



Public and Private Wildfire Risk Management: Spatial and Strategic Interaction

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Background

- Increase in the frequency and severity of wildfire in the western US

| Year | Suppression Cost (billions) | Acres Burned | Homes burned |
|------|--------------------------------|--------------|--------------|
| 2002 | \$1.66 | 6,937,584 | 4,184 |
| 2003 | \$1.32 | 4,918,088 | 4,508 |
| 2004 | \$.89 | 6,790,692 | 315 |
| 2005 | \$.87 | 8,686,153 | 402 |
| 2006 | ---- | 9,873,745 | 750 |

Source: National Interagency Coordination Center at the National Interagency Fire Center

- Increase in the number of individuals living in the wildland urban interface (WUI)

Fuel Treatments

- Spatial externalities
- Free riding
- Strategic behavior

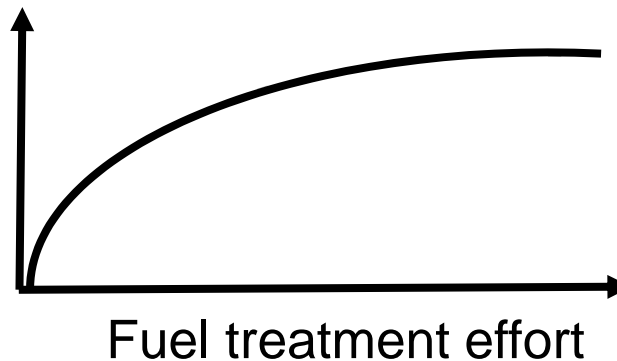
Game Theory and Strategic Behavior

Game consists of:

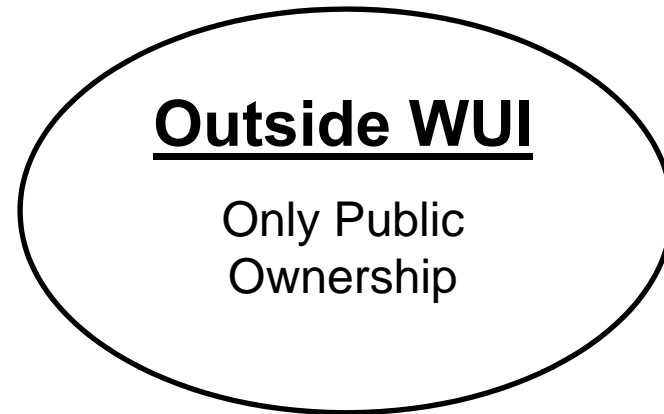
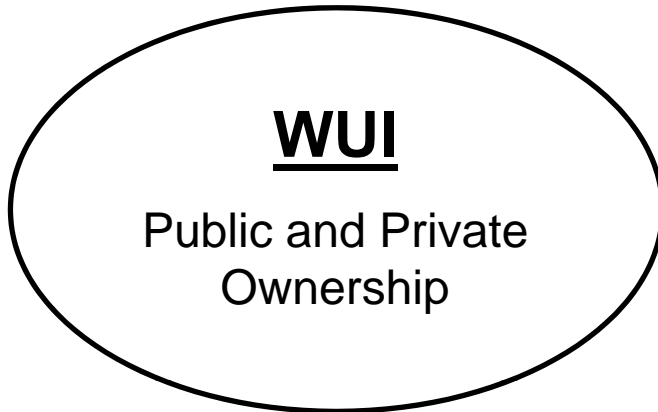
1. Players
2. Strategies
3. Payoffs



Probability
Values
Survive Fire



The Landscape



| | Public | Private |
|----------------|-----------|---------------|
| Choice | $e_{g,w}$ | e_p |
| Amenity Value | $A_{g,w}$ | A_p |
| Property Value | ϕv | $(1 - \phi)v$ |

| | Public | Private |
|----------------|-----------|---------|
| Choice | $e_{g,o}$ | --- |
| Amenity Value | $A_{g,o}$ | --- |
| Property Value | --- | --- |

