**Systems, Efficiency, and Democratic Capacity**
**Why America's Health, Climate, and Infrastructure Crises Share a Common Root**
Working Draft

Deborah J. Hanson
Founder & Executive Director, Wildfire Resilient Landscapes Institute
MPA, Environmental Policy & Management

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**Abstract**

Public challenges such as wildfire severity, chronic disease prevalence, infrastructure stress, and workforce instability are typically addressed as separate sectoral problems. This paper proposes an alternative interpretation: these conditions reflect a shared pattern of systemic efficiency decline across interconnected human and ecological systems. Drawing on systems science, resilience engineering, planetary health research, and public administration literature, the analysis reframes resilience as a function of recovery capacity, signal coordination, and cross-system integration rather than resource availability alone. The paper introduces the concept of the efficiency gap, defined as the widening disconnect between system input and sustained functional stability when recovery mechanisms are suppressed or fragmented. Using examples from public health, land management, and governance, the study examines how chronic stress without regeneration produces compensation-dependent systems characterized by rising throughput, escalating costs, and declining long-term performance. Wildfire Resilient Landscapes (WRL) is presented as a conceptual framework that synthesizes existing interdisciplinary research to interpret these patterns across domains. The framework does not present new empirical findings or implemented programs but offers an analytical lens for understanding how cumulative stress and diminished recovery capacity shape outcomes across bodies, landscapes, and public institutions. The paper concludes that improving long-term resilience requires shifting policy attention from crisis response toward system design that supports regeneration, coordination, and adaptive recovery.

*Keywords:* systems efficiency, resilience engineering, recovery capacity, planetary health, public systems, wildfire resilience, metabolic health, cross-sector governance, adaptive capacity, Wildfire Resilient Landscapes

## Section 1: Introduction

Across the United States, public systems are experiencing sustained and interconnected strain. Wildfire impacts are becoming more destructive while suppression expenditures continue to rise (Carlson et al., 2025; U.S. Forest Service, 2022). Health care spending is increasing alongside the prevalence of chronic disease, which accounts for a substantial share of total national expenditure (Hartman et al., 2026; Centers for Disease Control and Prevention [CDC], 2022). Workforce capacity is increasingly constrained by disability, long-term health conditions, and burnout that undermine sustained participation and performance (Dennett et al., 2025). These pressures accumulate across time rather than resolving through episodic response, suggesting that the dominant challenge is not isolated shocks but chronic system stress that reduces recovery capacity across domains (Bennett et al., 2015; Yu & Chaturvedi, 2025).

Despite their interconnected effects, wildfire, health, and workforce strain are typically governed and funded as separate sectoral problems. Administrative boundaries, budget categories, and accountability regimes tend to treat each domain as a distinct policy arena with separate performance metrics, timelines, and institutional owners (Grossi & Argento, 2022). This crisis-by-crisis framing can produce high levels of activity without long-term stabilization, because it emphasizes response and throughput while undermeasuring recovery, recurrence, and cumulative burden (FEMA, 2025; Huang et al., 2025). As a result, risk and cost often shift across systems rather than declining, with downstream public expenditures rising even when upstream interventions increase (Grossi & Argento, 2022; FEMA, 2025).

This paper characterizes the shared structural condition underlying these dynamics as an **efficiency gap**. The central issue is not primarily resource scarcity. Energy, labor, land, and public investment remain substantial, yet outcomes increasingly fail to stabilize over time

(Hartman et al., 2026; U.S. Forest Service, 2022). The difficulty lies in conversion, defined here as the capacity of systems to translate inputs into stable, adaptive, long-term function. Resilience and systems research demonstrates that failure often emerges not from insufficient resources, but from weak coordination, institutional fragmentation, unclear signals, and persistent reliance on short-term response in place of sustained recovery pathways (Bennett et al., 2015; FEMA, 2025; Huang et al., 2025). In this framing, rising activity can coexist with declining performance when the design conditions for recovery are suppressed.

The purpose of this paper is to synthesize interdisciplinary evidence and propose a conceptual model for understanding cross-domain instability through shared system conditions rather than sector-specific explanations. The core argument is that human metabolic dysfunction and ecological degradation can be interpreted through a common systems lens: chronic stress overwhelms recovery mechanisms, forcing systems into continuous compensation rather than regeneration (Bennett et al., 2015; Yu & Chaturvedi, 2025). When restoration processes fail, systems require increasing input and repeated intervention while delivering diminishing long-term stability, a pattern consistent with resilience engineering and recovery doctrine that emphasize stabilization and repair as determinants of long-run performance (FEMA, 2025; Huang et al., 2025). This analysis is conceptual and synthetic and does not present new empirical testing.

This paper contributes a cross-system interpretation of resilience centered on recovery capacity as a determinant of long-term public system performance. Section 2 defines efficiency in systems terms and identifies three enabling conditions: signal clarity, recovery capacity, and coordinated subsystem function (Bennett et al., 2015; FEMA, 2025; Grossi & Argento, 2022). Section 3 reviews cross-domain evidence showing parallel patterns of efficiency breakdown in metabolic regulation, wildfire dynamics, and urban heat exposure (CDC, 2023; Hu et al., 2025; CAL FIRE, 2023; Yu & Chaturvedi, 2025). Section 4 explains how throughput-focused performance regimes and fragmented governance drive compensation-dependent operation and recurring cost escalation (Dekker et al., 2008; Huang et al., 2025; Grossi & Argento, 2022). Section 5 introduces Wildfire Resilient Landscapes as a conceptual model that integrates these findings into a coherent analytical framework to support policy translation without claiming implemented program outcomes (FEMA, 2025; Yu & Chaturvedi, 2025).

