Not Everyone Recovers from Disaster in the Same Way: Wildfire Risk, Insurance Premiums, and Income-Stratified Migration in California

Marine Kang

Background

- Natural disasters in the U.S. have increased substantially over time (Boustan et al., 2020)

- Wildfires are becoming more frequent and intense, especially in California (Keeley & Syphard, 2021; Williams et al., 2019)

- Driven by:
- Climate change (Brown et al., 2023; Williams et al., 2019)
- Population growth & expansion into wildfire-prone areas (Keeley & Syphard, 2021)

- Wildfires affect communities through:
- Direct physical damage
- Changes in local economic conditions & risk expectations (Bayham et al., 2022)

Research Question

(1) How does wildfire exposure affect
migration flows?

(2) How do these patterns reflect deeper transformations in lived experience under
environmental risk?

Humanities Cases

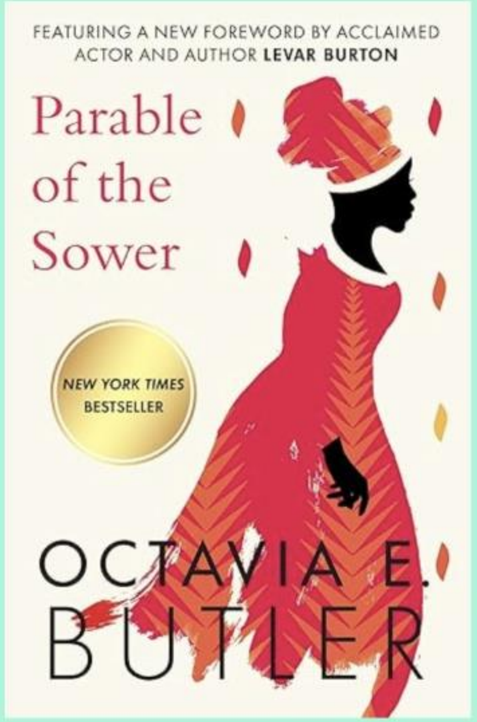
Environmental Imagination (Buell, 1995)
→ Perceptions of nature are shaped by cultural narratives
→ “Nature as fair” is a constructed belief

Deconstruction (Derrida)
→ Concepts like fairness and nature are linguistically unstable
→ Meanings are shaped through language, not fixed reality

Slow Violence (Nixon, 2011)
→ Environmental harm unfolds gradually over time
→ Inequality becomes visible in the aftermath, not the event

Cultural Trauma (Alexander, 2004; Smelser, 2004)
→ Disasters reshape collective identity
→ Same event → different experiences across groups

Environmental Justice (Banzhaf & McCormick, 2007)
→ Unequal outcomes driven by institutions & policy
→ Vulnerable populations bear disproportionate burdens



