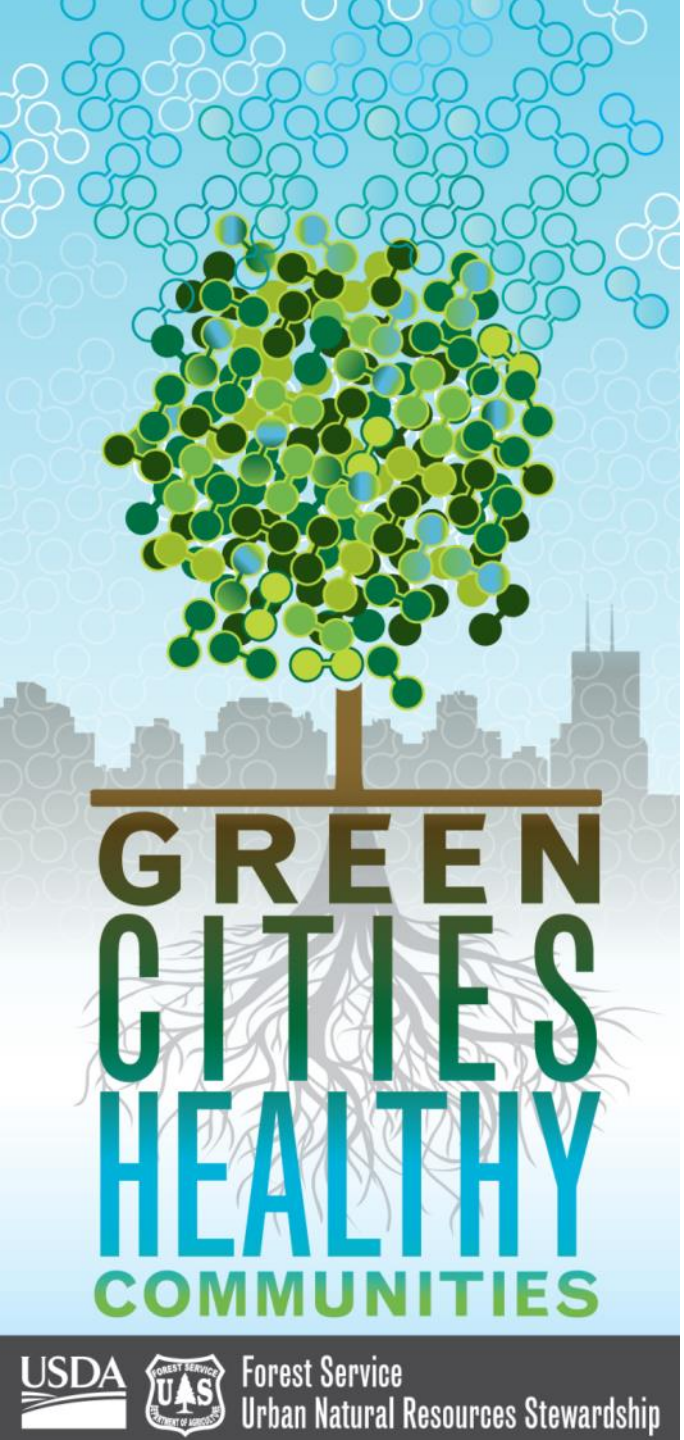

USDA Forest Service

URBAN FOREST CONNECTIONS

webinar series

Second Wednesdays | 1:00 – 2:15 pm ET

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Monitoring Urban Trees: Survival, growth, and energy-saving performance

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Monitoring urban trees: Survival, growth, and energy-saving performance

US Forest Service Urban Forest Connections Webinar

March 9, 2016

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US Forest Service

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UT Arlington

Pete Smith
Arbor Day Foundation

Outline

- Introduction
  - Why study tree mortality?
  - Why study yard trees?
- Part I: Sacramento Shade 5-year study
- Part II: Sacramento Shade 22-year study
- Part III: Energy-Saving Trees program

PLANT ONE MILLION

3 states. 13 counties. 1 tree at a time.

million treesLA

let's get growing!

milliontreesNYC

A PLANYC INITIATIVE WITH NYC PARKS AND THE NEW YORK RESTORATION PROJECT

visit **milliontreesnyc.org** or call **311**.

