Integrating socioeconomic and biophysical processes in a coupled landscape planning model

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Climate

Urbanization

Biodiversity

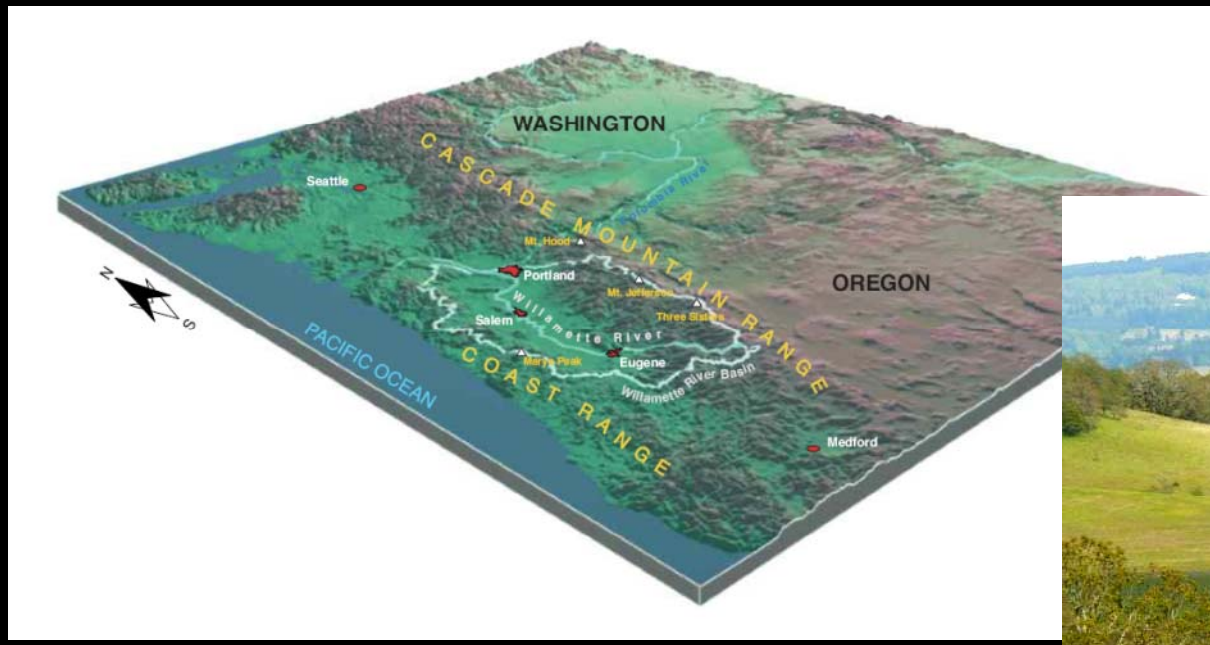
Wildfire

Today's Presentation

I owe much to: John Bolte, Dave Hulse, Alan Ager, Scott Bridgham, Ron Neilson, Gabe Yospin, Connie Harrington, Jane Kertis, Peter Gould and Alex Park

- The Willamette Valley Ecoregion
- Survey & Results
- Integrating Results in a Landscape Planning Model

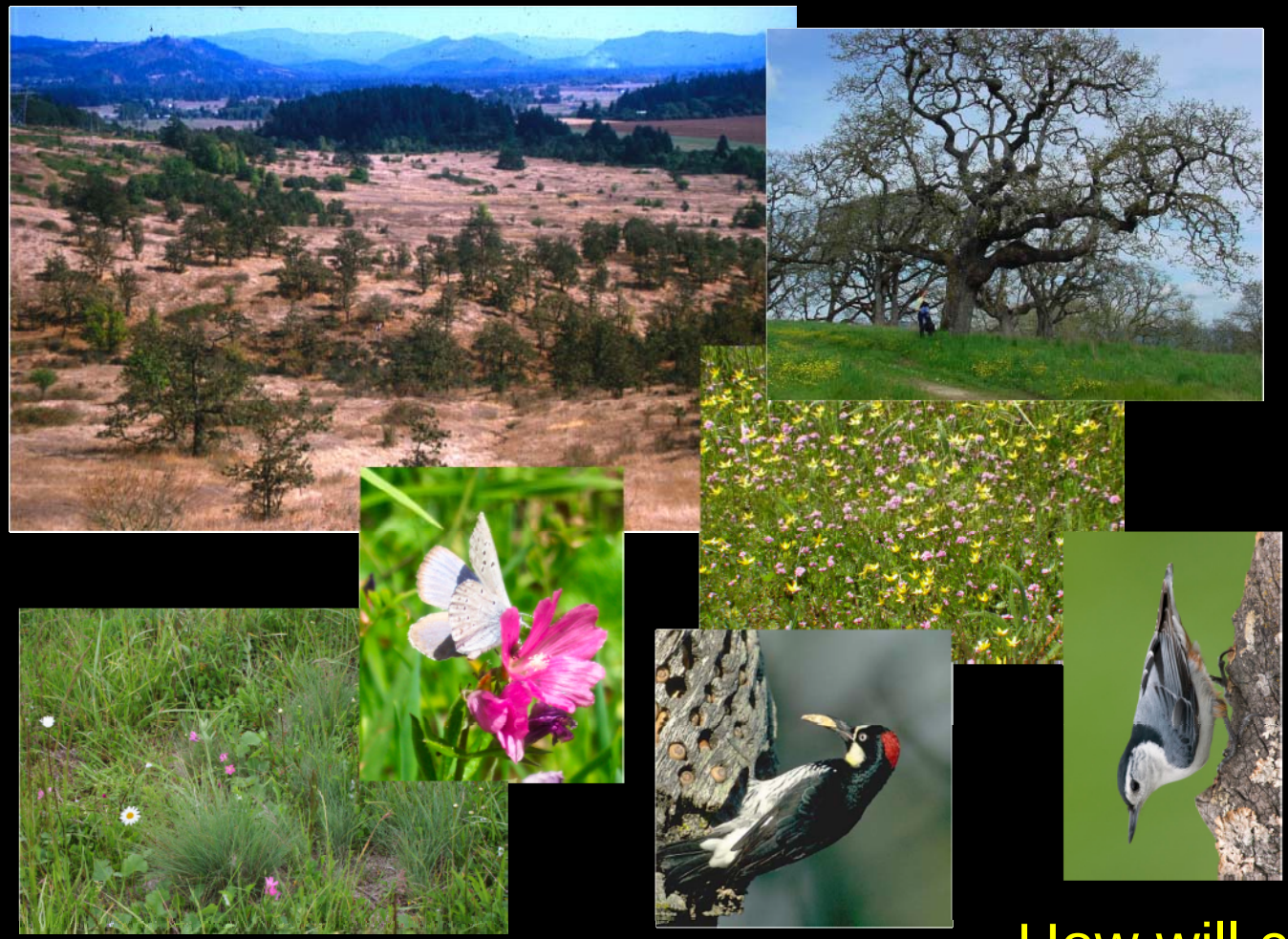
Oregon's Willamette Valley



Area: 30,000 km^2
Population: > 2,000,000 people expected to double by 2050
Climate: mild winters/dry summers; winter rains (50+") / summer drought

Projections: 1.5-4.5˚ C higher temperatures, 0-50% more precipitation; longer and deeper summer drought; more wildfire likely

Fire Adapted Oak Savanna Landscape



Oak savanna is a key conservation target
Highly vulnerable: 95% loss in 150 years

How will climate change affect?

How will climate change and rural landowner decisions interact?

Objective

- Investigate the influence of social-psych traits on perceptions of wildfire risk and opportunities to mitigate

Risk and Mitigation

- Influences: attitudes, efficacy, social pressure

Context

- A landscape largely devoid of uncontrolled wildfire
- Climate & population growth will increase fire risk
- Biodiversity conservation and wildfire risk reduction

But, in a landscape with little exposure to wildfire risk…

Perceptions of risk quickly formed without experience:

Cultural values and norms: Dake, Douglas, Wildavsky

Why do some people perceive as risky some things while others don't?