## Section 2: Conceptual Foundations

Within systems science and public governance, efficiency refers not to austerity or reduced consumption, but to the capacity to convert inputs such as energy, resources, and effort into stable outcomes over time. Efficient systems sustain function without excessive waste, strain, or degradation, and they reduce the need for repeated emergency intervention by restoring equilibrium after disturbance (Bennett et al., 2015; FEMA, 2025). This definition aligns with resilience engineering accounts of long-term performance, where stability depends on recovery timing and the integrity of feedback processes rather than on continuous output (Huang et al., 2025).

Signal clarity refers to the ability of a system to detect stress early, interpret it accurately, and initiate corrective adjustments before disruption escalates. In fragmented systems, signals are delayed, diluted, or separated across institutions, increasing the likelihood that stress is addressed only after it becomes crisis-level demand (Grossi & Argento, 2022; Huang et al., 2025). In health and labor contexts, delayed detection and fragmented pathways are associated with higher downstream utilization and prolonged work disruption, while integrated monitoring and earlier intervention improve stability (Dennett et al., 2025; Hartman et al., 2026; CDC, 2023). In infrastructure and system safety research, preventive monitoring and early-warning signals are linked to improved reliability and reduced cascading failure risk (Huang et al., 2025).

Recovery capacity is the ability to restore functional equilibrium after stress. It includes repair, regeneration, and reintegration processes that reduce recurrence and prevent chronic compensation. When recovery mechanisms are suppressed, systems shift toward repeated acute intervention that increases cumulative burden and long-term costs (FEMA, 2025; Huang et al., 2025). In public health contexts, suppressed recovery is reflected in rising chronic disease burden and sustained expenditure growth (Hartman et al., 2026; Hu et al., 2025; CDC, 2023). In hazard and disaster contexts, recovery doctrine emphasizes that resilience depends on stabilization and restoration, not solely on response effectiveness (FEMA, 2025). In land and fire policy, constrained regenerative function contributes to recurring severity and escalating response burden (CAL FIRE, 2023; U.S. Forest Service, 2022).

Coordinated subsystem function refers to alignment across interacting systems so that interventions in one domain do not amplify instability in another. Governance research emphasizes that fragmentation can shift risk across domains rather than reducing it, particularly when performance regimes and accountability structures encourage siloed success measures (Grossi & Argento, 2022). Recovery doctrine similarly emphasizes coordination across institutions to support long-term stabilization (FEMA, 2025). Planetary health scholarship reinforces that ecological and human systems are coupled and that governance design shapes cascading risk across sectors (Yu & Chaturvedi, 2025). In this framework, coordination is not organizational consolidation, but functional alignment around shared recovery outcomes.

## Section 3: Cross-Domain Evidence

Metabolic dysfunction provides a clear indicator of efficiency breakdown because it reflects impaired conversion of available energy into stable function. Longitudinal analyses document rising prevalence of impaired metabolic regulation in U.S. adults, including individuals not formally diagnosed with diabetes (Hu et al., 2025; CDC, 2023). Systems-based disease prevention research characterizes this as disruption of signaling and regulatory processes that produces functional scarcity despite abundant inputs (Bennett et al., 2015; NIDDK, 2022). Compensatory responses increase regulatory strain rather than restoring balance, contributing to chronic inflammation, fatigue, reduced physical and cognitive performance, and greater dependence on medical care (Hartman et al., 2026; Hu et al., 2025; NIDDK, 2022). Labor research further demonstrates that health shocks and prolonged illness can generate enduring work absences and downstream labor market effects, linking physiological stability to workforce capacity (Dennett et al., 2025).

Comparable patterns are visible in land and fire systems. Landscapes subjected to chronic stress while deprived of regenerative mechanisms shift toward compensation-dependent functioning, relying on suppression and emergency intervention rather than adaptive stabilization (U.S. Forest Service, 2022; Yu & Chaturvedi, 2025). Fire suppression without sustained fuel management, degraded soils without restoration, and fragmented habitats without ecological connectivity constrain recovery processes and increase the likelihood of severe disturbance (CAL FIRE, 2023; U.S. Forest Service, 2022). In this context, wildfire severity functions as a signal of suppressed regeneration and cumulative stress rather than a purely episodic hazard (Yu & Chaturvedi, 2025).

Urban heat islands illustrate how ecological inefficiency translates into human health risk and institutional demand. Reduced ecological buffering capacity increases physiological strain and contributes to downstream utilization in health systems and disruption in labor systems, consistent with evidence linking health burden, service utilization, and work disruption (Dennett et al., 2025; Hartman et al., 2026). Planetary health scholarship frames these as coupled ecological and human risks shaped by governance design and constrained recovery pathways (Yu & Chaturvedi, 2025). In this interpretation, environmental conditions operate as upstream determinants of recovery capacity that influence both biological function and public system load (Bennett et al., 2015; FEMA, 2025).

