landscapes shift from constant stress and compensation toward stability and recovery. This transition mirrors resilience patterns observed in other complex systems, where restoring recovery mechanisms reduces the need for repeated emergency intervention and improves long-term performance under stress (Yu & Chaturvedi, 2025).

Examples of Regenerative Practices

Prescribed fire and cultural burning reduce accumulated fuels, support native species, and restore natural fire cycles. Cultural burning practices developed by Indigenous communities are widely documented as enhancing ecosystem resilience while reducing wildfire severity (U.S. Forest Service, 2022). Native vegetation restoration and invasive species removal reduce fuel continuity and improve ecosystem stability by reestablishing plant communities adapted to local climate conditions and historical fire regimes (CAL FIRE, 2023). In urban and peri-urban landscapes, expanding tree canopy, restoring riparian corridors, and improving watershed function reduce heat stress, enhance moisture retention, and protect communities at the wildland–urban interface (U.S. Forest Service, 2022).

Feasibility Within Existing Infrastructure

Regenerative land management does not require new governance structures. Federal, state, and local agencies already administer programs capable of supporting these practices, including forest health grants, watershed restoration initiatives, and urban forestry programs. Implementation can be accelerated by prioritizing regenerative outcomes in grant scoring criteria, redirecting a portion of suppression funding toward preventive land management, and supporting long-term maintenance and stewardship rather than one-time treatments. These shifts align existing funding mechanisms with recovery-focused outcomes.

Supporting Evidence

Research from the U.S. Forest Service demonstrates that proactive fuel reduction, prescribed fire, and ecosystem restoration reduce wildfire intensity and long-term suppression costs, particularly when applied consistently over time (U.S. Forest Service, 2022). Similarly, CAL FIRE's Forest Health and Wildfire Resilience Action Plans emphasize regenerative land management as a cost-effective strategy for reducing wildfire risk and protecting communities by reducing fuel accumulation and restoring ecological function over time (CAL FIRE, 2023).

Policy Recommendation 3

Support Metabolic Health Initiatives as Infrastructure Investments, Not Lifestyle Programs

Action

Treat metabolic health as a systems-efficiency issue that directly affects workforce participation, disability rates, and long-term public spending, rather than framing it primarily as an individual lifestyle concern.

Rationale

Metabolic dysfunction, including insulin resistance and related conditions, is widespread in the

United States and increasingly contributes to chronic pain, fatigue, disability, and reduced productivity. These outcomes place sustained pressure on public health systems, workforce programs, and disability and social support expenditures (Centers for Disease Control and Prevention [CDC], 2023; Hu et al., 2025).

Despite these impacts, metabolic health interventions are often framed narrowly as lifestyle modification programs, placing responsibility on individuals rather than addressing systemic inefficiencies. This framing obscure the broader economic and public-sector consequences of metabolic dysfunction, including increased healthcare utilization, higher rates of work limitation, and early exit from the labor force (National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2022; Dennett et al., 2025).

When metabolic systems cannot efficiently convert available energy into stable function, individuals remain in a state of physiological compensation rather than recovery. Systems-based disease prevention research demonstrates that chronic metabolic dysfunction reflects sustained exposure to stressors without adequate recovery, leading to compensatory regulation rather than restoration. Over time, this pattern increases vulnerability across multiple organ systems and drives escalating healthcare utilization and disability (Bennett et al., 2015; NIDDK, 2022; Hartman et al., 2026). From a systems perspective, metabolic health should therefore be treated as infrastructure rather than as a behavioral issue.

Mechanism: How Metabolic Health Affects System Efficiency

Metabolic health influences system performance through multiple interconnected pathways. Impaired glucose regulation increases chronic inflammation and pain sensitivity, while energy inefficiency reduces physical and cognitive work capacity. Chronic metabolic stress delays tissue repair and recovery, increasing vulnerability to injury and prolonged illness. As functional limitations accumulate, healthcare utilization and disability claims rise, shifting costs downstream across public systems.

When metabolic function stabilizes, individuals are better able to sustain work, recover from injury, and avoid escalation into long-term disability. This improves system efficiency by reducing repeated downstream interventions and supporting sustained functional capacity.