Public's Problem

$$\max_{e_{g,w}, e_{g,o}} \{(A_{g,w} + \phi v) \pi(e_{g,w} + e_p) + A_{g,o} \pi(e_{g,o})\}$$

s.t.

$$c(e_{g,w} + e_{g,o}) = B$$

Private's Problem

$$\max_{e_p} \{(A_p + (1 - \phi)v) \pi(e_{g,w} + e_p) - e_p c\}$$

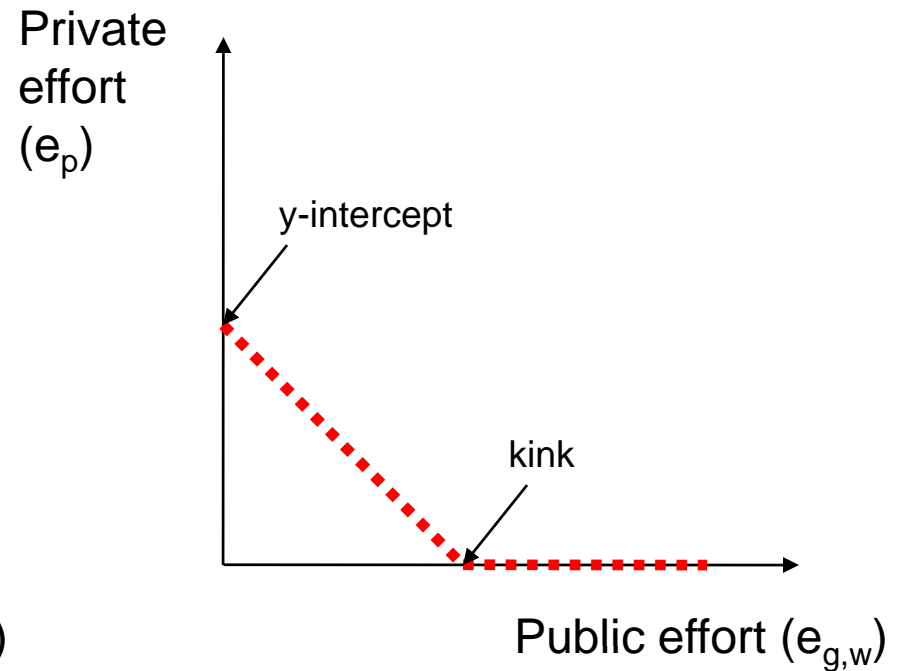
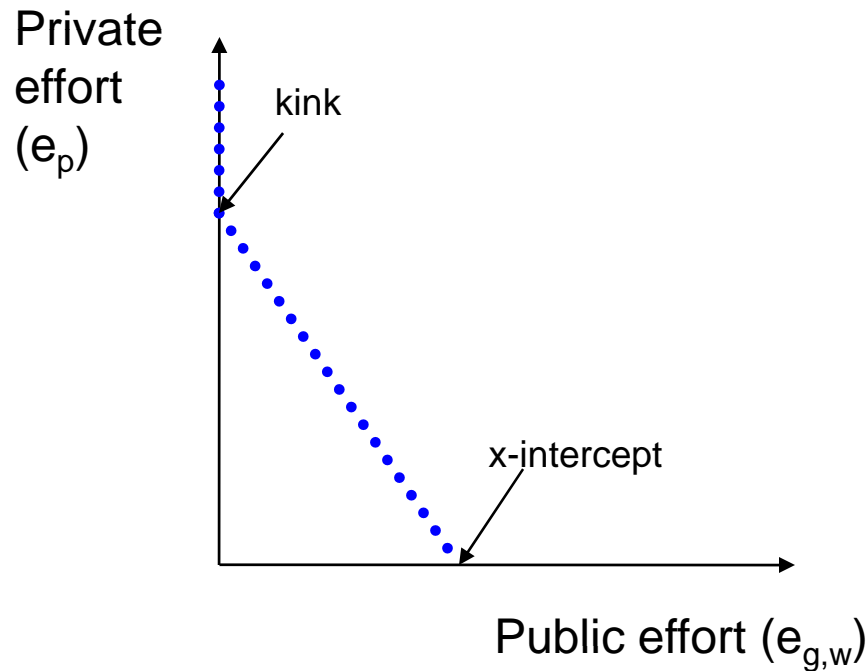
Social Planner's Problem