Selective attention:

- Worldviews
- Social structure – e.g.,
  - **Hierarchy**
  - **Autonomy**
  - **Community**

Survey Methods

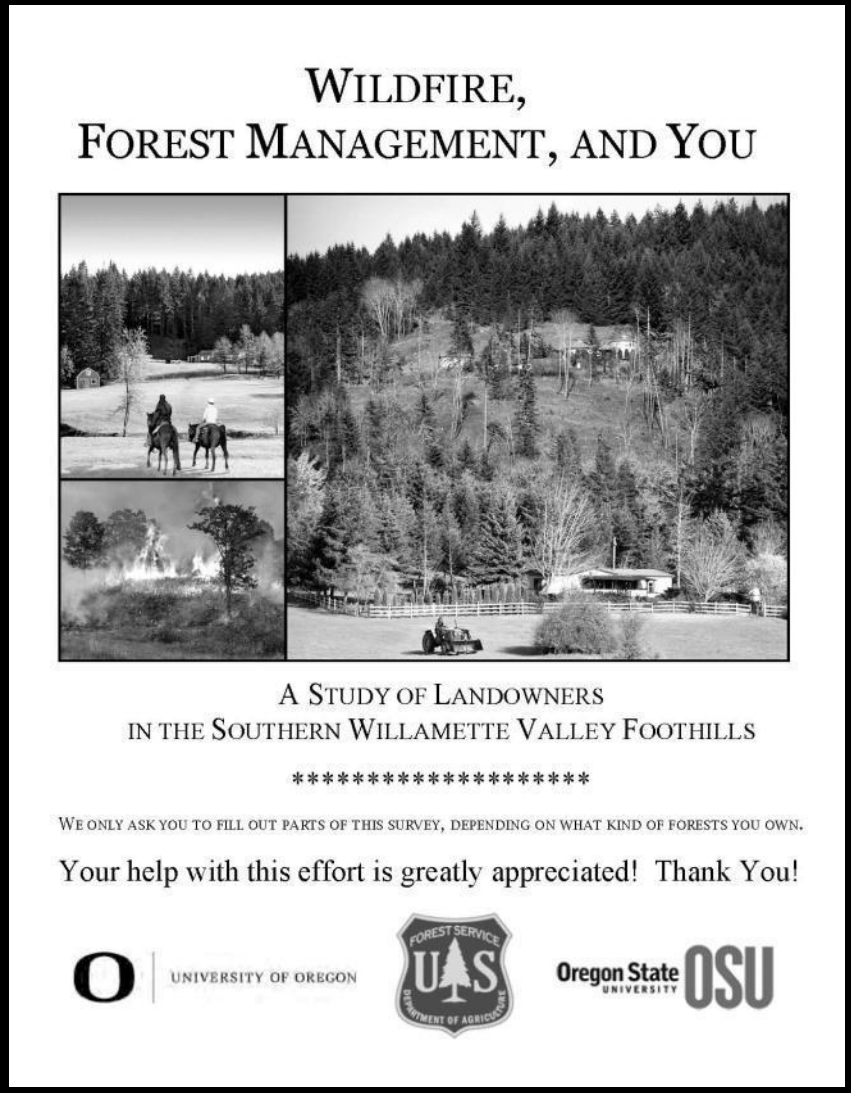
2 Surveys (Dillman 2000)

Lane and Linn County

Non-industrial Private Owners

Land Mgmt: n=652 (40%)

Forest Mgmt: n=362 (49%)



WILDFIRE,
FOREST MANAGEMENT, AND YOU

A STUDY OF LANDOWNERS
IN THE SOUTHERN WILLAMETTE VALLEY FOOTHILLS

****

WE ONLY ASK YOU TO FILL OUT PARTS OF THIS SURVEY, DEPENDING ON WHAT KIND OF FORESTS YOU OWN.

Your help with this effort is greatly appreciated! Thank You!

UNIVERSITY OF OREGON

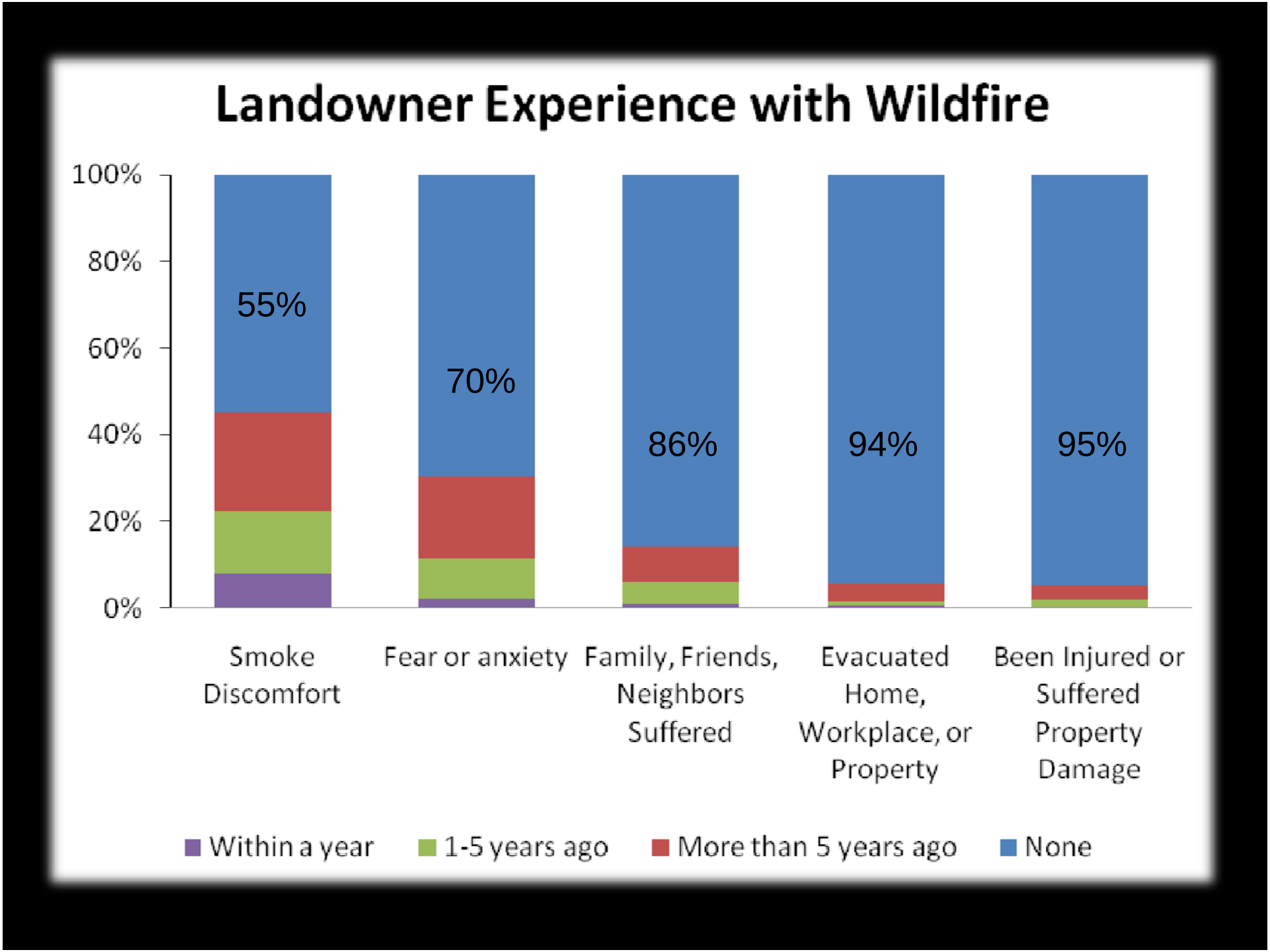
FOREST SERVICE US DEPARTMENT OF AGRICULTURE