These cross-domain dynamics are especially evident in California, where fire suppression history, fragmented land use, and expanding wildland-urban interface exposure increase disturbance severity and suppression burden, while urban growth heightens heat exposure (CAL FIRE, 2023; U.S. Forest Service, 2022). Regions characterized by degraded vegetation structure and limited regenerative capacity experience higher fire severity and escalating suppression costs, consistent with state wildfire resilience planning and federal fire management analysis (CAL FIRE, 2023; U.S. Forest Service, 2022). Overlapping patterns of environmental stress, chronic disease burden, and economic vulnerability amplify demand across public systems, contributing to compounded strain in health and labor domains (CDC, 2023; Hartman et al., 2026; Dennett et al., 2025; Yu & Chaturvedi, 2025). Recovery doctrine emphasizes that resilience depends on restoring function and reducing recurrence, not only responding during acute disruption (FEMA, 2025).

## Section 4: System Dynamics of the Efficiency Gap

Many public systems are evaluated through throughput measures such as services delivered, cases processed, or activities completed rather than through indicators of stabilization, recurrence reduction, or restoration. Resilience engineering and systems safety research shows that sustained performance depends on the capacity to absorb disturbance and restore function, and that output-centered performance regimes can obscure accumulating risk (Dekker et al., 2008; Huang et al., 2025). Governance research similarly finds that accounting and performance systems shape institutional perceptions of success and can constrain long-term capacity development under stress (Grossi & Argento, 2022).

When recovery is excluded from system design, activity can increase while underlying instability accumulates. Compensatory responses can temporarily maintain function but increase fragility by masking unresolved stress and delaying restoration, contributing to compounding performance loss over time (Huang et al., 2025). Recovery doctrine distinguishes response from stabilization and long-term restoration, emphasizing that repeated response without restoration produces chronic vulnerability (FEMA, 2025). This dynamic provides a shared explanation for recurring emergency suppression costs, rising chronic health utilization, and persistent workforce disruption (U.S. Forest Service, 2022; Hartman et al., 2026; Dennett et al., 2025).

Fragmented governance frequently shifts risk and cost across domains rather than reducing it. When environmental degradation increases health burden and work disruption, downstream systems absorb consequences that upstream institutions are not incentivized to measure or prevent (Grossi & Argento, 2022; Yu & Chaturvedi, 2025). Recovery frameworks emphasize that cross-institution coordination and aligned outcomes are necessary to prevent recurrence and to stabilize long-term function across systems (FEMA, 2025). Without alignment, systems can appear productive while total burden and cumulative expenditure rise.

## Section 5: Wildfire Resilient Landscapes Framework

Wildfire Resilient Landscapes is positioned as a conceptual analytical framework that synthesizes interdisciplinary research to interpret systemic efficiency decline across biological, ecological, and institutional systems (Bennett et al., 2015; Grossi & Argento, 2022; Yu & Chaturvedi, 2025). Its purpose is not to report implemented interventions or program outcomes, but to provide an organizing structure that explains why recurring crises persist despite sustained investment and activity.

The WRL model uses three operating principles to interpret system performance: signal clarity, recovery capacity, and coordinated subsystem function. These principles reflect resilience and recovery research emphasizing that long-run stability depends on early detection of stress, supported restoration processes, and coordination across interacting domains (Bennett et al., 2015; FEMA, 2025; Huang et al., 2025). In this framework, efficiency failure occurs when signals are fragmented or delayed, recovery mechanisms are suppressed, and coordination is weak enough that interventions increase load elsewhere rather than stabilizing the system overall (Grossi & Argento, 2022; Yu & Chaturvedi, 2025).

The WRL framework is conceptual and synthetic. It does not claim causal proof within a single dataset, nor does it claim demonstrated implementation success. Instead, it integrates established findings from systems-based disease prevention, resilience engineering, recovery doctrine, wildfire and land management analysis, and governance research to propose a coherent explanation for cross-domain instability (Bennett et al., 2015; CAL FIRE, 2023; FEMA, 2025; Grossi & Argento, 2022; Huang et al., 2025; Yu & Chaturvedi, 2025). Its primary value is policy translation: it clarifies shared structural drivers that can guide measurement reform and upstream design choices within existing institutions.

## Section 6: Policy Recommendations

### Policy Recommendations

The following recommendations do not propose the creation of new programs or institutions. Instead, they translate established empirical findings from resilience science, systems engineering, public health, and land management into design principles that emphasize recovery capacity, efficiency, and long-term system stability. Each recommendation can be implemented within existing governance structures through adjustments to performance measurement, funding priorities, and cross-sector coordination (FEMA, 2025; Huang et al., 2025; Grossi & Argento, 2022).

### Policy Recommendation 1

Measure recovery capacity, not only output and throughput, in public systems

Public performance regimes should be expanded to include indicators that capture recovery and regeneration following disturbance, rather than relying primarily on short-term output measures. This recommendation concerns performance measurement reform within existing agencies rather than program expansion, consistent with resilience engineering arguments that performance must be evaluated through recovery dynamics, not only operational activity (Dekker et al., 2008; Huang et al., 2025).

Across federal and state systems, long-term costs frequently converge even when administrative responsibilities are separated. Disaster response systems manage repeated emergencies, public health systems absorb the burden of chronic disease, and workforce and disability programs respond to diminished labor participation. When recovery does not occur, costs accumulate across institutional boundaries regardless of which system first encounters disruption, consistent with recovery doctrine emphasizing stabilization as a cross-system determinant of long-term demand (FEMA, 2025; Hartman et al., 2026; Dennett et al., 2025; CDC, 2022).

Research in resilience engineering and systems governance demonstrates that performance regimes focused primarily on throughput obscure accumulating risk and delay corrective intervention. Metrics that capture stabilization and recovery improve coordination across systems, reduce cumulative strain, and enhance long-term functional capacity without requiring institutional restructuring (Dekker et al., 2008; Huang et al., 2025; Grossi & Argento, 2022).