$$\max_{e_{g,w}, e_{g,o}, e_p} \{A_{g,o} \pi(e_{g,o}) + (A_{g,w} + v + A_p) \pi(e_{g,w} + e_p) - c(e_{g,w} + e_{g,o} + e_p)\}$$

How does each player respond to what the other is doing?

..... Public's Response Function

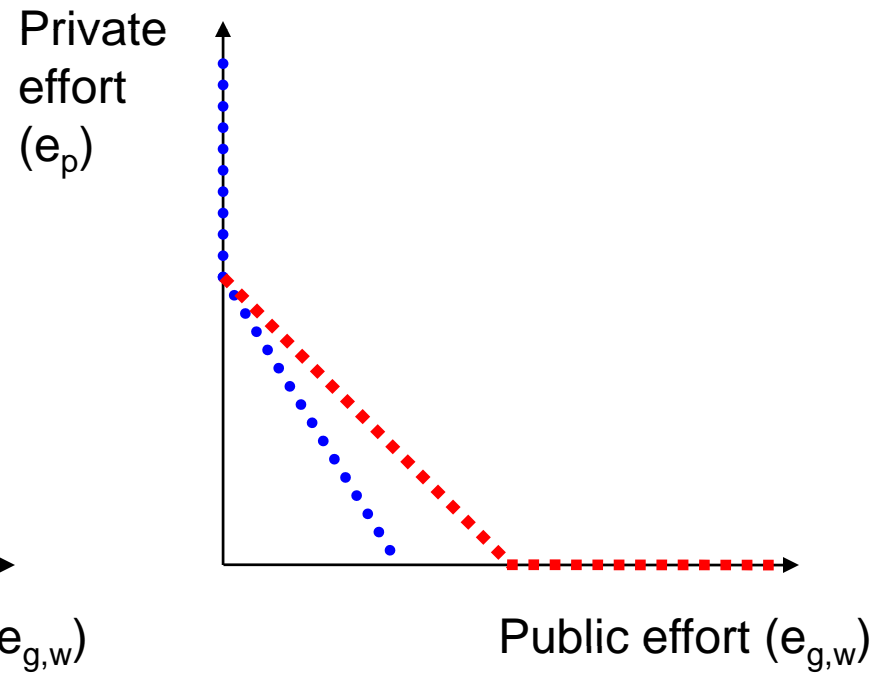
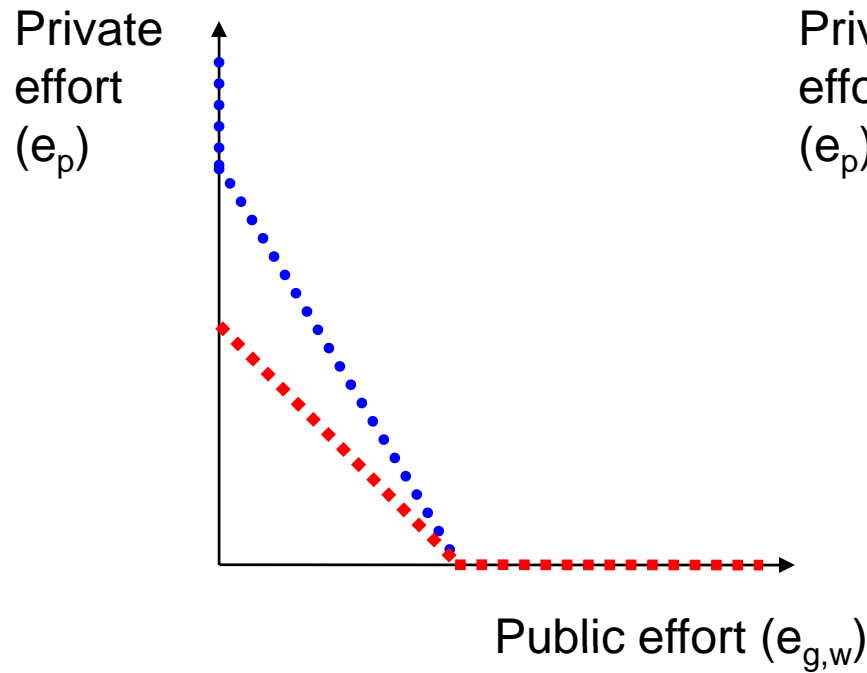
..... Private's Response Function