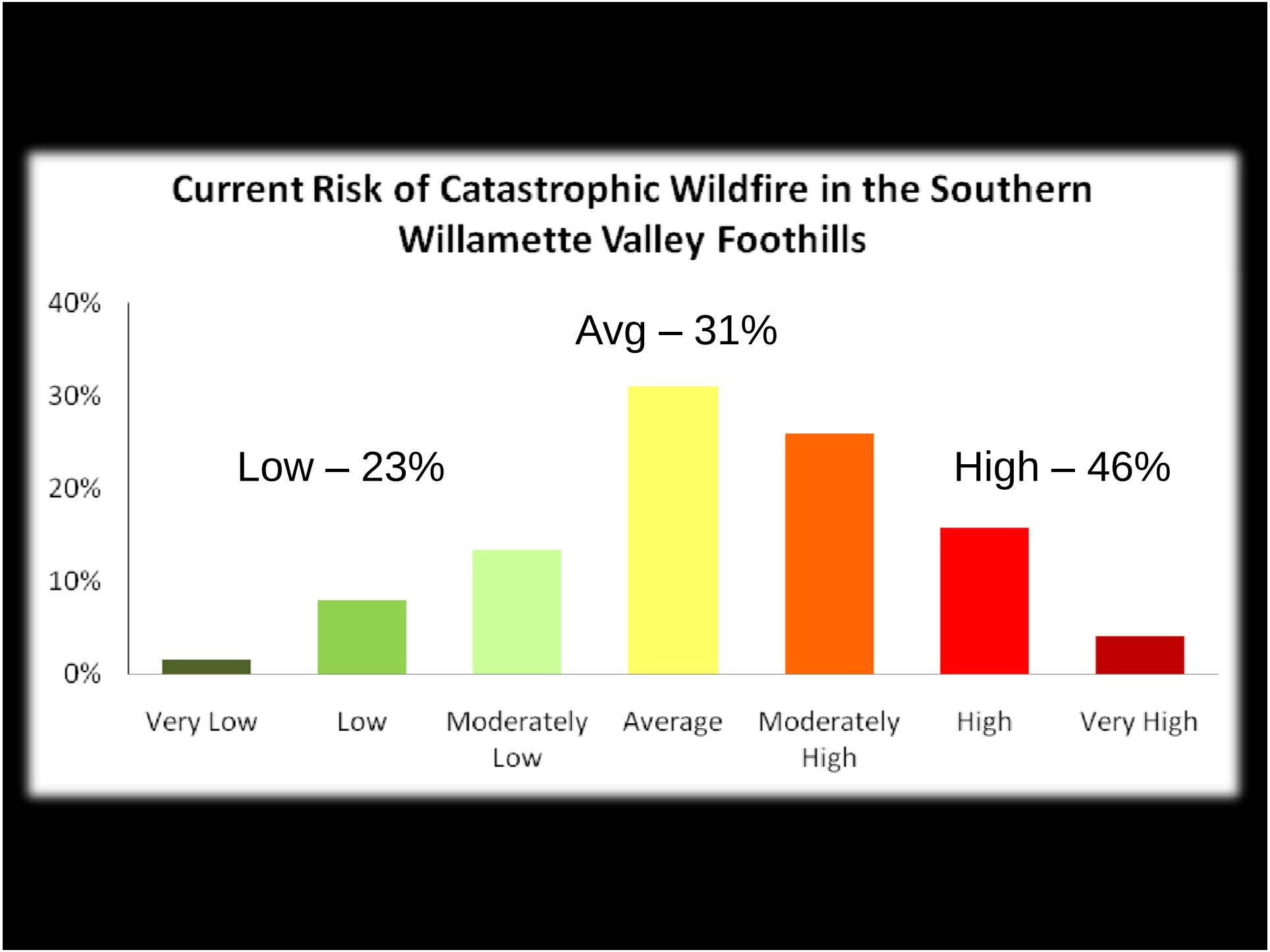
Oregon State UNIVERSITY OSU

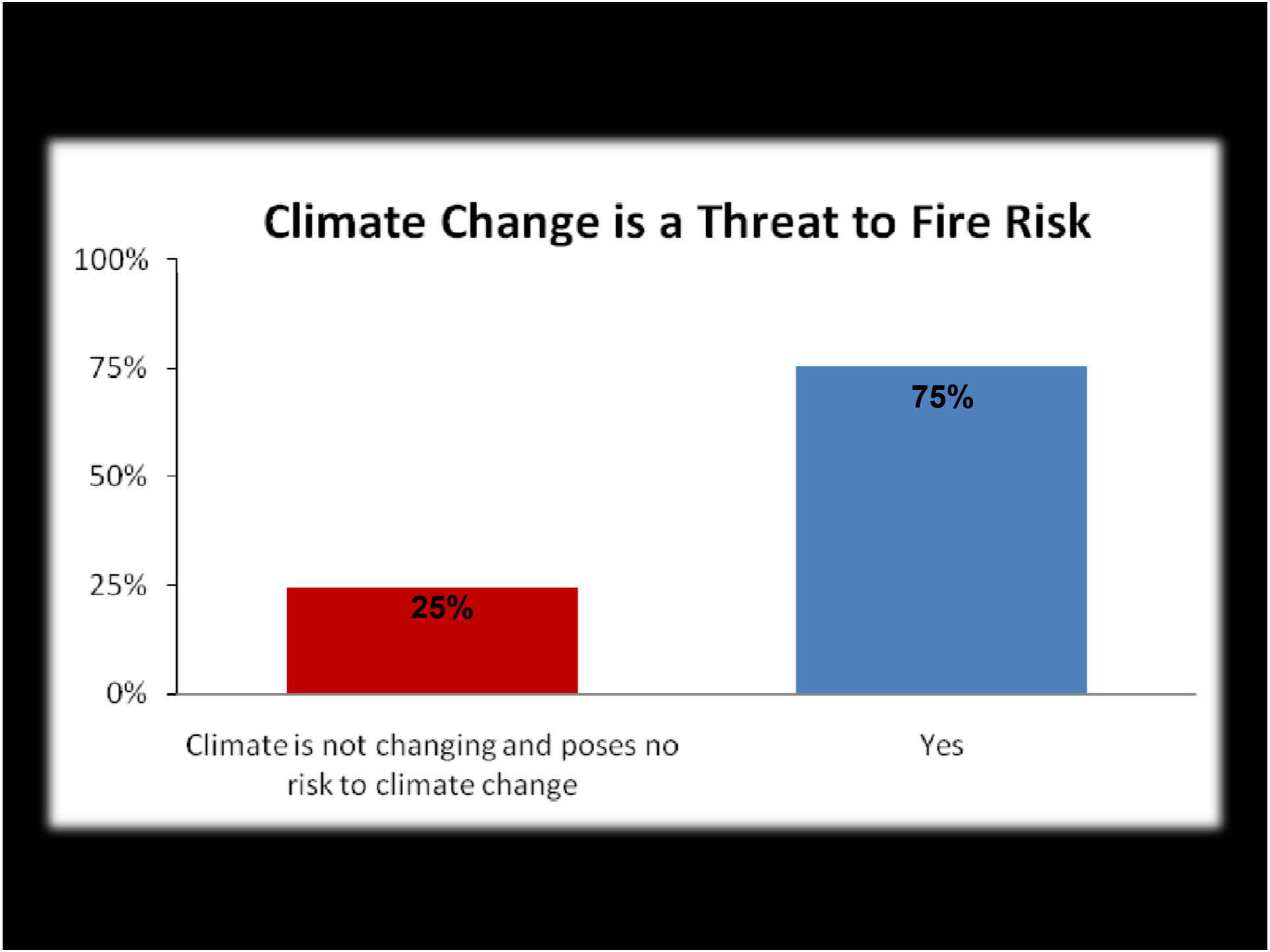
Who?