THE MILE HIGH MILLION

AN INITIATIVE OF GREENPRINT DENVER

SACRAMENTO TREE FOUNDATION

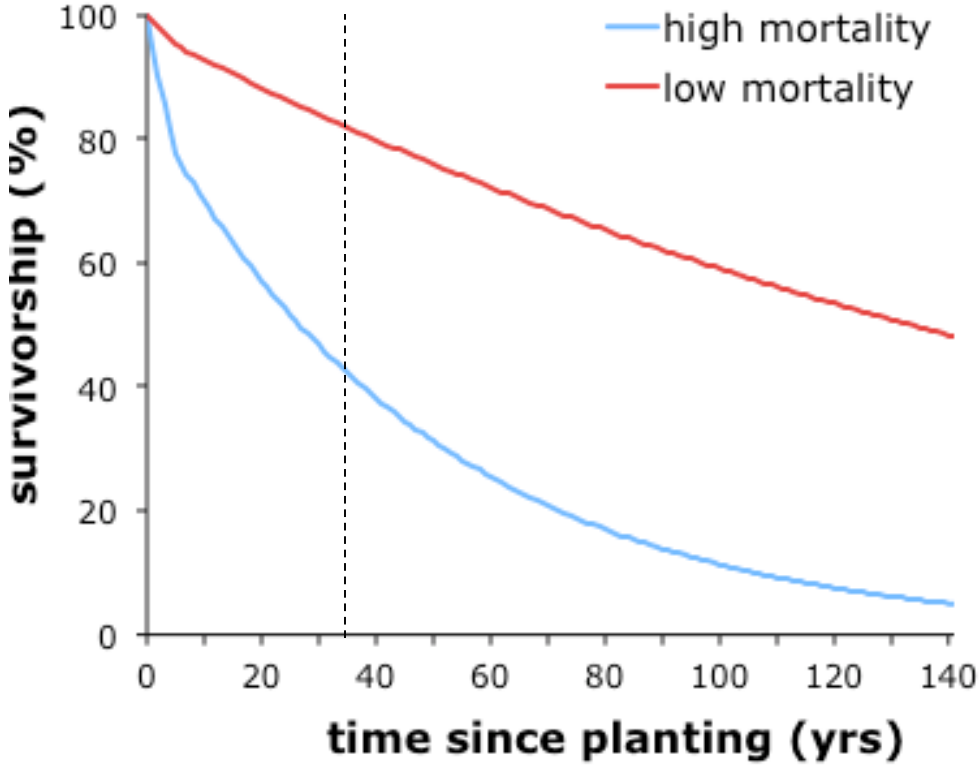
5 Million Trees for Our Future

Help us plant 5 million trees in the greater Sacramento region by 2025!

This tree gives back
$1,781
worth of environmental benefits
over the next 15 years.
The Morton Arboretum
RMB
TREES
EVERY TREE COUNTS

Mortality rate assumptions

- Million Trees LA cost-benefit analysis
  - *High morality scenario*: 5% years 1-5, 2% years 6+
  - *Low mortality scenario*: 1% years 1-5, 0.5% years 6+



<u>After 35 years</u>:

High mortality:

58% dead

Low mortality:

18% dead

McPherson et al. (2008)
McPherson (2014)

Why study tree mortality?

- Mortality assumptions affect cost-benefit calculations
- Plan ahead for tree removal and replacement
- Target program improvements for at-risk trees

Roman (2014)
Roman et al. (in press)

Why study yard trees?

- Yards and lawns are the primary point of contact between urban residents and nature
- Yard tree distribution programs operate quite differently from street tree planting programs
  - Private land (not public right-of-way)
  - Rely on residents for tree care
- Yard tree planting is essential to meet canopy cover and planting campaign goals