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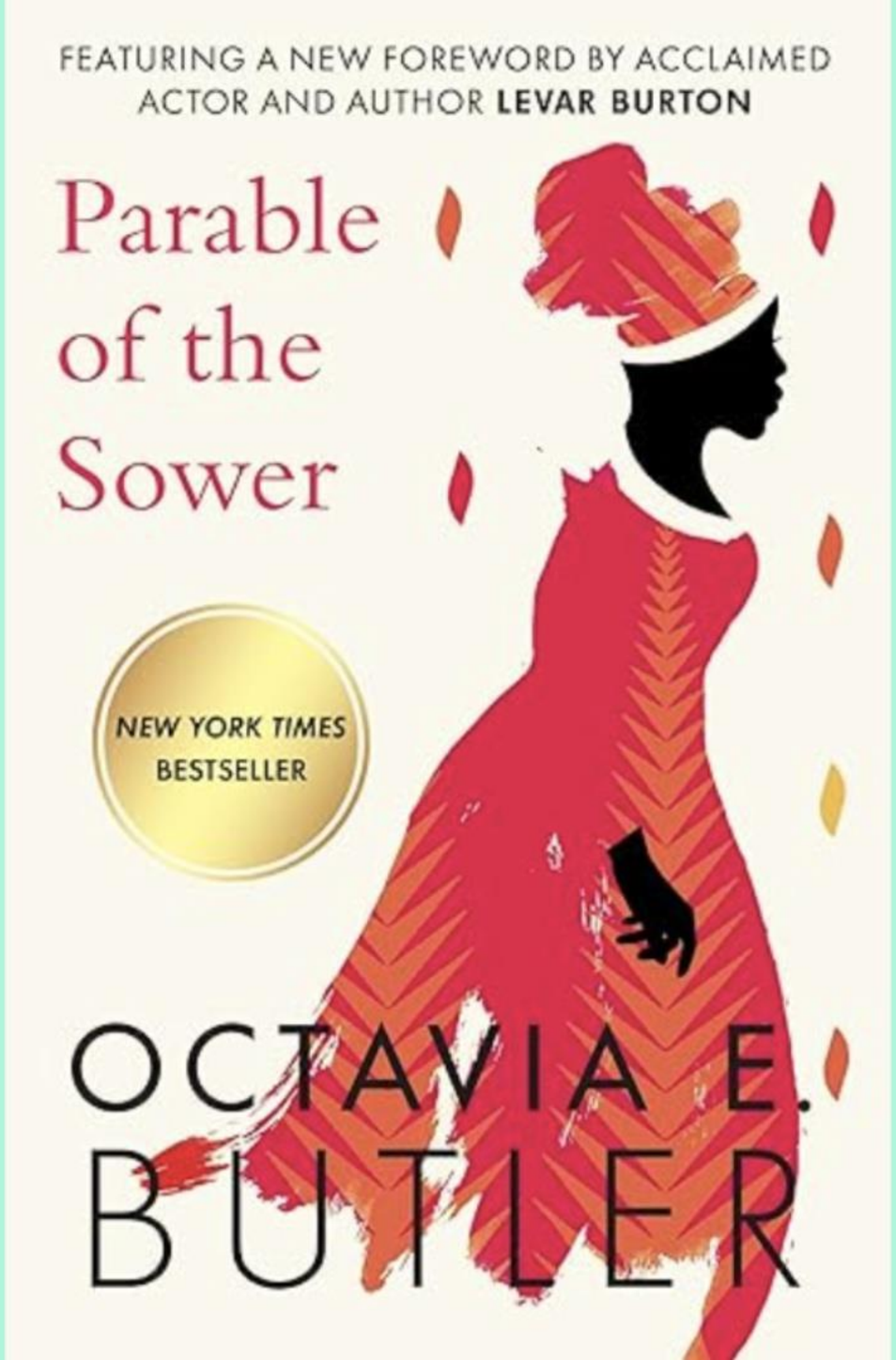
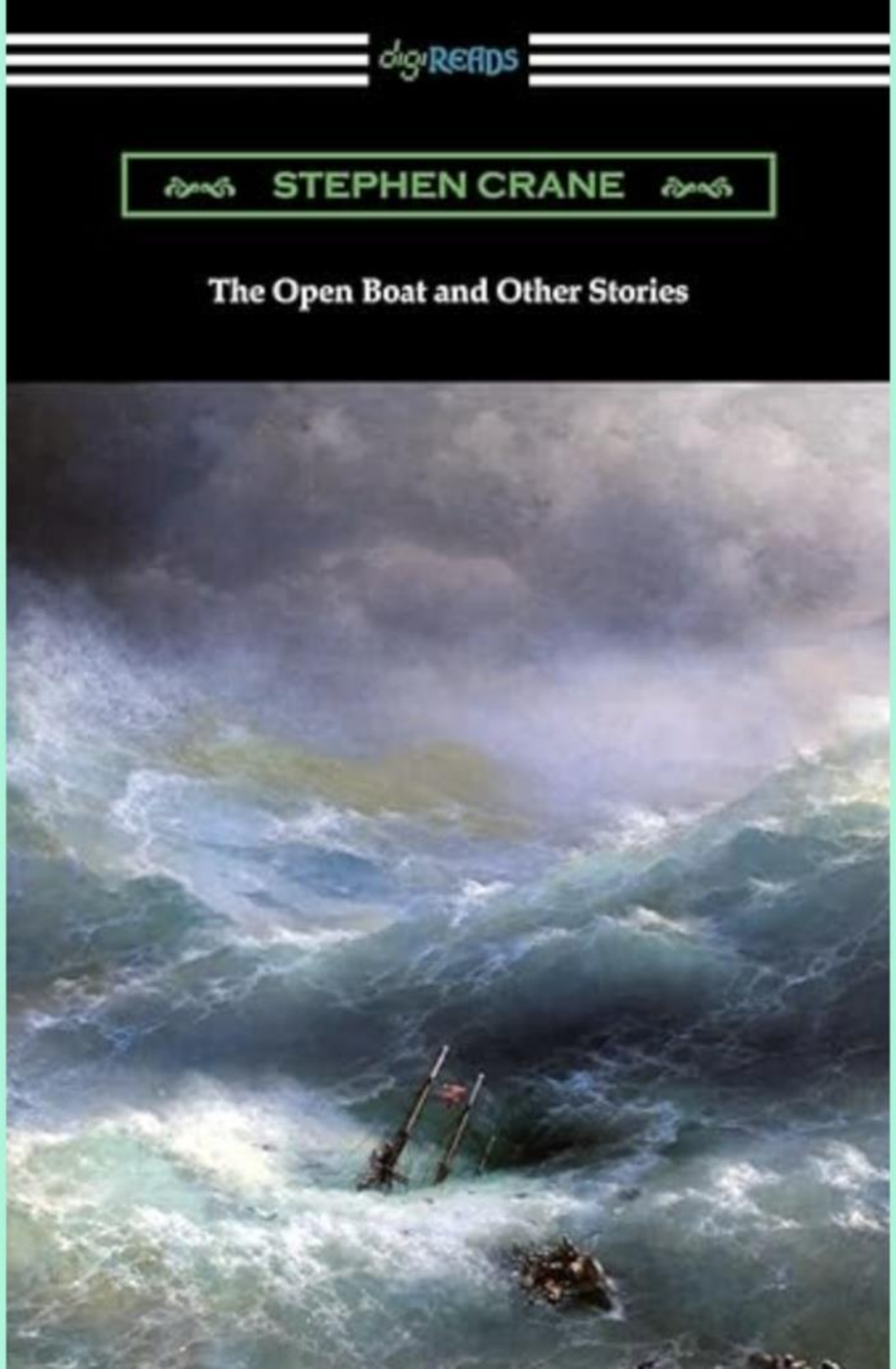