Examples of Metabolic Health Infrastructure Investments

Investments in metabolic health infrastructure can be implemented through existing public systems. Expanding metabolic health programs through public health departments and Federally Qualified Health Centers improves access to preventive screening, early intervention, and stabilization for populations most affected by chronic metabolic stress (CDC, 2023; Hu et al., 2025). Integrating metabolic health screening and support into workforce sustainability and occupational health planning helps prevent injury recurrence, reduce sick leave, and improve long-term workforce participation, particularly in physically demanding or high-stress sectors (NIDDK, 2022; Dennett et al., 2025). Improving access to nutrition security programs and evidence-based metabolic treatments further support system stability by reducing emergency care utilization and preventing progression to advanced disease states that drive long-term costs (CDC, 2023; Hartman et al., 2026).

Feasibility Within Existing Infrastructure

Supporting metabolic health as infrastructure does not require new agencies or major system redesign. Existing public health systems, community health centers, workforce programs, and disability prevention initiatives already collect relevant data and deliver related services. Implementation can be advanced by prioritizing metabolic stabilization outcomes in public health funding criteria, integrating metabolic health indicators into workforce and disability prevention programs, and treating preventive metabolic care as a cost-avoidance investment in budget planning. These changes align existing structures around shared efficiency outcomes rather than isolated service delivery.

Supporting Evidence

The CDC documents strong associations between metabolic dysfunction and increased prevalence of chronic pain, functional limitations, and reduced labor participation, all of which contribute to rising public health and disability costs (CDC, 2023; Hu et al., 2025). NIDDK similarly identifies insulin resistance and metabolic syndrome as key drivers of delayed recovery, chronic disease progression, and reduced productivity (NIDDK, 2022). Population-level health expenditure analyses further show that chronic metabolic disease is associated with sustained increases in healthcare utilization, reinforcing the importance of early stabilization and prevention as infrastructure investments rather than discretionary wellness programs (Hartman et al., 2026).

Policy Recommendation 4

Fund Cross-Sector Resilience Programs That Integrate Land, Health, and Community Systems

Action

Create funding structures that enable coordination across environmental, health, housing, and labor sectors. This recommendation focuses on aligning incentives and outcomes through shared funding criteria and performance goals, not on organizational merger or consolidation. Participating agencies retain distinct roles and authorities while coordinating around long-term recovery and resilience outcomes.

Rationale

Many of the most persistent public challenges in the United States—including wildfire risk, chronic illness, heat exposure, housing instability, and workforce disruption—are deeply interconnected, yet they are addressed through siloed funding streams and program structures. Environmental agencies focus on land and natural resources, public health agencies address disease and prevention, housing agencies manage the built environment, and labor agencies focus on workforce participation.

When these systems operate independently, interventions often address symptoms rather than root causes. Degraded landscapes increase heat and fire risk, which worsens health outcomes and disrupts employment. These downstream effects are then managed separately by health and labor systems, increasing cumulative public costs without improving long-term resilience. Cross-sector resilience programs recognize that land, health, and community systems are functionally linked. Addressing them together improves efficiency, reduces duplication, and strengthens recovery capacity across systems.

Mechanism: How Cross-Sector Integration Improves System Performance

Integrated resilience programs improve outcomes by coordinating investments across systems that influence one another. Environmental interventions reduce heat, wildfire risk, and exposure-related physiological stress. Health interventions improve population capacity to withstand environmental stress and recover following disruption. Housing and infrastructure investments shape exposure levels, recovery time, and workforce stability. Labor and workforce programs support sustained participation following illness, injury, or environmental disruption.

When goals and funding across these systems are aligned, interventions reinforce one another rather than operating in isolation. This coordination reduces downstream cost shifting, shortens recovery time, and improves overall system stability.