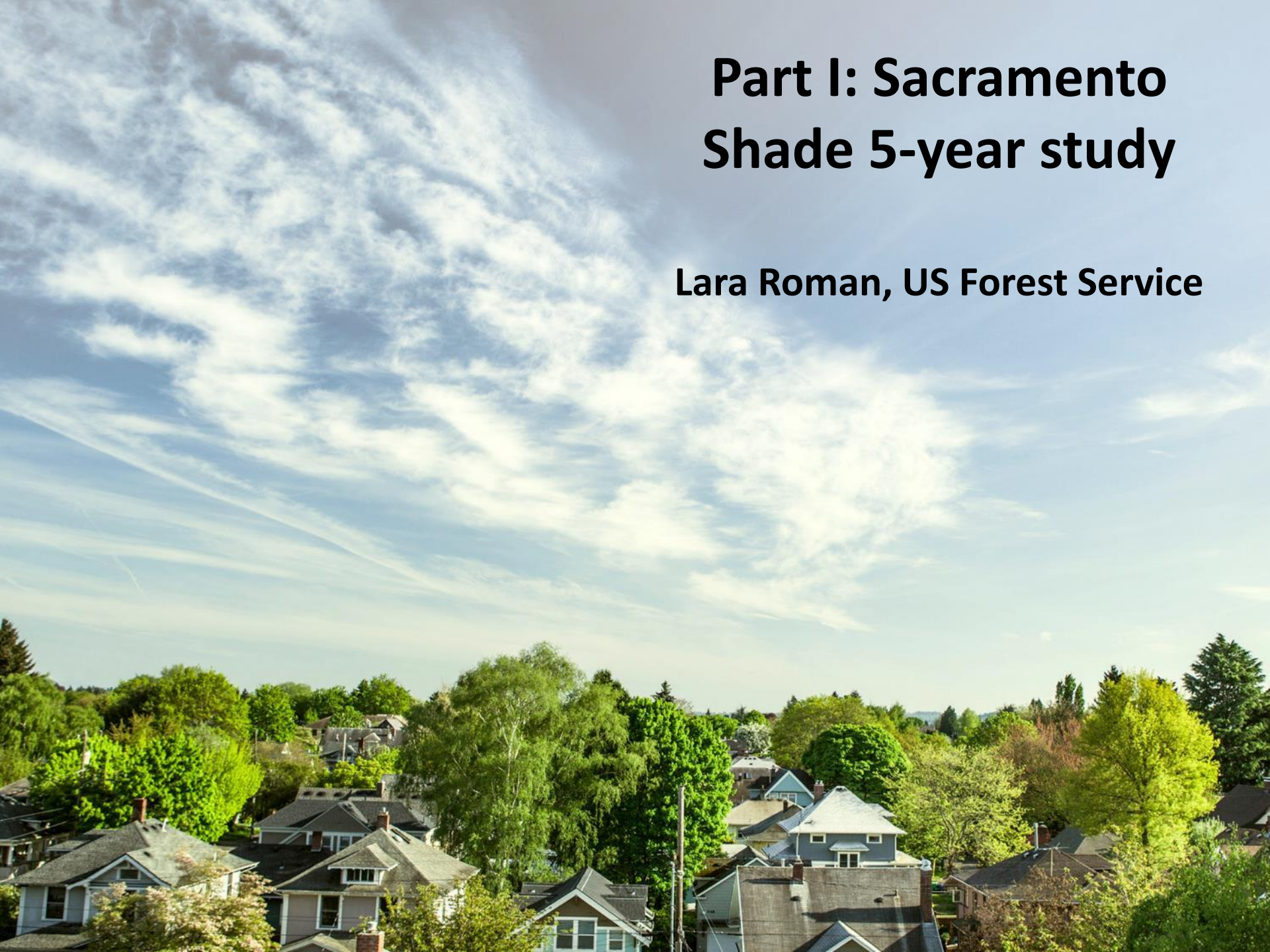
Residential urban tree canopy

city	year	% existing canopy	% residential out of total existing canopy	% possible additional canopy	% residential out of possible additional canopy	source
Baltimore, MD	2007	27%	41%	44%	27%	O'Neil-Dunne (2009)
New York City, NY	2010	21%	28%	44%	35%	O'Neil-Dunne (2012)
Philadelphia, PA	2008	20%	23%	49%	24%	O'Neil-Dunne et al. (2011)
Providence, RI	2007	23%	62%	53%	47%	City of Providence (2008)

Nguyen et al. (in preparation)
UTC summary courtesy of D.H. Locke

Part I: Sacramento Shade 5-year study

Lara Roman, US Forest Service



Sacramento Shade program

- Reduce energy use through tree shade
- 500,000 trees given away since 1990

Sacramento Municipal Utility District (SMUD) → Sacramento Tree Foundation (STF) → Residents

Funding	Program implementation	Tree planting
Quality Assurance	Community foresters	Maintenance

5-year survival study goals

- Assess tree survival during establishment phase
- Evaluate risk factors for tree death

13,594 trees delivered in 2007 → Study sample: 436 single-family residential trees

Roman et al. (2014)

Defining terms

- **Annual survival rate**

  Proportion of individuals surviving each year

$$\textit{annual survival} = \frac{\textit{\# alive}\ (T+1)}{\textit{\# alive}\ (T)}$$

- **Annual mortality rate**

  Proportion of individuals dying each year

$$\textit{annual mortality} = 1 - \textit{annual survival}$$

Defining terms (cont.)