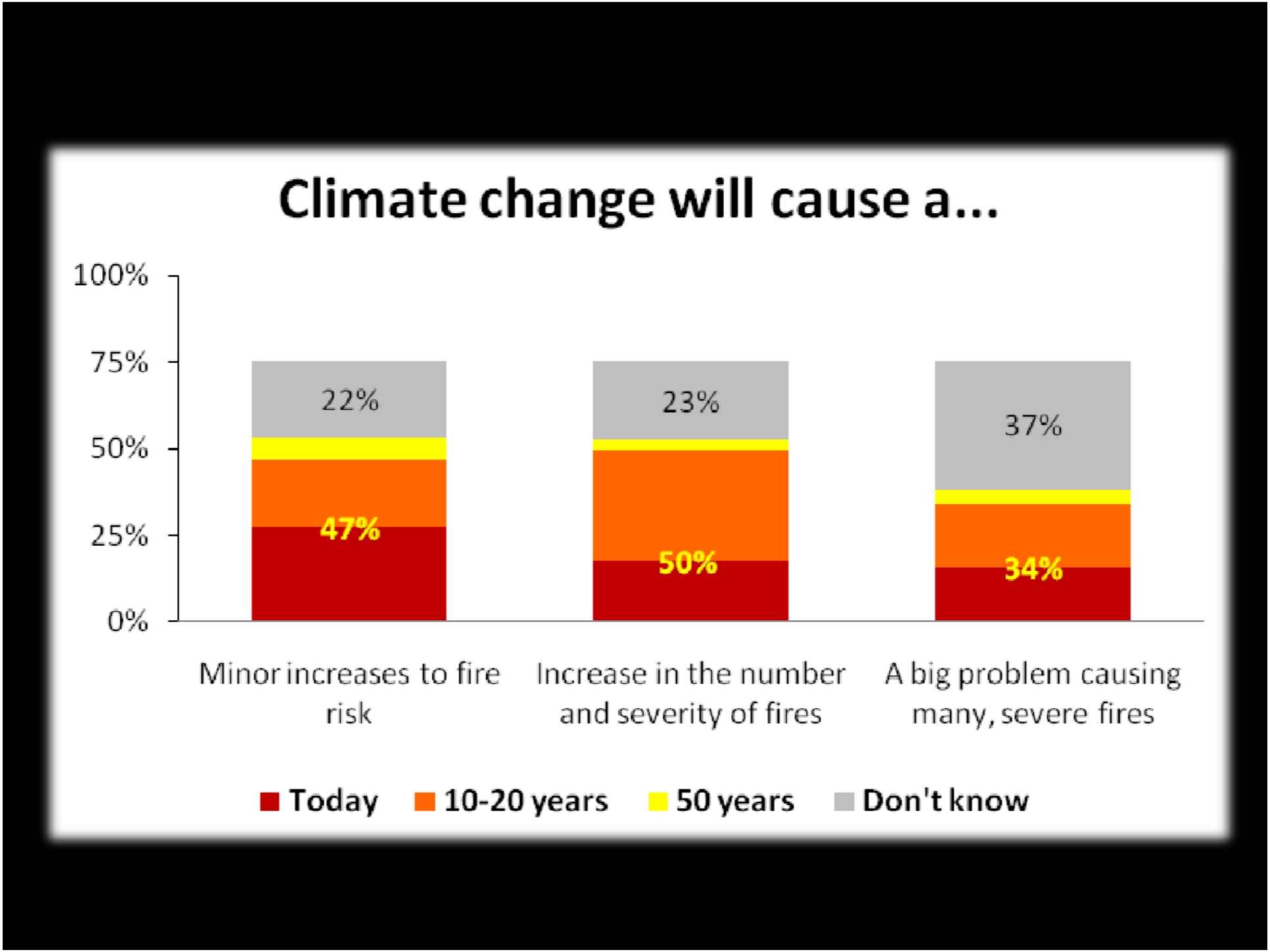
- Parcel Size –
  50% GT 25 Acres
  Ave 95 Acres
- Years of Owned –
  Average 24 Years
- Improvement Value –
  75% below
  $212,000
- Education –
  50% College
  Degree or greater

- Household Income –
  50% greater than
  $75,000

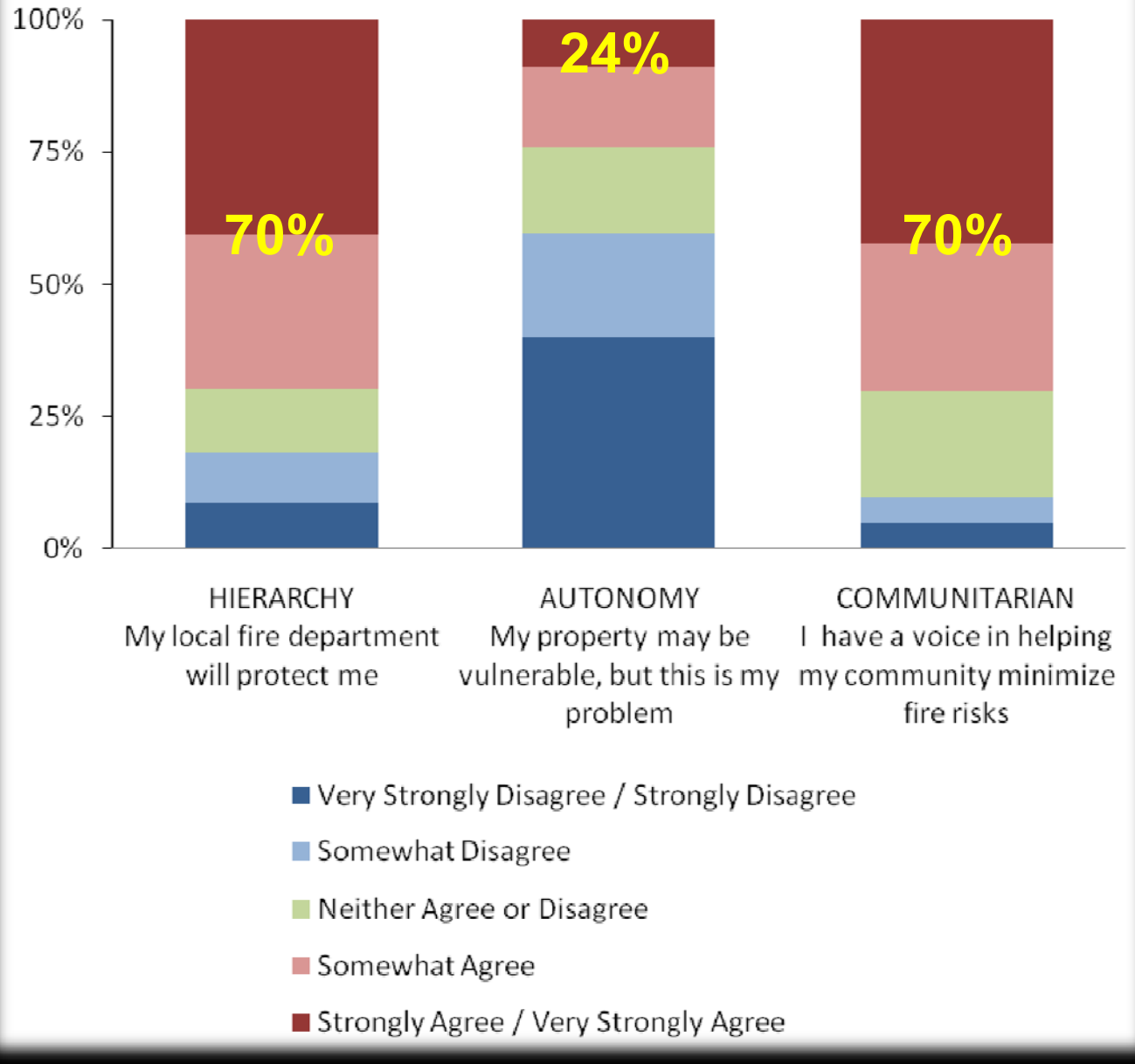

Landowner Experience with Wildfire
100%
80%
60%
40%
20%
0%
55%
70%
86%
94%
95%
Smoke Discomfort
Fear or anxiety
Family, Friends, Neighbors Suffered
Evacuated Home, Workplace, or Property
Been Injured or Suffered Property Damage
Within a year
1-5 years ago
More than 5 years ago
None


Current Risk of Catastrophic Wildfire in the Southern Willamette Valley Foothills
40%
30%
20%
10%
0%
Avg – 31%
Low – 23%
High – 46%
Very Low
Low
Moderately Low
Average
Moderately High
High
Very High