Recovery capacity can be evaluated by examining whether systems return to stable function following stress rather than repeatedly cycling through crisis. In wildfire and land management, vegetation regrowth, soil stabilization, and post-disturbance fuel trajectories are associated with reduced fire severity and lower long-term suppression costs (U.S. Forest Service, 2022; CAL FIRE, 2023). In public health, sustained reductions in emergency department utilization following preventive intervention indicate improved system efficiency and lower long-term expenditure (CDC, 2022; Hartman et al., 2026). In workforce systems, retention, reduced work absence, and sustained labor force participation reflect restored functional capacity and reduced disruption persistence (Dennett et al., 2025).

Implementation is feasible within existing infrastructure. Federal and state reporting systems already collect much of the relevant data through grant reporting and performance management frameworks. Aligning a limited set of recovery indicators across agencies through grant criteria and reporting standards would improve coordination and long-term performance without structural reorganization (FEMA, 2025; Huang et al., 2025). Quantitative resilience research consistently finds that recovery time and post-disturbance stabilization are dominant predictors of long-term system performance, while systems optimized for continuous throughput exhibit compounding performance decline (Huang et al., 2025).

**Policy Recommendation 2**

Invest in regenerative land management that reduces chronic ecological stress

Funding priorities should emphasize land management practices that restore ecological recovery processes and reduce long-term wildfire risk, including prescribed fire, native vegetation restoration, soil recovery, and habitat connectivity. This aligns with wildfire and resilience planning that frames disturbance severity as a consequence of altered ecological function and constrained regeneration (CAL FIRE, 2023; U.S. Forest Service, 2022).

In many wildfire-prone landscapes, increasing fire severity reflects prolonged ecological stress combined with suppressed recovery processes rather than isolated catastrophic events. Fire suppression, land fragmentation, invasive species expansion, and altered hydrology reduce ecosystem resilience and increase fuel accumulation, producing higher-intensity disturbance and greater response burden when fire occurs (U.S. Forest Service, 2022; CAL FIRE, 2023). Planetary health scholarship similarly emphasizes coupled ecological and governance drivers that shape resilience outcomes over time (Yu & Chaturvedi, 2025).

Existing funding structures remain heavily oriented toward suppression and emergency response rather than landscape recovery. This approach treats wildfire as episodic disturbance rather than as a chronic systems condition. Without sustained recovery, background ecological stress intensifies and suppression costs recur across fire seasons, placing continuous pressure on public budgets (U.S. Forest Service, 2022; CAL FIRE, 2023). Recovery-oriented frameworks emphasize that long-term stability depends on restoring regenerative pathways rather than relying on repeated response (FEMA, 2025).

Regenerative land management reduces wildfire severity by restoring natural fuel regulation and ecosystem function. Prescribed fire, native vegetation recovery, soil restoration, and habitat connectivity reduce excessive fuel accumulation, improve moisture retention, increase structural diversity, and restore fire regimes that regulate disturbance intensity. Systems that retain regenerative processes require fewer emergency interventions and exhibit greater stability under repeated stress, consistent with resilience findings on recovery dynamics and coupled system risk (Yu & Chaturvedi, 2025; Huang et al., 2025).

Evidence supporting these practices is extensive. Cultural burning traditions developed by Indigenous communities are widely documented as enhancing ecosystem resilience and moderating fire behavior (U.S. Forest Service, 2022). Native vegetation restoration and invasive species control reestablish locally adapted plant communities and reduce fuel continuity (CAL FIRE, 2023). Urban and peri-urban ecological restoration supports heat moderation and community protection in interface zones, contributing to reduced exposure-related strain (U.S. Forest Service, 2022; Yu & Chaturvedi, 2025).

Implementation does not require new governance structures. Federal, state, and local programs already administer forest health, watershed restoration, and urban forestry initiatives. Prioritizing regenerative outcomes in grant scoring, reallocating a portion of suppression funding toward preventive management, and supporting long-term stewardship would align existing programs with recovery-oriented objectives (CAL FIRE, 2023; U.S. Forest Service, 2022). Proactive fuel reduction and ecosystem restoration are consistently associated with reduced fire intensity and lower long-term suppression expenditure (U.S. Forest Service, 2022; CAL FIRE, 2023).

**Policy Recommendation 3**

Support metabolic health initiatives as infrastructure investments

Metabolic health should be treated as a systems-efficiency determinant that influences workforce participation, disability prevalence, and long-term public expenditure, rather than framed solely as an individual lifestyle concern. Public health surveillance and disease prevention research support framing metabolic stability as a structural contributor to long-run system performance (CDC, 2023; Bennett et al., 2015; NIDDK, 2022).

Metabolic dysfunction is widespread in the United States and contributes to chronic pain, fatigue, disability, and reduced productivity. These outcomes generate sustained demand across healthcare, workforce, and disability systems and are associated with rising utilization and expenditure trajectories (CDC, 2023; Hu et al., 2025; Hartman et al., 2026). Despite these impacts, interventions are often framed as individual behavior change rather than as systemic efficiency measures, which can obscure the structural determinants of stability and recovery emphasized in systems-based disease prevention (Bennett et al., 2015).