- **Survivorship**

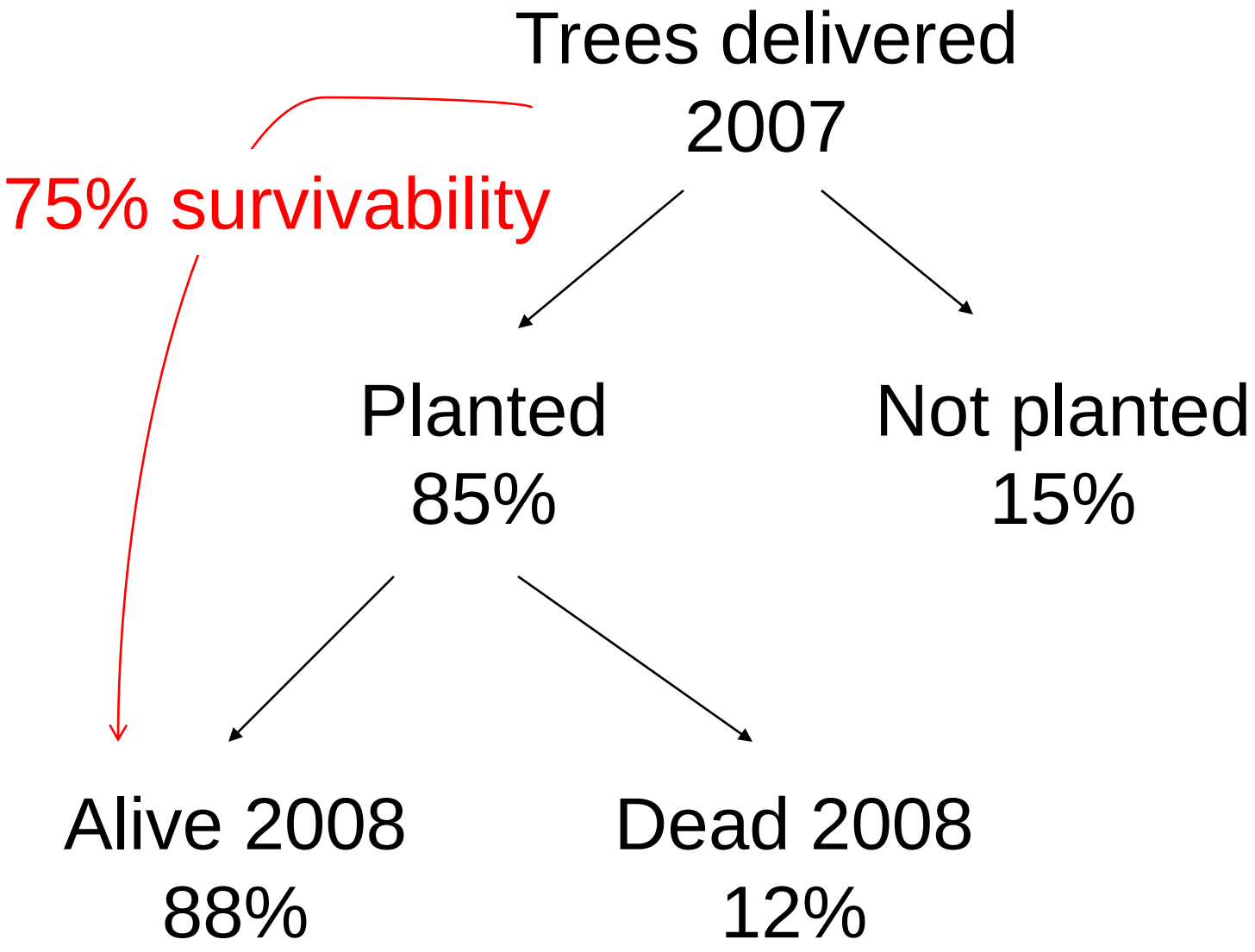
  Proportion of individuals surviving out of those <u>planted</u>