Extreme Free Riding Equilibria

..... Public's Response Function

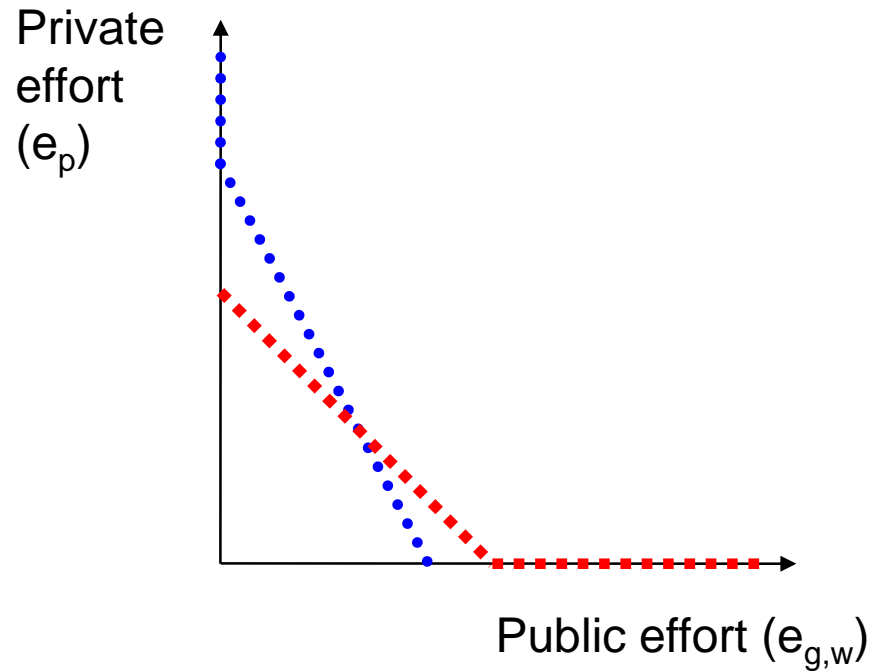
..... Private's Response Function

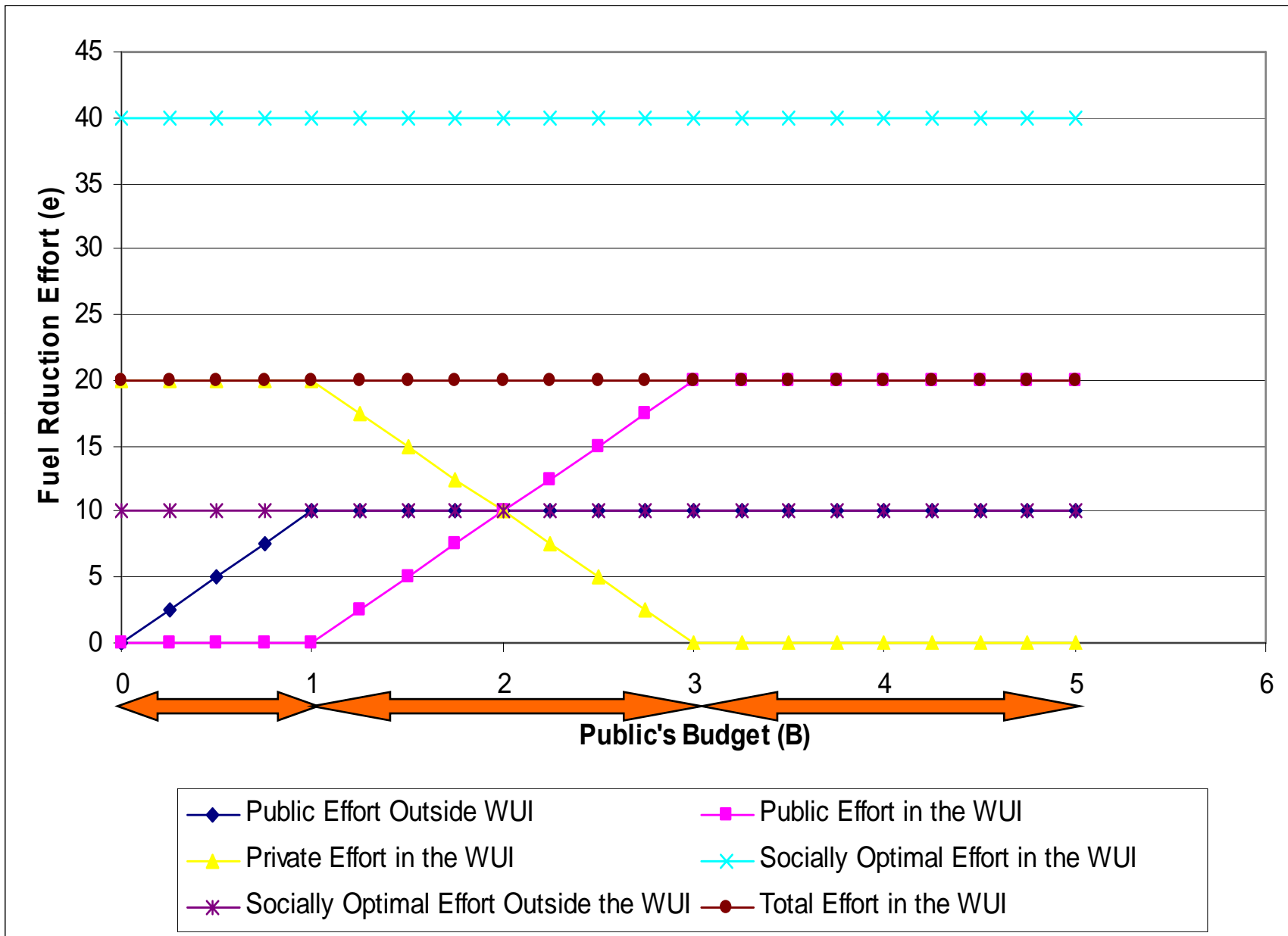


Shared Effort Equilibrium

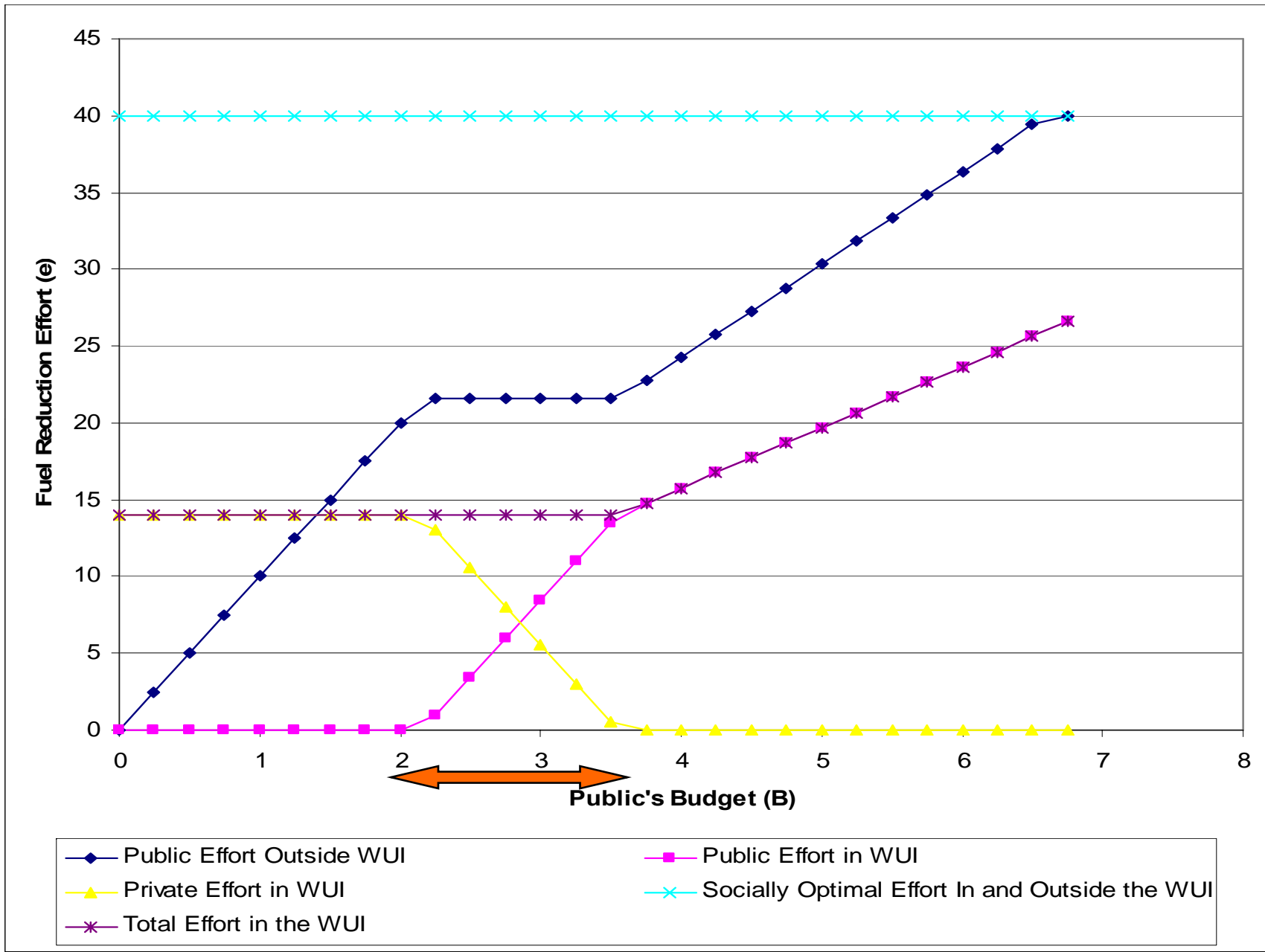
..... Public's Response Function

..... Private's Response Function

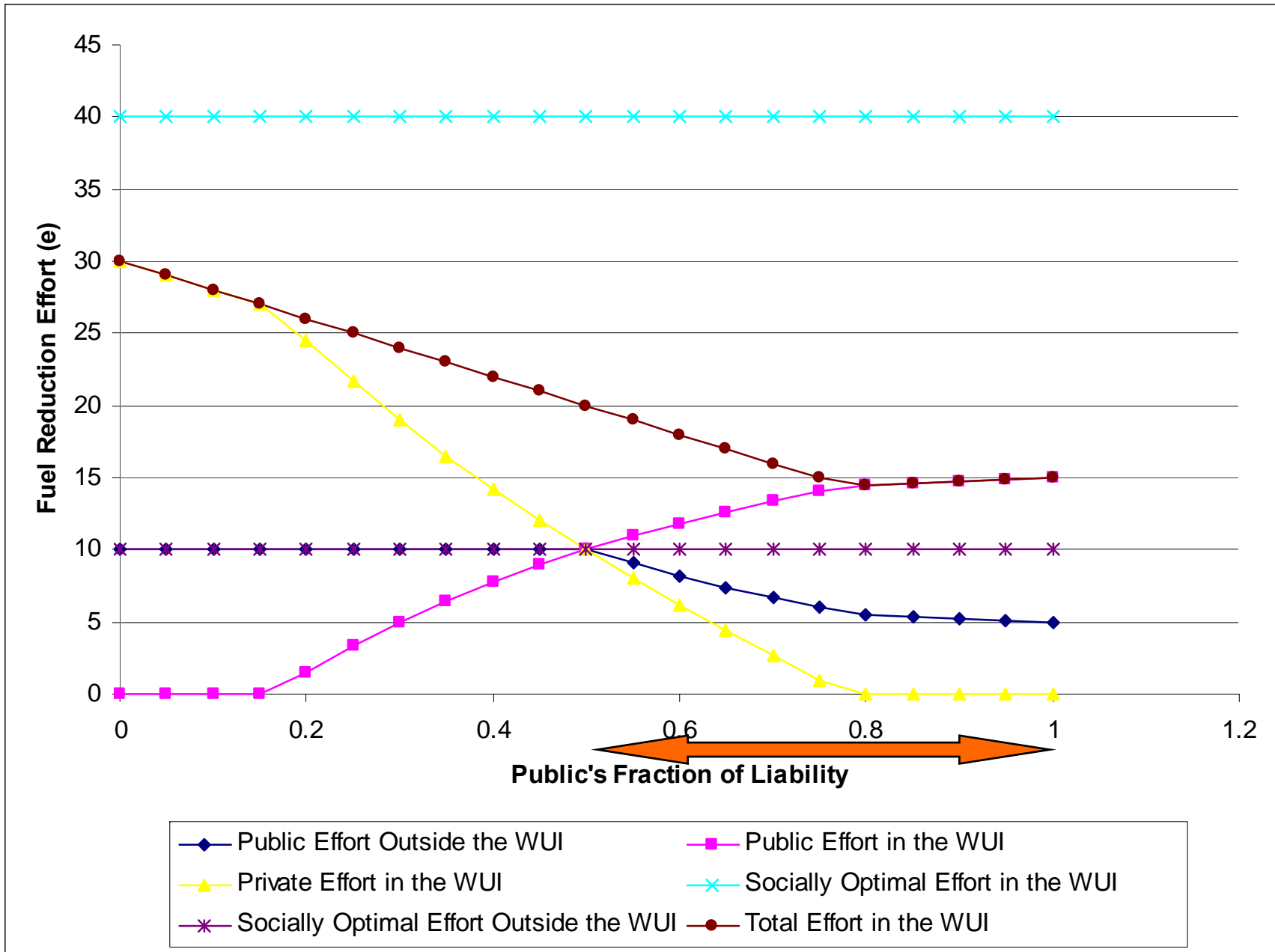




Equilibrium effort levels for: $A_{g,o}=1$; $A_{g,w}=1$; $A_p=1$; $\phi=0.5$; $v=2$; $c=0.1$.



Equilibrium effort levels for: $A_{g,o}=4$; $A_{g,w}=1$; $A_p=1$; $\varphi=0.8$; $v=2$; $c=0.1$.



Equilibrium effort levels for: $A_{g,o}=1$; $A_{g,w}=1$; $A_p=1$; $B=2$; $v=2$; $c=0.1$.

Policy Implications

- WUI requirements should be removed from the Healthy Forest Restoration Act
- Reduce public liability
- Increase the valuation of undervalued (or un-priced) amenities outside the WUI
- Increasing public's budget will not necessarily lead to increases in fuel reduction effort outside the WUI nor increases in total effort in the WUI

Main Points

- Increasing public spending on fuel treatments in the WUI decreases private land owners' incentives for fuel treatments.
- Given public budget constraints the more funds that are spent in the WUI, the less money that is available outside the WUI.

Objectives of Future Research

1. Spatially explicit landscape with public and private ownership.
2. Government regulation, liability rules, and private insurance
3. Best policies for typical ownership patterns