Systems-based disease prevention research demonstrates that chronic metabolic dysfunction reflects sustained exposure to stress without adequate recovery, producing compensatory regulation rather than restoration. This increases vulnerability across organ systems and contributes to escalating healthcare utilization and functional limitation, reinforcing the relevance of early stabilization and recovery capacity (Bennett et al., 2015; NIDDK, 2022; Hartman et al., 2026). Longitudinal prevalence research further supports the scale and persistence of these burdens (Hu et al., 2025; CDC, 2023).

Metabolic function influences system performance through multiple pathways. Impaired glucose regulation increases inflammatory burden, reduces physical and cognitive capacity, delays recovery from injury, and elevates long-term disability risk. Stabilization reduces downstream intervention, supports sustained labor participation, and reduces prolonged work disruption following health shocks (NIDDK, 2022; Dennett et al., 2025; Hartman et al., 2026). This logic aligns with systems framing that emphasizes conversion of inputs into functional capacity over time rather than episodic intervention (Bennett et al., 2015).

Implementation can occur through existing public health and workforce systems. Expanded screening and early intervention through public health departments and Federally Qualified Health Centers improves access to stabilization (CDC, 2023; Hu et al., 2025). Integration into occupational health and workforce sustainability efforts is consistent with evidence showing long-term work disruption following health shocks and the value of recovery-oriented reintegration (Dennett et al., 2025). Nutrition security and evidence-based treatment reduce emergency care utilization and disease progression, supporting long-run expenditure control (CDC, 2022; Hartman et al., 2026; NIDDK, 2022).

Existing systems already collect relevant data and deliver related services. Prioritizing metabolic stabilization outcomes in funding criteria and workforce programs would align prevention with long-term cost avoidance, consistent with public expenditure analysis and chronic disease surveillance (Hartman et al., 2026; CDC, 2022; CDC, 2023). Population-level evidence links metabolic dysfunction to chronic disease burden, reduced labor participation, and increased healthcare expenditure, supporting early stabilization as an infrastructure investment (Hu et al., 2025; Dennett et al., 2025; Hartman et al., 2026).

**Policy Recommendation 4**

Fund cross-sector resilience programs that integrate land, health, and community systems

Funding structures should enable coordinated investment across environmental, health, housing, and labor systems through shared outcome measures and aligned incentives. This recommendation does not require institutional consolidation. Agencies retain distinct authorities while coordinating around recovery and resilience outcomes, consistent with public governance research on coordination and performance regimes and with federal recovery doctrine emphasizing multi-system stabilization (Grossi & Argento, 2022; FEMA, 2025).

Persistent public challenges, including wildfire risk, chronic illness, heat exposure, housing instability, and workforce disruption, are structurally interconnected but managed through separate funding streams. Environmental degradation increases physiological stress and economic disruption, which are then addressed independently by health and labor systems, contributing to cost shifting and cumulative demand (Yu & Chaturvedi, 2025; Hartman et al., 2026; Dennett et al., 2025). Governance research suggests that fragmentation can undermine long-term performance by constraining coordination and obscuring shared accountability (Grossi & Argento, 2022).

Cross-sector resilience programs recognize functional interdependence among ecological conditions, population health, and community stability. Coordinated investment reduces duplication, shortens recovery time, and prevents downstream cost shifting across systems, consistent with resilience engineering findings on recovery dynamics and performance under repeated disturbance (Huang et al., 2025; FEMA, 2025). Planetary health scholarship similarly emphasizes that interdependence requires integrated policy approaches to reduce cascading risk (Yu & Chaturvedi, 2025).

Integrated programs improve performance by aligning interventions that influence one another. Environmental stabilization reduces exposure-related strain. Health interventions improve recovery capacity. Community infrastructure shapes exposure and resilience. Workforce programs sustain participation following disruption. This logic follows from recovery doctrine and resilience research emphasizing that stabilization and restoration require coordinated action across systems rather than isolated response (FEMA, 2025; Huang et al., 2025; Yu & Chaturvedi, 2025).

Implementation is feasible through existing grant mechanisms, interagency agreements, and pooled funding structures. Procedural barriers to coordination can be reduced by requiring multi-agency participation in grants and establishing shared recovery metrics. Governance research on public sector performance systems reinforces that changing accountability and measurement structures can shape coordination without institutional merger (Grossi & Argento, 2022; FEMA, 2025). Evidence across planetary health and resilience engineering supports integrated approaches as more durable than siloed interventions under conditions of repeated stress (Yu & Chaturvedi, 2025; Huang et al., 2025).

**Policy Recommendation 5**

Shift from reactive spending to upstream efficiency design

Public budgeting should be rebalanced toward preventive and recovery-oriented investment that reduces the frequency and severity of recurring crises. This recommendation concerns expenditure timing and system design rather than reductions in services or access, consistent with federal recovery doctrine and resilience engineering evidence on the determinants of long-run cost and stability (FEMA, 2025; Huang et al., 2025).

Public spending is heavily concentrated on response to system failure, including wildfire suppression, emergency healthcare, and disaster recovery. While necessary, these expenditures often address symptoms rather than structural drivers, contributing to recurring demand and rising cost trajectories in both hazard response and healthcare utilization (U.S. Forest Service, 2022; Hartman et al., 2026; FEMA, 2025). Chronic disease surveillance further supports that sustained disease burden produces long-run expenditure pressure (CDC, 2022; CDC, 2023).

Systems operating near or beyond stress limits require continuous emergency intervention. This reflects structural inefficiency rather than insufficient effort. Upstream investment reduces crisis frequency, stabilizes system performance, and lowers cumulative public expenditure, consistent with resilience research emphasizing recovery capacity as a primary determinant of long-run performance under repeated disturbance (Huang et al., 2025; FEMA, 2025). Governance scholarship suggests that what budgets prioritize reflects institutional definitions of success and shapes long-run capacity (Grossi & Argento, 2022).