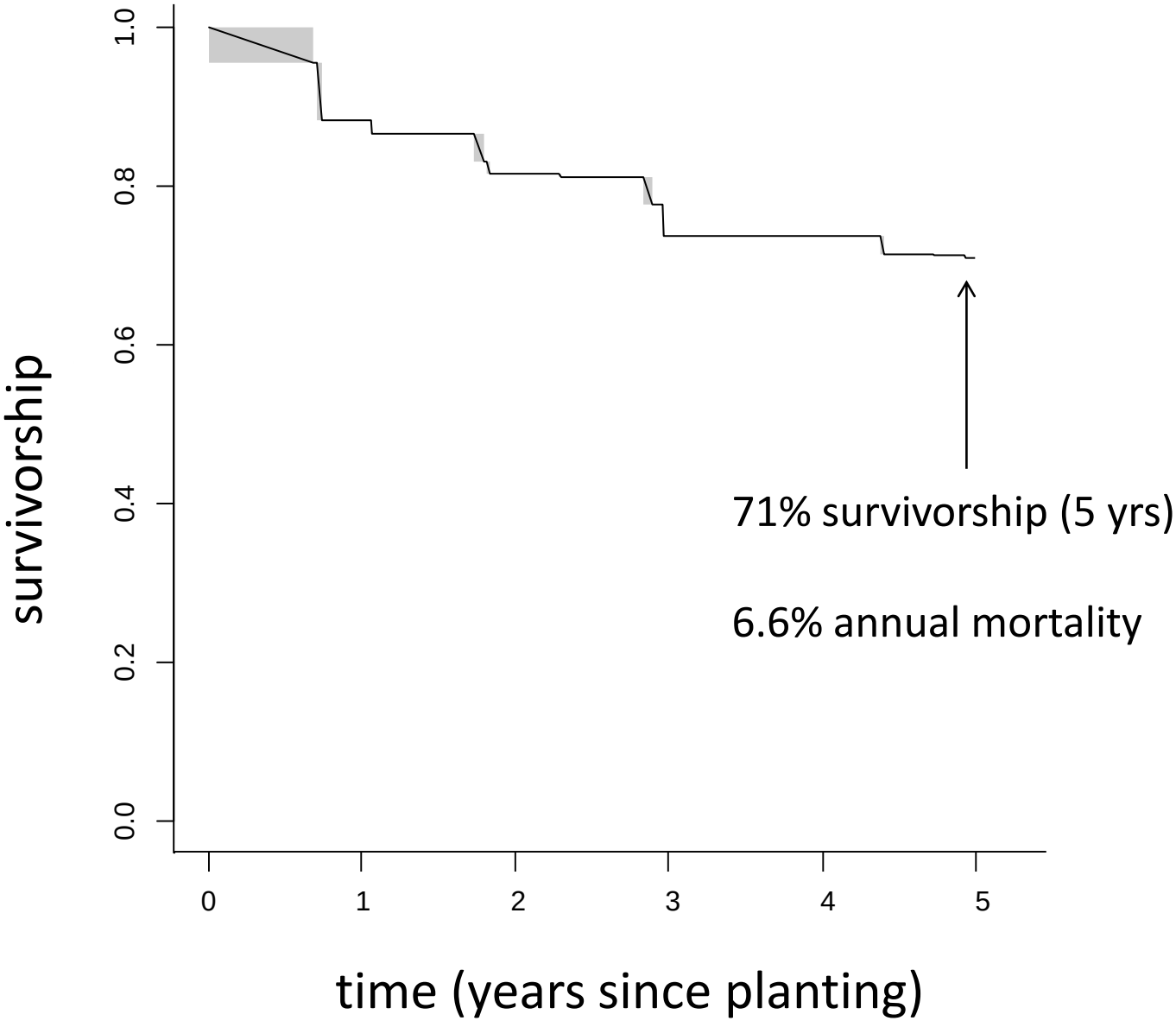
$$\textit{survivorship to time } T = \frac{\textit{\# alive } (T)}{\textit{\# planted}}$$