OCTAVIA E.
BUTLER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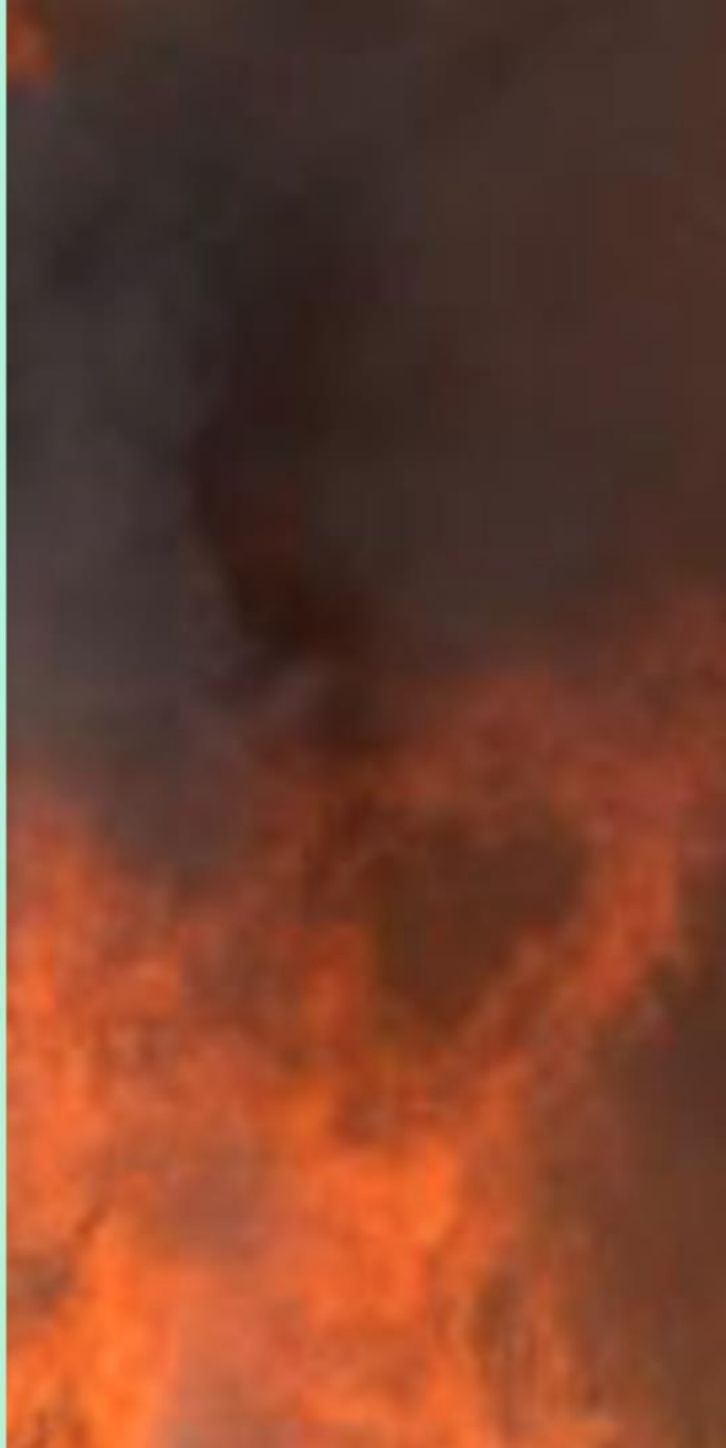
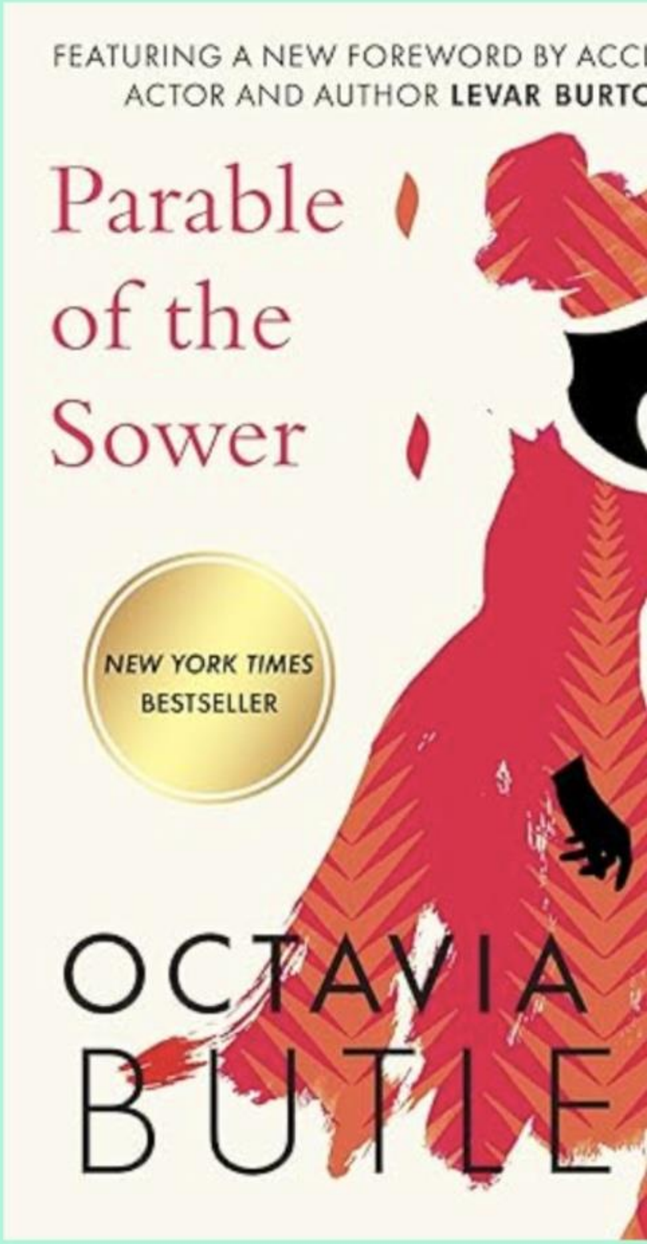
STEPHEN CRANE
The Open Boat and Other Stories