Preventive land management reduces wildfire severity and suppression cost. Early metabolic stabilization reduces acute healthcare utilization and long-term disability risk. System design that reduces exposure and supports recovery shortens disruption duration and reduces recurrence. These mechanisms are consistent with wildfire planning evidence, chronic disease and metabolic science, and resilience engineering findings on recovery timing and durability (U.S. Forest Service, 2022; CAL FIRE, 2023; NIDDK, 2022; CDC, 2023; Huang et al., 2025).

Implementation does not require increased total spending. Reallocation within existing emergency and response budgets can support preventive investment. Multi-year budgeting and avoided-cost analysis allow long-term savings to be captured in fiscal planning, consistent with federal recovery doctrine emphasizing restoration and reduced recurrence as central performance goals (FEMA, 2025). Public expenditure analysis further supports that chronic utilization growth and response burden create structural fiscal pressure that prevention can reduce over time (Hartman et al., 2026; U.S. Forest Service, 2022).

Evidence consistently demonstrates that preventive land management reduces suppression expenditure (U.S. Forest Service, 2022; CAL FIRE, 2023), while early metabolic intervention and stabilization reduce healthcare utilization and long-term disability burden (CDC, 2023; NIDDK, 2022; Hartman et al., 2026). Systems that prioritize stabilization experience lower cumulative cost and greater durability under repeated disturbance, while systems optimized for continuous response exhibit compounding performance decline (Huang et al., 2025; Dekker et al., 2008).

## Section 7: Discussion—Linking Systems Theory to Policy Design

The central theoretical contribution of this paper is the identification of efficiency as a unifying mechanism connecting human health, ecological stability, and institutional performance. Across systems science, resilience engineering, and public governance research, sustained function is determined not by resource volume alone but by the capacity to convert input into stable, regenerative outcomes over time (Bennett et al., 2015; Grossi & Argento, 2022). This conversion process depends on three interrelated system properties: signal clarity, recovery capacity, and coordinated interaction among subsystems. When these properties weaken, systems shift from regenerative operation to compensatory operation. Activity increases, but stability declines.

Public policy has historically addressed instability through sector specific interventions. Environmental agencies manage land disturbance, health systems manage disease burden, housing systems manage exposure and displacement, and labor systems manage functional participation. While administratively rational, this structure assumes that disturbances originate within individual sectors. Systems theory suggests otherwise. Disturbances propagate across interconnected domains through feedback loops that amplify stress and delay recovery. Ecological degradation increases heat exposure and disaster risk, which affects physiological stress and chronic disease prevalence. Health burden affects workforce participation and economic stability. Housing conditions shape exposure patterns and recovery time. Institutional fragmentation distributes responsibility across sectors while obscuring shared causal structure (Yu & Chaturvedi, 2025; World Health Organization, 2022).

This interdependence has direct implications for policy design. If systemic inefficiency arises from suppressed recovery capacity, then interventions that target symptoms within single sectors cannot restore long term stability. They may temporarily manage consequences while leaving underlying stress dynamics intact. Resilience research consistently demonstrates that systems designed primarily for response rather than recovery experience compounding performance loss under repeated disturbance (Huang et al., 2025). Conversely, systems that invest in regenerative processes reduce the frequency and severity of future disruptions while lowering cumulative cost.

Policy therefore functions not only as a mechanism for service delivery but also as a mechanism for regulating system recovery. Performance measurement regimes determine whether institutions prioritize stabilization or throughput. Budget structures determine whether resources flow toward prevention or repeated response. Governance arrangements determine whether agencies operate independently or coordinate around shared stressors. These design features shape system behavior over time. In this sense, public policy operates as a form of systems architecture.

The efficiency gap described in this paper can therefore be understood as a policy relevant to systems condition. It reflects the mismatch between institutional design and the functional requirements of recovery-based stability. When recovery is under measured, underfunded, or administratively fragmented, systems compensate through increased throughput. Emergency response expands, chronic conditions accumulate, and fiscal pressure intensifies. These outcomes are often interpreted as external shocks or rising demand. Systems theory suggests they are predictable consequences of recovery constrained design.

Linking theory to policy requires shifting the analytical focus from sectoral performance to system stabilization. This shift does not require institutional consolidation or centralized control. Instead, it requires alignment of measurement, incentives, and investment around recovery capacity. Recovery based metrics make stabilization visible. Regenerative land management restores ecological buffering. Metabolic health support stabilizes human functional capacity. Cross sector coordination reduces cost shifting and feedback amplification. Upstream investment reduces repeated crisis expenditure. Each of these actions targets system properties rather than sector outputs.

This perspective reframes resilience as a governance function rather than a sector specific outcome. Systems that maintain recovery capacity preserve human participation, ecological function, and institutional performance simultaneously. Systems that suppress recovery accumulate instability that eventually manifests as crisis across domains. The policy challenge is therefore not simply managing risk but designing systems capable of restoring function after stress. In complex social ecological environments, recovery is not ancillary to performance. It is the primary determinant of long-term stability.