- **Survivability**

  Proportion of individuals surviving out of those <u>distributed</u>

$$\textit{survivability to time } T = \frac{\textit{\# alive } (T)}{\textit{\# distributed}}$$


Trees delivered
2007
75% survivability
Planted
85%
Not planted
15%
Alive 2008
88%
Dead 2008
12%

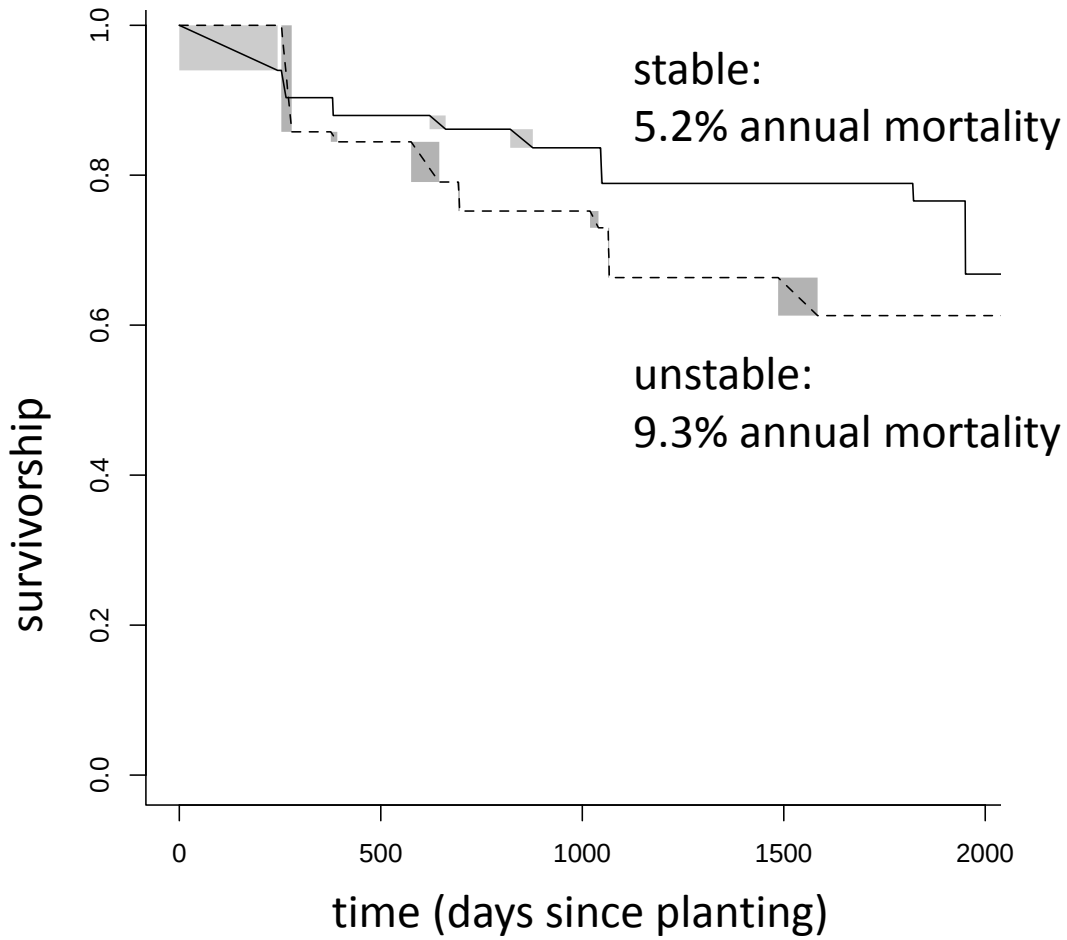

survivorship
1.0
0.8
0.6
0.4
0.2
0.0
0
1
2
3
4
5
time (years since planting)
71% survivorship (5 yrs)
6.6% annual mortality

Planting status

- Educational attainment (↓ education, ↓ planted)
- Homeowner stability (↓ stable, ↓ planted)

5 year survival

- Homeowner stability (↓ stable, ↓ survival)



Conclusions

- Observed mortality > assumed mortality
- Most trees lost in the first year
  - Failure to plant
  - 1st year mortality
- Many residents do not follow recommended maintenance practices
- Importance of stable homeownership