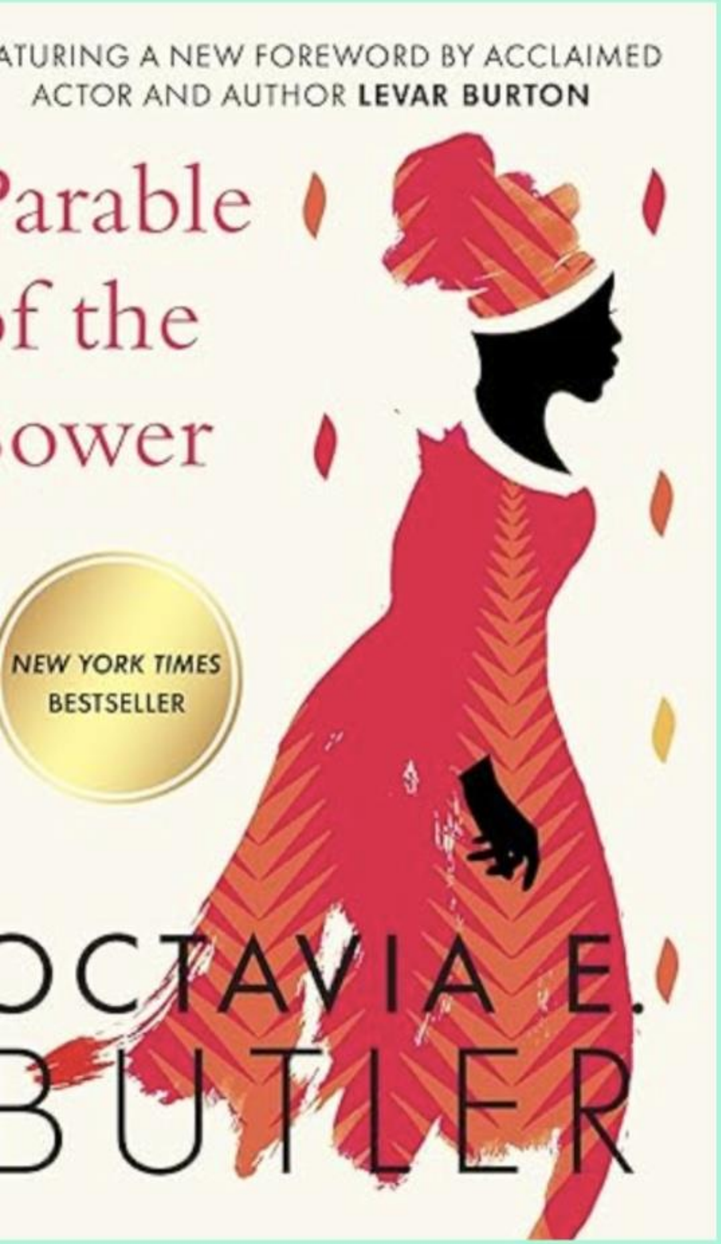


The Open Boat (Stephen Crane)

Nature is indifferent, not fair
Individuals face the same disaster but experience it differently
Highlights gap between expectation (fairness) and reality (random survival)