***Theoretical Contribution***

This paper advances a systems-based interpretation of resilience that reframes ecological degradation, chronic disease burden, and institutional strain as manifestations of a shared underlying condition: systemic efficiency failure. Rather than treating wildfire risk, metabolic dysfunction, and governance fragmentation as distinct sectoral problems, the framework identifies recovery capacity as the central determinant of long-term system stability across human, ecological, and institutional domains. This interpretation aligns with systems-based disease prevention research, resilience engineering, and planetary health scholarship emphasizing feedback regulation, recovery processes, and cross-system interdependence (Bennett et al., 2015; Huang et al., 2025; Yu & Chaturvedi, 2025).

The primary theoretical contribution is the articulation of the efficiency gap as a cross-system condition characterized by the inability to convert available resources into sustained, regenerative function over time. Drawing on systems science, resilience engineering, and planetary health scholarship, the paper integrates signal clarity, recovery capacity, and coordinated subsystem interaction into a unified model of public system performance. This model extends existing resilience theory by linking biophysical regulation, ecological regeneration, and institutional governance within a shared analytical structure (Bennett et al., 2015; Grossi & Argento, 2022; Huang et al., 2025; Yu & Chaturvedi, 2025).

A second contribution lies in reframing democratic participation as a function of system capacity rather than formal institutional access alone. By demonstrating how cumulative exposure to environmental, physiological, and institutional stress can erode functional ability to engage public systems, the paper connects resilience theory to democratic theory through the concept of capacity-dependent participation. Evidence linking environmental exposure, chronic disease burden, and labor force participation supports the interpretation of functional capacity as a structural condition shaping social and institutional engagement (Dennett et al., 2025; CDC, 2023; Yu & Chaturvedi, 2025).

Together, these contributions position recovery capacity as a foundational organizing principle for understanding long-term public system performance.

***Limitations of the Framework***

This study is conceptual and synthetic in nature and does not present original empirical testing of the efficiency gap model. The framework is developed through integration of existing research across multiple disciplines rather than through primary data collection or statistical analysis. As a result, causal pathways are theoretically inferred rather than empirically demonstrated within a single unified dataset, consistent with integrative approaches commonly used in systems and planetary health research (Bennett et al., 2015; Yu & Chaturvedi, 2025).

Second, the cross-sector scope of the framework necessarily abstracts from important institutional, geographic, and socioeconomic variation. Systems operate differently across jurisdictions, governance structures, and environmental conditions. Governance research demonstrates that institutional arrangements shape policy performance and accountability in ways that may not be captured by generalized models (Grossi & Argento, 2022).

Third, measurement of recovery capacity remains an emerging methodological challenge. While the paper proposes recovery-oriented indicators, standardized operational metrics for cross-sector system stabilization are not yet fully developed or widely adopted. Resilience engineering research emphasizes that quantifying recovery dynamics across complex systems remains an ongoing area of methodological development (Huang et al., 2025).

Finally, the framework emphasizes structural and systemic dynamics and does not fully examine political feasibility, institutional inertia, or distributional consequences associated with large-scale policy redesign. These governance constraints are widely recognized in public administration and resilience policy research and require further investigation (Grossi & Argento, 2022; FEMA, 2025).

***Implications for Public Administration Research***

The framework suggests several important implications for the study and practice of public administration.

First, it shifts analytical attention from service delivery outputs to system stabilization outcomes. Traditional performance regimes emphasize activity levels, program reach, and short-term results. A recovery-centered perspective emphasizes durability, regeneration, and reduced recurrence of crisis. Disaster recovery doctrine and resilience engineering research both emphasize stabilization following disturbance as the primary determinant of long-term system performance (FEMA, 2025; Huang et al., 2025).

Second, the framework highlights the need for cross-sector performance analysis. Administrative boundaries often obscure shared causal structure across environmental, health, and social systems. Planetary health scholarship demonstrates that ecological conditions, human health, and governance structures interact through reinforcing feedback loops that influence long-term system outcomes (Yu & Chaturvedi, 2025).

Third, the model expands the concept of administrative capacity. Capacity is typically defined in terms of institutional resources, staffing, and technical competence. This paper suggests that human physiological stability, environmental buffering, and recovery time function as foundational conditions enabling administrative participation and compliance. Population health surveillance and labor market research demonstrate that chronic disease burden and long-term health disruption directly affect functional capacity and workforce participation (CDC, 2023; Dennett et al., 2025; Hu et al., 2025).

Fourth, the framework positions public policy as systems architecture. Governance decisions shape feedback loops, recovery timing, and stress exposure patterns. Administrative design therefore becomes a primary mechanism through which long-term resilience is produced or constrained. Governance scholarship and resilience research both emphasize institutional design as a determinant of system performance and stability (Grossi & Argento, 2022; Huang et al., 2025).

These implications suggest that resilience, recovery, and efficiency should be treated as core analytical categories within public administration scholarship rather than peripheral concerns.

### *Future Research Directions*

Several lines of inquiry emerge from this framework.

Empirical research is needed to operationalize and measure recovery capacity across sectors, including development of standardized indicators that capture stabilization following stress exposure. Quantitative resilience research demonstrates the importance of recovery timing and system repair dynamics but highlights the need for improved cross-sector measurement approaches (Huang et al., 2025).

Longitudinal studies could examine relationships between recovery time, repeated system disruption, and cumulative public expenditure. Health expenditure analyses and disaster recovery research indicate that delayed stabilization is associated with sustained cost growth across systems (Hartman et al., 2026; FEMA, 2025).

Comparative institutional analysis could evaluate how different governance arrangements influence cross-sector coordination and recovery performance. Public governance research shows that institutional design shapes accountability, coordination, and long-term policy effectiveness (Grossi & Argento, 2022).