Examples of Cross-Sector Resilience Investments

Co-funded initiatives between public health agencies and natural resource departments can support urban greening, wildfire buffer zones, and heat mitigation strategies that deliver both environmental and health benefits. Integrated green infrastructure and health programs, such as linking tree canopy expansion or waterway restoration with community health initiatives, reduce environmental stress while supporting physical and mental well-being. Regional resilience collaboratives that include land managers, health agencies, housing authorities, workforce organizations, and local governments enable coordinated planning and shared accountability for resilience outcomes across jurisdictions.

Feasibility Within Existing Infrastructure

Cross-sector resilience funding does not require the creation of new agencies. Many federal and state programs already support collaborative initiatives through grants, pilot programs, and interagency agreements. Barriers to coordination are often procedural rather than structural. Implementation can be advanced by designing grants that require multi-agency participation, allowing pooled or braided funding across departments, and establishing shared outcome metrics tied to resilience and recovery. These mechanisms enable collaboration while preserving agency missions and authority.

Supporting Evidence

Research across planetary health, resilience engineering, and public governance consistently demonstrates that integrated approaches addressing environmental, health, and social systems together are more effective and efficient than siloed interventions, particularly for complex challenges involving cascading risk and long-term recovery. Planetary health scholarship emphasizes that ecological conditions, human health, and governance systems are interdependent, and that resilience outcomes improve when land, health, and community systems are treated as interconnected rather than sequential or isolated (Yu & Chaturvedi, 2025).

Systems engineering research further shows that coordinated system design improves recovery time, reduces cumulative performance degradation, and strengthens long-term stability compared to fragmented or sector-specific responses (Huang et al., 2025). Public governance research similarly finds that alignment across policy domains and performance regimes improves system effectiveness by reducing duplication, conflicting incentives, and downstream cost shifting (Grossi & Argento, 2022). Together, this evidence supports cross-sector resilience investments as a practical mechanism for improving system efficiency and recovery capacity by addressing shared stressors across land, health, housing, and labor systems.

Policy Recommendation 5

Shift From Reactive Spending to Upstream Efficiency Design to Reduce Long-Term Public Costs

Action

Rebalance public budgets toward upstream efficiency design that reduces the frequency and severity of repeat crises. This recommendation focuses on preventing recurring emergencies and stabilizing systems over time, not on cutting services or reducing access to care.

Rationale

Public spending in the United States is heavily weighted toward reactive responses to system failure, including wildfire suppression, emergency healthcare, disaster recovery, and disability support. While these expenditures are necessary, they often address symptoms rather than underlying causes. As a result, the same costs recur across budget cycles with increasing intensity.

When systems are designed to operate at or beyond their stress limits, emergency spending becomes routine rather than exceptional. This pattern reflects inefficiency at the system level, where insufficient investment in prevention and recovery capacity leads to repeated high-cost interventions. Shifting spending upstream allows public systems to reduce the frequency and severity of crises, stabilize performance over time, and lower cumulative public costs.

Mechanism: How Upstream Design Improves Fiscal Efficiency

Upstream efficiency design improves outcomes by reducing the need for repeated emergency intervention. Preventive land management lowers wildfire severity, reducing suppression and recovery costs. Early metabolic stabilization reduces emergency healthcare utilization and long-term disability. Infrastructure and system design reduce exposure to chronic stressors that drive repeat crises.

By investing earlier in system stability, public spending shifts from perpetual response to sustained function. Quantitative resilience research demonstrates that systems with delayed recovery experience compounding performance loss and higher long-term costs, while systems designed for early stabilization and repair demonstrate greater fiscal efficiency and lower failure risk over time (Huang et al., 2025).

Examples of Upstream Efficiency Investments

In wildfire and land management, redirecting a portion of emergency suppression funding toward preventive fuel management, prescribed fire, and ecological restoration reduces fire intensity and suppression costs over time (U.S. Forest Service, 2022; California Department of Forestry and Fire Protection [CAL FIRE], 2023). In health systems, shifting expenditures toward early metabolic screening, stabilization, and preventive care reduces reliance on repeated acute interventions, emergency department visits, and long-term disability support (Centers for Disease

Control and Prevention [CDC], 2023; National Institute of Diabetes and Digestive and Kidney Diseases [NIDDK], 2022). Applying cost-benefit analysis that incorporates long-term savings, avoided emergencies, and reduced recurrence of system failure allows policymakers to evaluate investments based on total system impact rather than short-term expense.