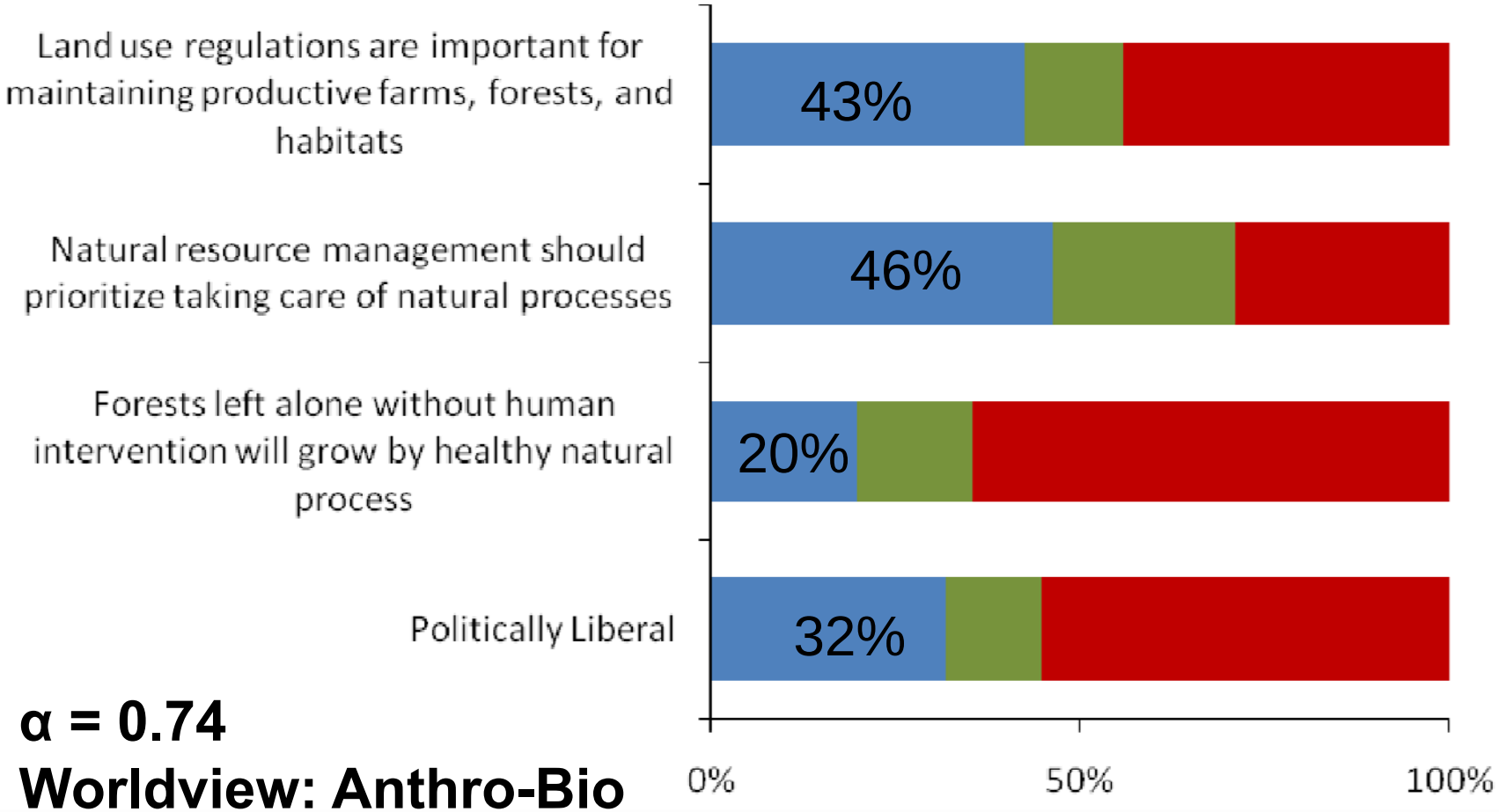

Climate Change is a Threat to Fire Risk
100%
75%
50%
25%
0%
25%
75%
Climate is not changing and poses no risk to climate change
Yes


Climate change will cause a...
100%
75%
50%
25%
0%
22%
47%
23%
50%
37%
34%
Minor increases to fire risk
Increase in the number and severity of fires
A big problem causing many, severe fires
Today
10-20 years
50 years
Don't know

Cultural Views of Risk

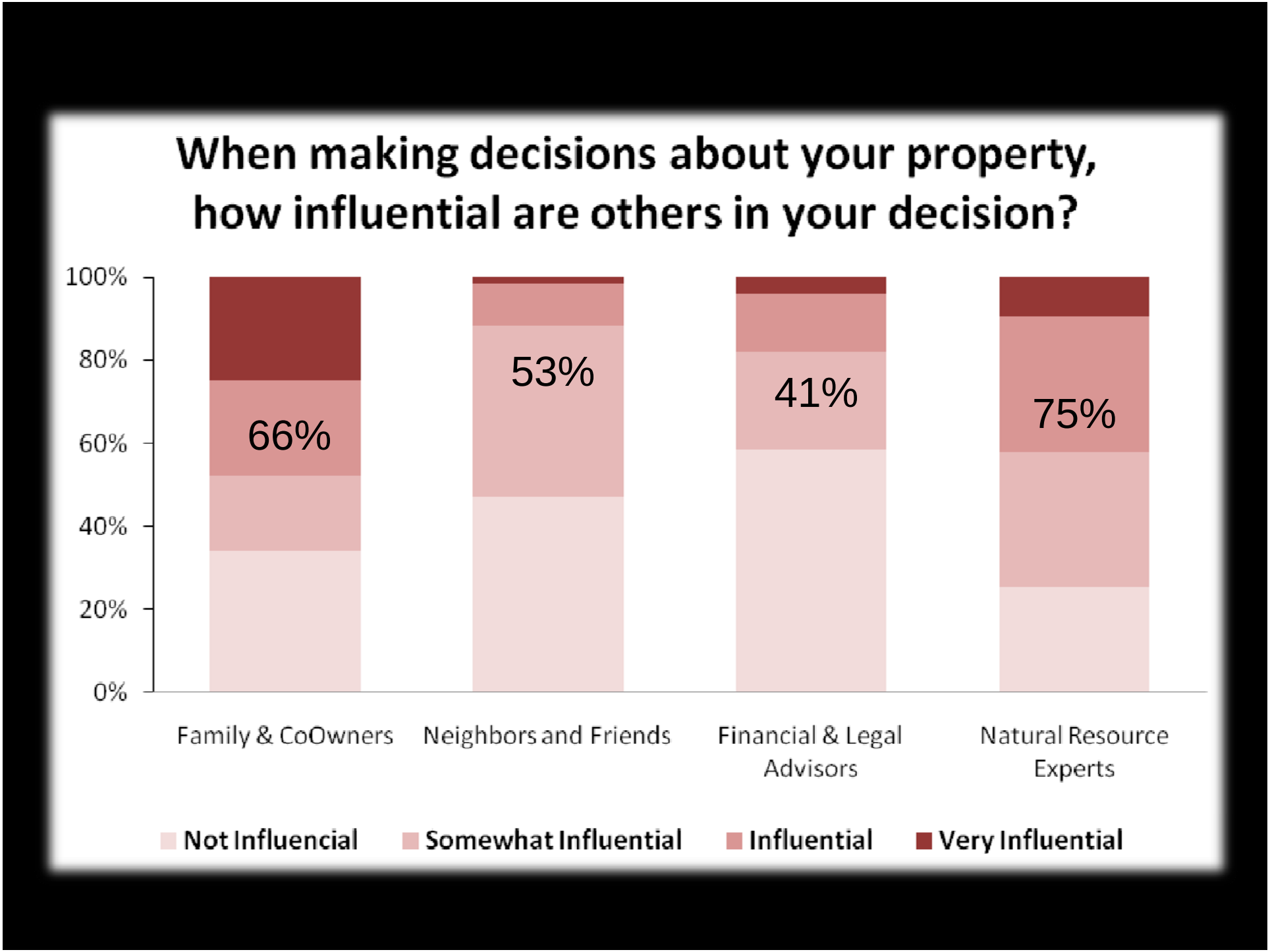


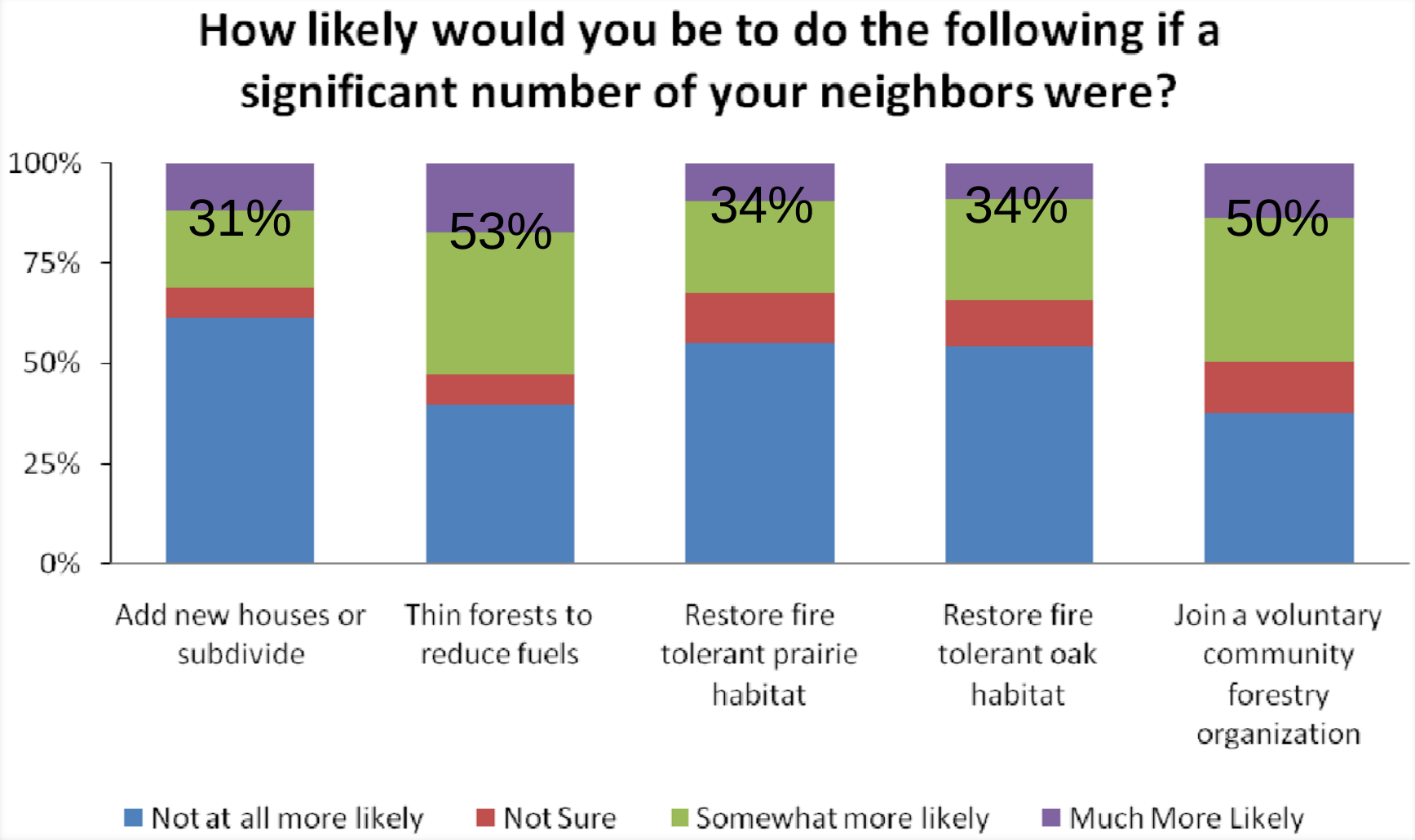
Worldview on Natural Resource Management