→ Challenges the idea that nature produces equal outcomes

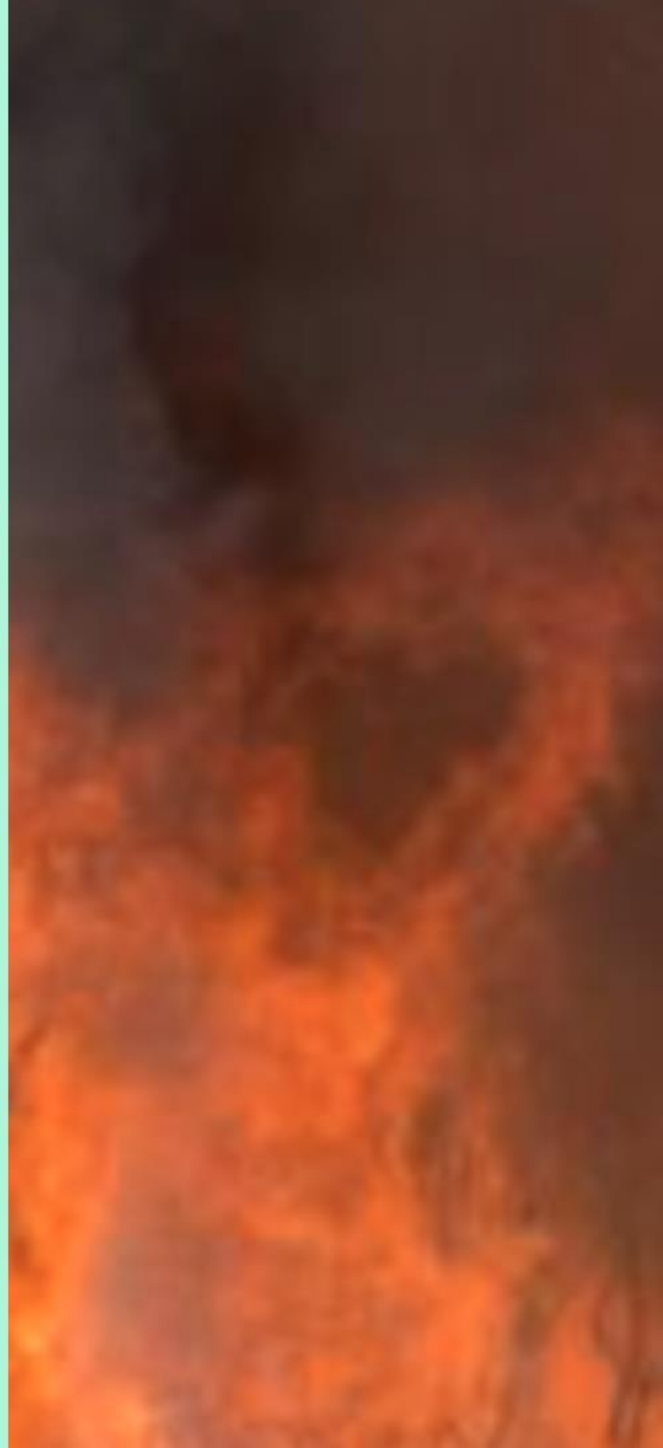


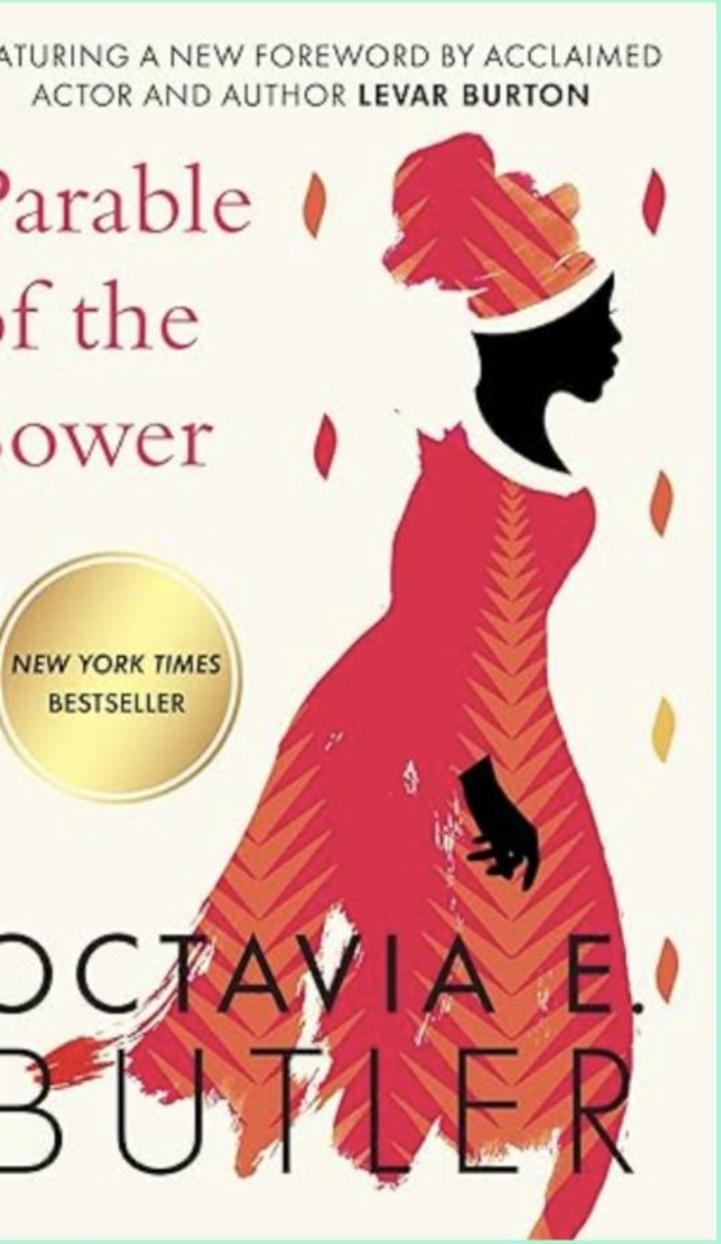


Parable of the Sower (Octavia Butler)

Environmental crisis as an ongoing condition, not a one-time event
Survival depends on resources, mobility, and social position
Different characters → different capacities to respond and recover