Feasibility Within Existing Budget Structures

Rebalancing toward upstream investment does not require increasing total public spending. Instead, it involves reallocating a portion of existing emergencies and response budgets toward preventive and recovery-focused design. This shift can be implemented by setting aside a percentage of emergency response funds for preventive investment, allowing multi-year budgeting to capture long-term savings, and incorporating avoided cost estimates into budget justifications and program evaluations. These mechanisms align fiscal planning with long-term efficiency goals without creating new bureaucratic structures.

Supporting Evidence

Resilience engineering research demonstrates that recovery timing and stabilization capacity are primary determinants of long-term system cost and performance. Systems that prioritize early repair and upstream stabilization experience lower cumulative degradation and reduced fiscal strain compared to systems reliant on repeated emergency intervention (Huang et al., 2025). Sector-specific evidence further shows that preventive land management reduces wildfire suppression costs over time (U.S. Forest Service, 2022; CAL FIRE, 2023), while early metabolic intervention is associated with reduced healthcare utilization and improved functional outcomes that limit long-term disability and public expenditure (CDC, 2023; NIDDK, 2022; Hartman et al., 2026). Together, these findings support a shift toward upstream efficiency design as a fiscally responsible strategy for managing complex public systems.

Conclusion: Efficiency, Democracy, and Capacity

The efficiency problem described in this paper is systemic, not sector specific. Health, environment, housing, homelessness, education, and labor are interacting systems. When they underperform together, people do not simply fall through cracks. They are ground down over decades. This framing is consistent with emerging planetary health scholarship, which identifies wildfire, chronic disease, and governance fragmentation as interconnected efficiency failures rather than separate sectoral problems (Yu & Chaturvedi, 2025).

In public administration, challenges of this scale are often described as wicked problems. That framing is accurate. Wicked problems cross agency boundaries, have no single owner, and generate unintended consequences when addressed in isolation. Yet the term does not fully capture the lived reality of prolonged exposure to systems that consistently fail to support recovery.

Political and administrative theory has long emphasized that democratic governance depends on meaningful access to public institutions. In principle, democracy assumes that individuals can seek assistance, exercise choice, and navigate public systems when needs arise. Services exist. On paper, the system functions.

However, this assumption breaks down when access is structurally impaired. The uncomfortable truth policy often avoids is this: choice without functional access is not real choice.

Democratic systems implicitly assume stable bodies, stable housing, cognitive and physical bandwidth, and institutions that can be navigated. When those conditions are absent, the language of personal responsibility becomes fiction. People are technically allowed to choose, but practically unable to do so.

I am not describing a personal failure. I am describing compound system exposure. Living in a heat island without tree canopy increases chronic stress and inflammation. Under-resourced schools shape lifelong opportunity and health literacy. Housing instability magnifies physical strain and limits recovery. Fragmented health systems delay diagnosis and intervention. Environmental conditions quietly worsen every other condition (Centers for Disease Control and Prevention [CDC], 2023; Yu & Chaturvedi, 2025).

Each system can plausibly say, “This is not our responsibility.” Taken together, the outcome is what I have lived: an atrocity of accumulation. From a policy perspective, this is not anecdote. It is a case study in cumulative inefficiency.

This is the democracy paradox at the center of the efficiency gap. Democracy promises autonomy and choice. Public systems are designed around individual access. But systemic inefficiency steadily removes the actual capacity to choose. People are told to ask for help, navigate services, and advocate for themselves while their bodies, time, and resources are depleted by the very systems meant to support them.

This is not a failure of democracy as an ideal. It is a failure of implementation and system design.

America’s most pressing challenges are often framed as shortages of resources or funding. Evidence increasingly indicates the deeper issue is inefficiency. Systems that cannot convert energy, care, and investment into stable, regenerative outcomes burn through people, landscapes, and public budgets (Huang et al., 2025).