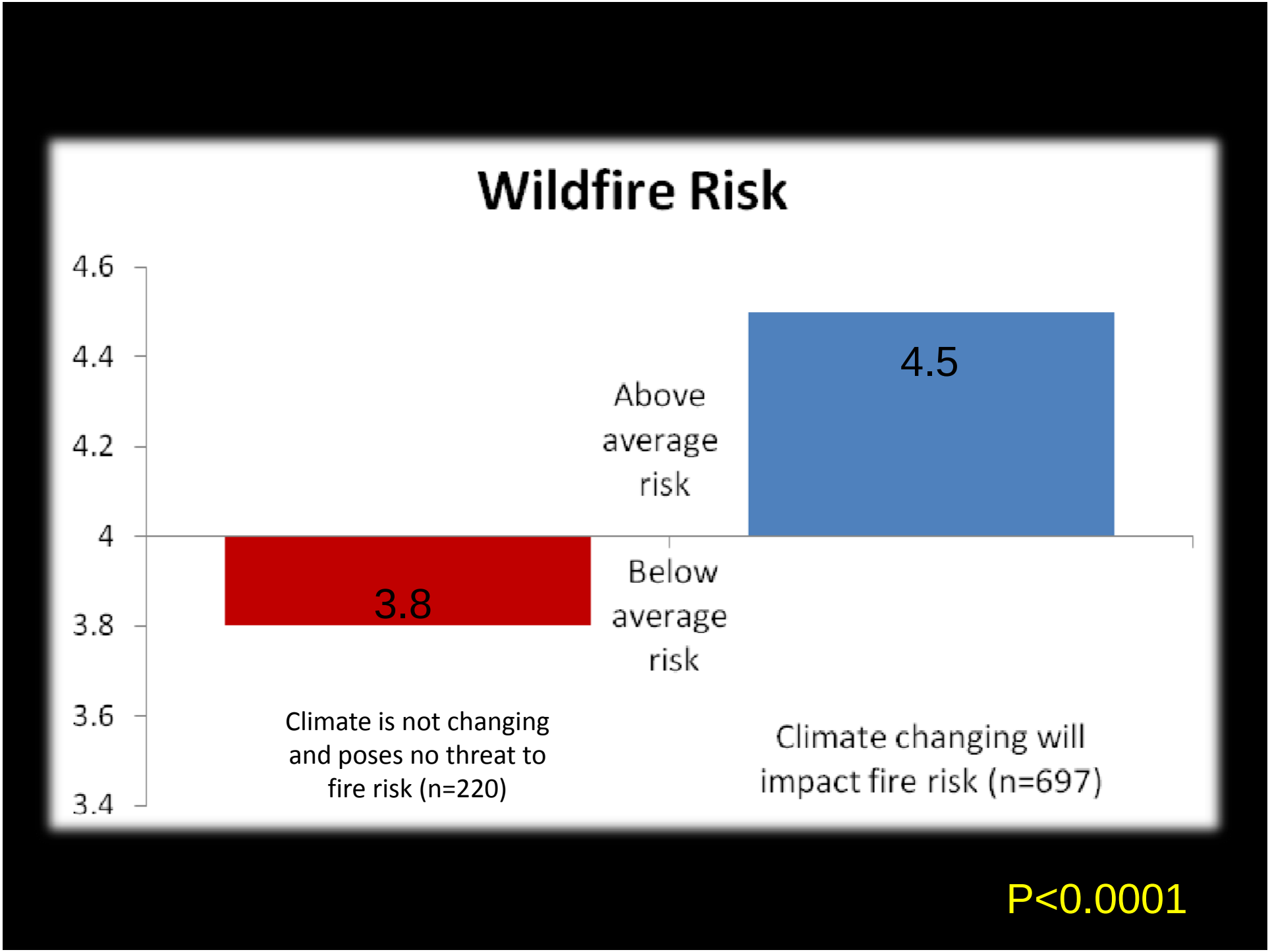


α = 0.74

Worldview: Anthro-Bio

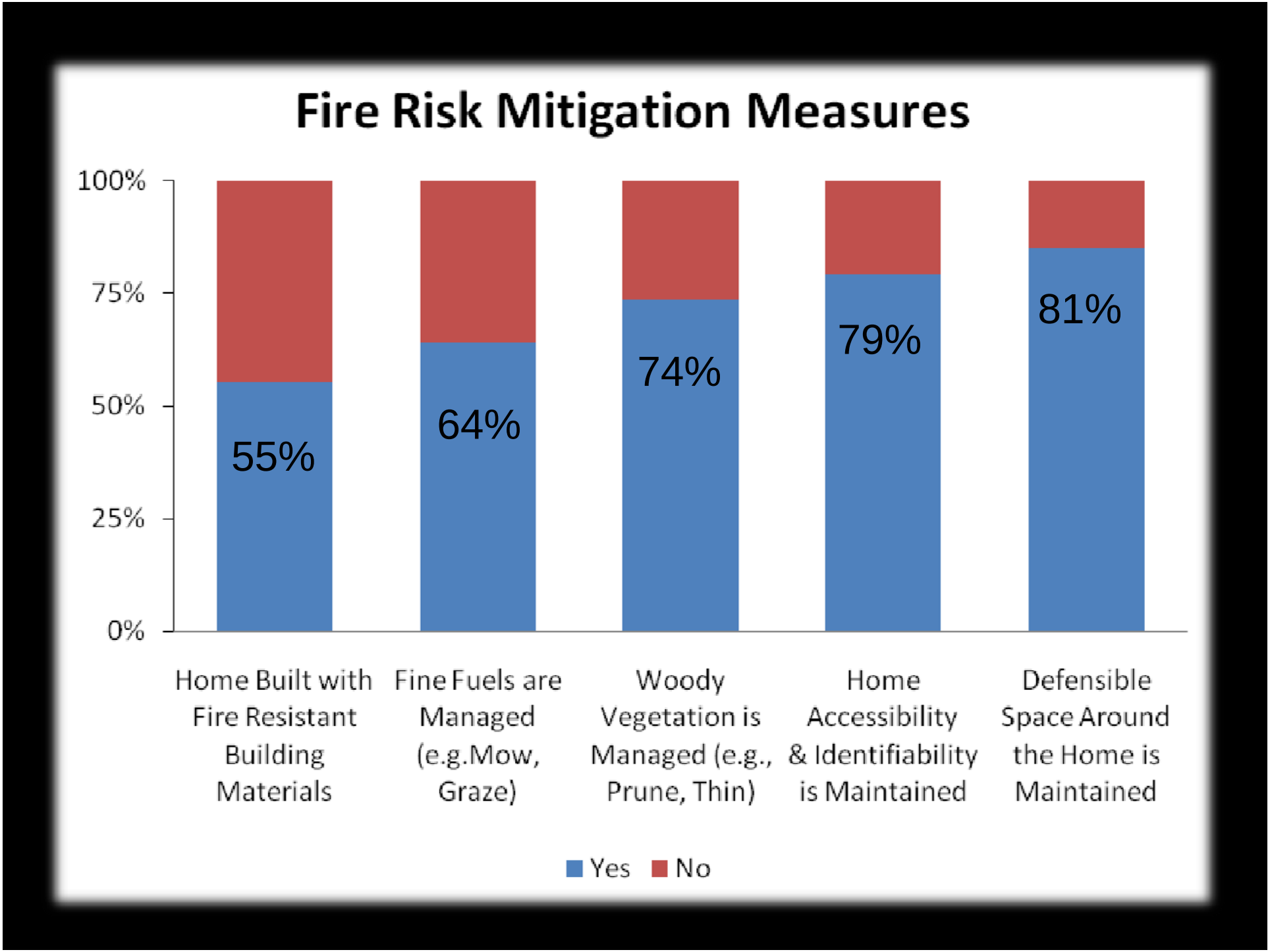

When making decisions about your property, how influential are others in your decision?
100%
80%
60%
40%
20%
0%
66%
53%
41%
75%
Family & CoOwners
Neighbors and Friends
Financial & Legal Advisors
Natural Resource Experts
Not Influencial
Somewhat Influential
Influential
Very Influential

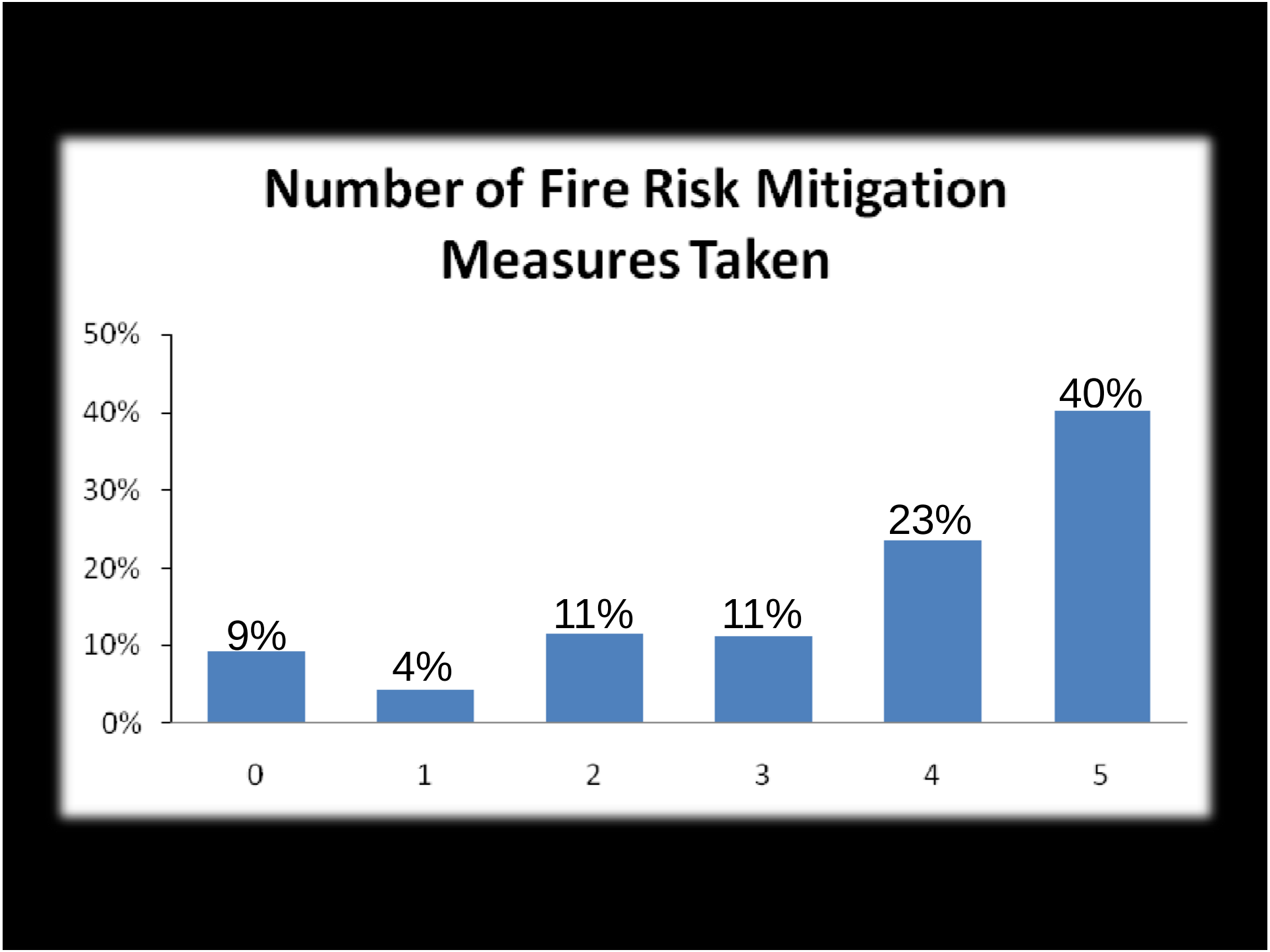

How likely would you be to do the following if a significant number of your neighbors were?
100%
75%
50%
25%
0%
31%
53%
34%
34%
50%
Add new houses or subdivide
Thin forests to reduce fuels
Restore fire tolerant prairie habitat
Restore fire tolerant oak habitat
Join a voluntary community forestry organization
Not at all more likely
Not Sure
Somewhat more likely
Much More Likely


Wildfire Risk
4.6
4.4
4.2
4
3.8
3.6
3.4
4.5
Above average risk
3.8
Below average risk
Climate is not changing and poses no threat to fire risk (n=220)
Climate changing will impact fire risk (n=697)
P<0.0001

Influences of Wildfire Risk Perception

Parameter	Estimate	P-Value