Modeling research could explore feedback dynamics linking environmental exposure, health burden, labor participation, and fiscal performance. Planetary health scholarship emphasizes the importance of modeling interconnected ecological and human systems to understand cascading risk (Yu & Chaturvedi, 2025).

Implementation research is also needed to examine how recovery-based performance metrics can be integrated into existing budgeting, reporting, and evaluation systems without major structural reorganization (FEMA, 2025).

Finally, normative and democratic theory research should examine the relationship between functional capacity, institutional accessibility, and meaningful participation under conditions of cumulative system stress, particularly where environmental and health burdens constrain social and economic engagement (Dennett et al., 2025; CDC, 2023).

### *Policy Translation Summary*

The central policy implication of this research is that long-term public stability depends less on resource volume than on recovery capacity. Systems that cannot restore function after stress generate recurring crises that increase fiscal burden, reduce human capacity, and degrade ecological resilience simultaneously. Empirical research across health expenditure, disaster recovery, and resilience engineering demonstrates that delayed stabilization is associated with sustained cost growth and performance decline across sectors (Hartman et al., 2026; FEMA, 2025; Huang et al., 2025).

Policy design that prioritizes stabilization, regeneration, and cross-sector coordination can reduce repeated emergency expenditure while preserving functional participation across society. Regenerative land management, metabolic health stabilization, and integrated resilience investment reflect approaches supported by land management research, public health surveillance, and planetary health scholarship (CAL FIRE, 2023; CDC, 2023; Yu & Chaturvedi, 2025).

In practical terms, resilience policy is not primarily about responding more effectively to disruption. It is about designing systems that require fewer emergency responses because recovery processes are structurally supported. When recovery capacity is strengthened, environmental stability, human health, and institutional performance improve together. When recovery capacity is suppressed, instability accumulates across domains regardless of sector-specific intervention (Bennett et al., 2015; Huang et al., 2025; Yu & Chaturvedi, 2025).

## Section 8: Conclusion—Efficiency, Democratic Function, and Human Capacity

The efficiency problem examined in this paper is systemic rather than sector specific. Health, environmental conditions, housing stability, labor participation, and institutional performance operate as interdependent systems that shape one another over time. When these systems underperform simultaneously, the outcome is not simply service gaps but cumulative erosion of human and ecological capacity. This interpretation is consistent with resilience science and planetary health scholarship, which increasingly identify wildfire risk, chronic disease burden, and governance fragmentation as interconnected manifestations of systemic inefficiency rather than independent sectoral failures (Bennett et al., 2015; Grossi & Argento, 2022; Yu & Chaturvedi, 2025). Public administration has long described such conditions as wicked problems characterized by cross jurisdictional effects, diffuse responsibility, and unintended consequences. However, the central issue is not complex alone. It is the sustained interaction between chronic stress and insufficient recovery capacity across multiple domains of life.

Democratic governance is premised on meaningful access to institutions. Individuals must be able to seek assistance, exercise choice, and navigate public systems in order for democratic participation to function as intended. This assumption depends on material and physiological capacity, including physical stability, cognitive bandwidth, time availability, and institutional navigability. When these enabling conditions deteriorate, formal access persists while practical access declines. This distinction has direct implications for democratic theory. Choice without functional capacity cannot produce meaningful participation. Systems that require sustained individual navigation while simultaneously eroding the resources necessary for navigation undermine their own accessibility. Environmental exposure, health burden, housing instability, and institutional fragmentation operate cumulatively across the life course, shaping stress load, recovery time, and long-term functional capacity (Centers for Disease Control and Prevention, 2023; World Health Organization, 2022; Yu & Chaturvedi, 2025). Each system operates within its administrative mandate, yet their combined effects generate systemic strain that no single sector is designed to resolve.

From a policy perspective, this pattern reflects structural inefficiency rather than isolated institutional failure. Multiple systems expend increasing resources while failing to produce durable stabilization. Individuals encounter repeated interventions without sustained recovery, while public expenditures rise alongside declining functional capacity. Systems engineering and resilience research consistently demonstrate that long term performance depends more on recovery time and stabilization capacity than on throughput volume or activity level (Bennett et al., 2015; Huang et al., 2025). When recovery is not built into system design, emergency response becomes routine rather than exceptional, and compensatory activity substitutes for restoration. The result is what may be described as a democratic capacity paradox. Democratic institutions assume autonomous individuals capable of navigating public systems, yet systemic inefficiency progressively reduces the capacity required for such engagement. Participation remains formally available but functionally constrained.

This is not a failure of democratic ideals but a systems design problem. Contemporary policy discourse frequently frames national challenges as resource shortages, yet evidence across resilience engineering, public governance, and disaster management suggests a deeper issue of conversion efficiency. Systems that cannot translate investment into sustained stability consume increasing inputs while producing diminishing long-term function (Federal Emergency Management Agency, 2025; Organisation for Economic Cooperation and Development, 2021; Huang et al., 2025). The Wildfire Resilient Landscapes framework contributes to this discussion by reframing resilience as a function of recovery capacity and coordinated system performance. Environmental buffering, metabolic stability, housing security, preventive care, and recovery oriented public metrics are not peripheral benefits but structural conditions that enable sustained social and economic participation. Systems designed for recovery maintain function under stress, reduce cumulative expenditure, and preserve human and ecological viability over time. Systems that recover do not accumulate instability at the same rate as systems organized around continuous compensation. From a governance perspective, this distinction is foundational.

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