→ Inequality persists and deepens over time





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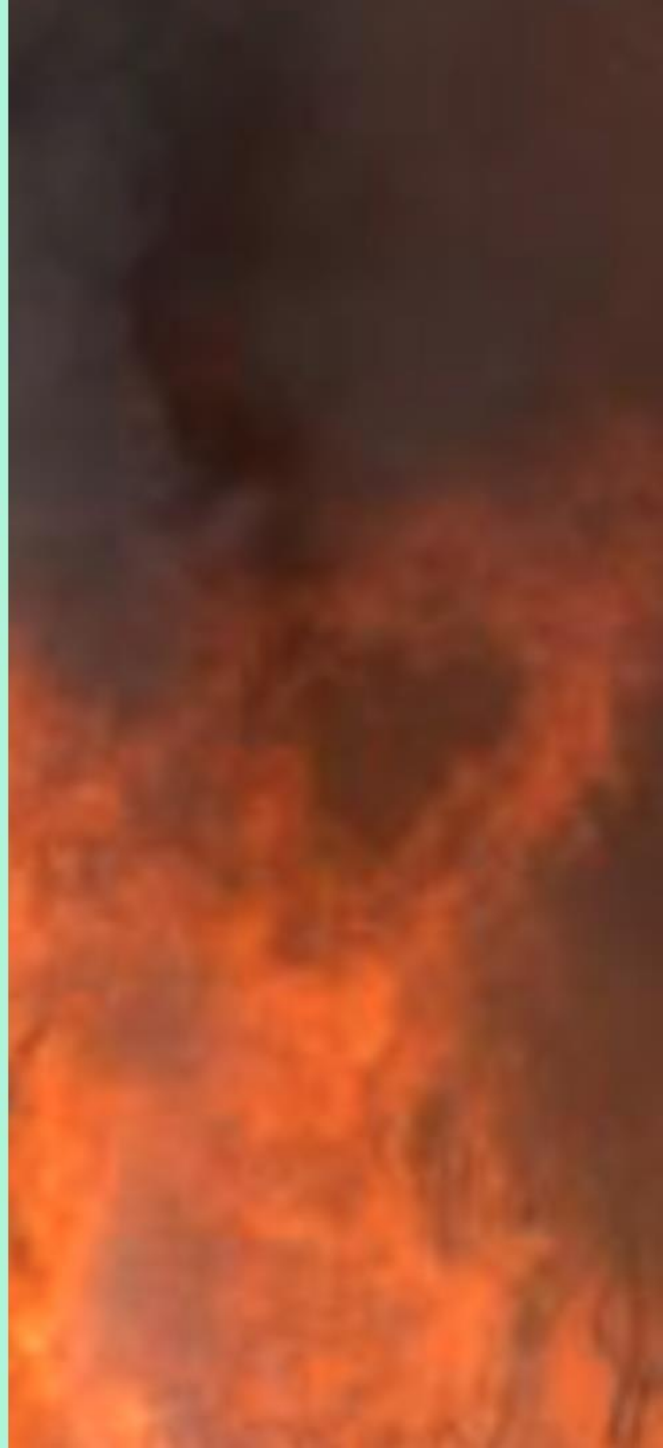

Literature

→ **Out-migration ↑**
(Boustan et al., 2020; Ton et al., 2025)

Net migration flows ↓
(Winkler & Rouleau, 2021)

Conditional / Mixed Effects n-migration ↑
(Gruber, 2022)

Short-run out-migration only
(McConnell et al., 2024)

Who lives in risky areas?
low-income: affordability
high-income: amenities
(Laszewski, 2024; Wibbemeyer & Robertson, 2022)

Inequality
Repeated exposure burden
(Hino & Field, 2023)

Literature

Insurance

→ **Financial constraints ↑**
(Boomhower et al., 2024; Keys & Mulder, 2025)

Theory Only
Indirect Mechanism

Theory

- Standard Framework (Kennan & Walker, 2011)

$$Move_{it} = \begin{cases} 1 \; if \; \mathrm{V}_{ikt}^{move} > \mathrm{V}_{izt}^{stay} \\ 0 \; \; if \mathrm{V}_{ikt}^{move} \leq \mathrm{V}_{izt}^{stay} \end{cases}$$

- Budget Constraint

$$Y_i \geq C^{min} + H + I + R$$

- High-income households:

$$Y_H \geq C^{min} + H + I + R$$

→ Can remain (feasible)

- Low-income households:

$$Y_L < C^{min} + H + I + R$$

→ Constraint binds

DATA

Category	Description
Unit	ZIP × quarter panel (CA)
Period	2017q2 – 2023q1
Migration	USPS COA (net, in, out; per capita)
Wildfire	CAL FIRE (acres burned; p90 threshold)
Income	Census median income
Housing	Redfin housing prices