Belief: No Climate Change	3.11	<.0001
Belief: Climate Change	3.45	<.0001
Risk: Hierarchy	-0.04	NS
Risk: Communitarian	0.11	0.0010
Risk: Autonomy	-0.10	0.0041
Worldview: Natural Resources	-0.06	NS
Influence: Experts	0.22	<.0001
Influence: Neighbors	0.11	0.0234
Experience	0.45	<.0001
LS Means: Risk Perception (p=0.0031)	NCC 4.1	CC 4.5


Fire Risk Mitigation Measures
100%
75%
50%
25%
0%
55%
64%
74%
79%
81%
Home Built with Fire Resistant Building Materials
Fine Fuels are Managed (e.g.Mow, Graze)
Woody Vegetation is Managed (e.g., Prune, Thin)
Home Accessibility & Identifiability is Maintained
Defensible Space Around the Home is Maintained
Yes
No


Number of Fire Risk Mitigation Measures Taken
50%
40%
30%
20%
10%
0%
9%
4%
11%
11%
23%
40%
0
1
2
3
4
5

Influences on Number of Wildfire Risk Mitigation Actions

Parameter	Estimate	P-Value
Belief: Climate Change	0.09	NS
Risk Perception: Wildfire	0.18	0.0013
Risk: Hierarchy	0.11	0.0337
Risk: Communitarian	0.10	NS
Risk: Autonomy	0.24	<.0001
Worldview: Natural Resources	-0.08	NS
Influence: Experts	0.11	NS
Influence: Neighbors	0.14	0.0163
Experience	-0.04	NS