This is where the Wildfire Resilient Landscapes framework contributes. WRL does not argue for more spending, less choice, or centralized control. It advances a resilience lens grounded in efficiency, recovery capacity, and coordination across systems. Shade trees, metabolic health, stable housing, preventive care, and recovery-focused public metrics are not ancillary benefits. They are the conditions that make democratic participation possible.

I often acknowledge that I am better off than some people. That is true in relative terms. But relative suffering does not invalidate systemic harm. Education, insight, and the ability to articulate these failures did not protect me from heat exposure, physical overuse, delayed care, or fragmented systems. If anything, seeing the failures clearly has made them more difficult to carry.

What I am describing is not bitterness. It is diagnosis.

And it belongs in policy discourse.

Systems that can recover do not burn as easily.

References

Bennett, B. J., Hall, K. D., Hu, F. B., McCartney, A. L., & Roberto, C. (2015). Nutrition and the science of disease prevention: A systems approach to support metabolic health. *Annals of the New York Academy of Sciences, 1352*(1), 1–12. https://doi.org/10.1111/nyas.12945

California Department of Forestry and Fire Protection. (2023). *California wildfire and forest resilience action plan*. https://wildfiretaskforce.org/action-plan/

Carlson, A. R., Hawbaker, T. J., Mockrin, M. H., Radeloff, V. C., Bair, L. S., Caggiano, M. D., Meldrum, J. R., Alexandre, P. M., Kramer, H. A., & Steblein, P. F. (2025). Rising rates of wildfire building destruction in the conterminous United States. *Proceedings of the National Academy of Sciences of the United States of America, 122*(51), e2505886122. https://doi.org/10.1073/pnas.2505886122

Centers for Disease Control and Prevention. (2022). *Chronic disease indicators*. U.S. Department of Health and Human Services. https://www.cdc.gov/cdi

Centers for Disease Control and Prevention. (2023). *National diabetes statistics report*. U.S. Department of Health and Human Services. https://www.cdc.gov/diabetes/data/statistics-report

Dennett, J. M., Soltas, E. J., Goda, G. S., Thornhill, T. A., Werner, K., & Gonsalves, G. S. (2025). Enduring outcomes of COVID-19 work absences on the U.S. labor market. *JAMA Network Open, 8*(10), e2536635. https://doi.org/10.1001/jamanetworkopen.2025.36635

Federal Emergency Management Agency. (2025). *National Disaster Recovery Framework*. U.S. Department of Homeland Security. https://www.fema.gov/emergency-managers/national-preparedness/frameworks/recovery

Grossi, G., & Argento, D. (2022). The fate of accounting for public governance development. *Accounting, Auditing & Accountability Journal, 35*(9), 272–303. https://doi.org/10.1108/AAAJ-11-2020-5001

Hartman, M., Martin, A. B., Lassman, D., & Catlin, A. (2026). National health care spending increased 7.2 percent in 2024 as utilization remained elevated. *Health Affairs (Millwood, Va.)*. https://doi.org/10.1377/hlthaff.2025.01683

Hu, M., Le, M. H., Yeo, Y. H., et al. (2025). Diabetes prevalence and management patterns in U.S. adults, 2001–2023. *Acta Diabetologica, 62*, 2159–2170. https://doi.org/10.1007/s00592-025-02572-6

Huang, X., Li, Y., Zhang, Z., & Chen, J. (2025). *[Article title as shown in your PDF]*. *Reliability Engineering & System Safety*. https://doi.org/10.1016/j.ress.2024.109620

National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases. (2022). *Insulin resistance and metabolic syndrome*. https://www.niddk.nih.gov

U.S. Forest Service. (2022). *The rising cost of wildfire operations: Effects on the Forest Service budget*. U.S. Department of Agriculture. https://www.fs.usda.gov

Yu, J., & Chaturvedi, E. (2025). California’s wildfire crisis and the future of planetary resilience. In A. Cilento, F. Penna, G. Antonelli, & E. Chaturvedi (Eds.), *Planetary health: Laws, policies and science on the “One Health” approach* (pp. 81–109). Springer. https://doi.org/10.1007/978-3-031-90621-3_6