- Key advantage: High-frequency, ZIP-level variation

Regression Models (1)

- Baseline Two-Way Fixed Effects

$$Y_{it} = \beta WF_{it} + \alpha_i + \delta_t + \varepsilon_{it}$$

- Y_{it} :ZIP-level migration rate (net / in / out)
- WF_{it} :Wildfire exposure
- α_i, δ_t :ZIP and time fixed effects

Regression Models (2)

- Threshold Event Study (P90)

$$Y_{it} = \sum_{k=-4}^{8} \beta_k \cdot \text{Event}_{i,t+k} + \alpha_i + \delta_t + \varepsilon_{it}$$

- Distributed Lag Model and Interaction

$$Y_{it} = \sum_{k=0}^{8} \beta_k \ln(\text{WF}_{(i,t-k)}) + \sum_{k=0}^{8} \gamma_k [\ln(\text{WF}_{(i,t-k)}) \cdot \text{High}_i] + \alpha_i + \delta_t + \varepsilon_{it}$$

Main Results (1-1)
Distributed Lag (Baseline)

	(1) Net total	(2) Net permanent	(3) In permanent	(4) Out permanent
Log intensity (t)	0.000040*	0.000013	-0.000037**	-0.000046**
	(0.000021)	(0.000019)	(0.000016)	(0.000020)
Lag 1	0.000006	0.000018	-0.000022	-0.000038*
	(0.000024)	(0.000018)	(0.000016)	(0.000020)
Lag 2	0.000008	0.000010	-0.000018	-0.000024
	(0.000021)	(0.000018)	(0.000019)	(0.000019)
Lag 3	0.000015	0.000024	-0.000024	-0.000045**
	(0.000022)	(0.000018)	(0.000015)	(0.000019)
Lag 4	0.000007	-0.000011	-0.000017	-0.000012
	(0.000023)	(0.000018)	(0.000016)	(0.000018)

Main Results (2)
Distributed Lag Effects (High-Income Interaction)

	(1) Net total	(2) Net permanent	(3) In permanent	(4) Out permanent
Log intensity	-0.000010	-0.000046*	-0.000109***	-0.000070**
	(0.000030)	(0.000027)	(0.000021)	(0.000030)
Log intensity × highincome	0.000097**	0.000115***	0.000144***	0.000050
	(0.000039)	(0.000034)	(0.000027)	(0.000032)
Lag 1	-0.000027	0.000007	-0.000068***	-0.000073**
	(0.000038)	(0.000027)	(0.000023)	(0.000031)
Lag 1 × highincome	0.000059	0.000017	0.000089***	0.000071**
	(0.000041)	(0.000031)	(0.000028)	(0.000035)
Lag 2	-0.000045	-0.000038	-0.000024	0.000009
	(0.000031)	(0.000026)	(0.000026)	(0.000030)
Lag 2 × highincome	0.000104***	0.000093***	0.000000	-0.000078**
	(0.000039)	(0.000034)	(0.000033)	(0.000036)
Lag 3	-0.000001	0.000021	-0.000084***	-0.000104***
	(0.000034)	(0.000029)	(0.000022)	(0.000033)
Lag 3 × highincome	0.000019	-0.000002	0.000097***	0.000105***
	(0.000040)	(0.000033)	(0.000028)	(0.000037)

Discussion

- Wildfire exposure does not lead to mass out-migration

→ Instead, it creates a “mobility freeze”

- Migration is a constrained decision:
- Economic: budget constraints, insurance burden
- Humanities: constrained agency under environmental risk

- Tension between:
- Migration pressure (higher cost of staying)
- Migration feasibility (limited ability to move)

- Insurance market as a plausible mechanism:
- Rising premiums, reduced coverage, insurer exit

→ Limits both recovery

- Unequal impacts across groups:
- Low-income → financially constrained, “trapped”
- High-income → greater flexibility and adaptation

→ Environmental risk produces uneven mobility outcomes

- not everyone can respond in the same way, but inequality persists

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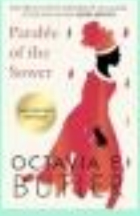
Humanities Framework

Literature

Standard Migration → Wildfire Evidence → Inequality

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Theory Only Indirect Mechanism

Theory

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Regression Models (2)

Main Results (1-1) Distributed Lag (Baseline)

Main Results (2) Distributed Lag Effects (High-Income Interaction)

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