In the next 5-10 years what is the likelihood that you will…

Forest Thinning & Fuels

Defensible Space

Savanna Structure

Full Savanna Restoration

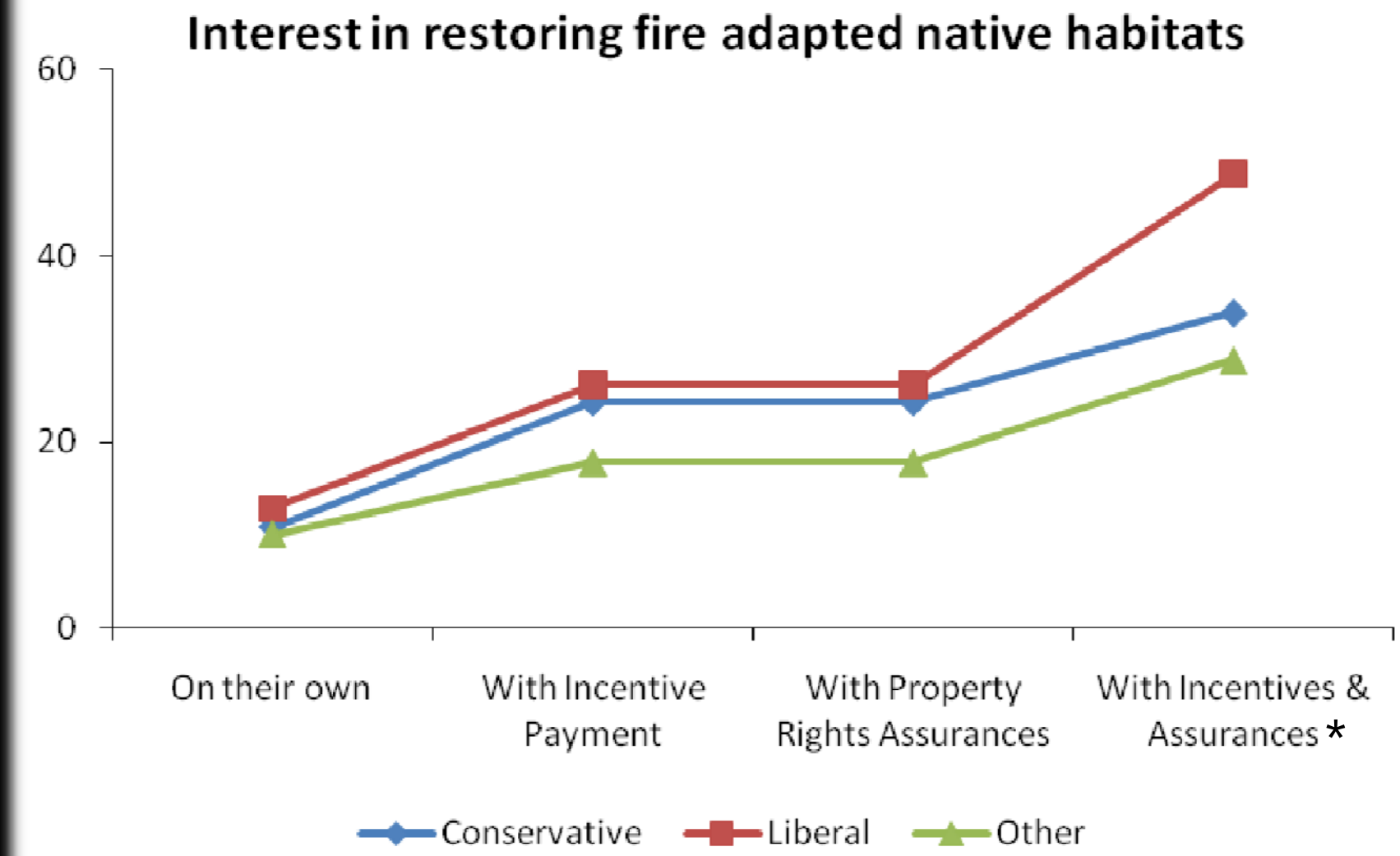
Oak Woodland Structure

Property Rights and Incentives

Influences on interest in restoring native fire adapted habitats in the future

Parameter	On Own	Incentive Payments	Property Rights Assurances	Incentives & Assurances
Political Ideology	-	-**	-	-***
Wildfire Risk Perception	-0.79	-0.75	0.23	-2.47
Risk: Hierarchy	-0.82	-1.32	-2.09	-1.96
Risk: Communitarian	1.36	1.36	1.95	0.41
Risk: Autonomy	0.89	-0.44	-1.01	-2.09
Worldview: Natural Resources	-1.26	-0.51	-0.06	3.81*
Influence of Experts	5.97***	6.15***	7.19**	11.18***
Experience	1.63	0.93	1.19	0.62
* p<0.1; ** p<0.05; ***p<0.01 n	231	232	231	232

Forest Thinning – NR Worldview



Least squares corrected means; * p<0.01

People would generally rather fight two tigers tomorrow than one tiger today

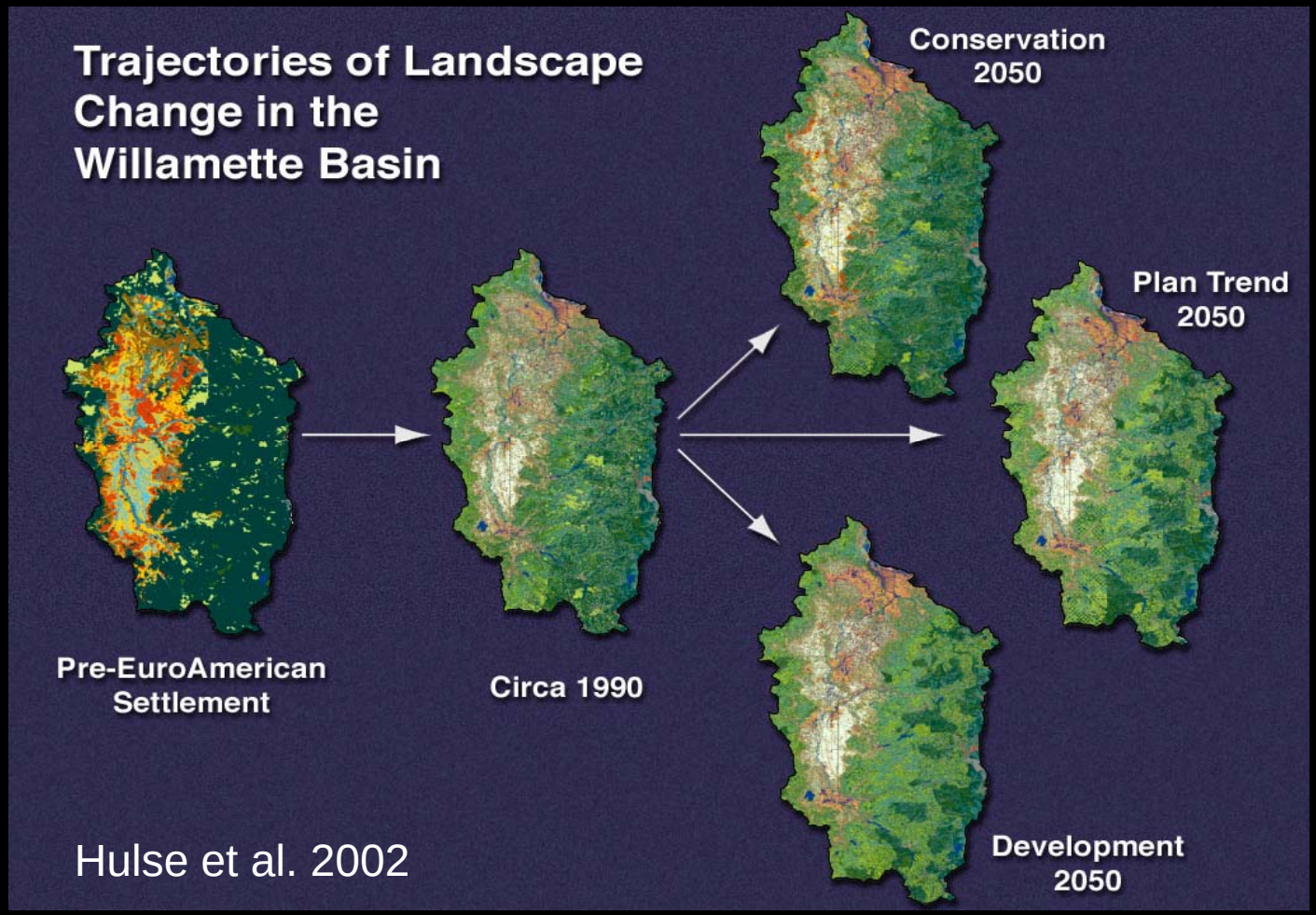
Imagine climate change causes reductions in rainfall, snowpack, or groundwater…

- Make no changes because it would either be temporary or not affect me
  - ~ 1 in 3 chance (Hierarchy, Ideology, NR Worldview)
  - Anthropocentric – 40% more likely to make no changes
- Manage for drought tolerant, fire-adapted forest types
  - ~ 1 in 4 chance (Neighbors, Experts)
  - Biocentric – 35% more likely to manage for fire adapted types
- Stop management of agricultural land and let nature take it's course
  - ~ 1 in 5 chance (Hierarchy, Neighbors, NR Worldview)
  - Biocentric – 50% more likely to stop mgmt

Thoughts

- Most landowners in WVE have little experience with wildfire, but are doing a lot
- About half think climate change will result in a moderate increase to fire risk
- Belief in climate change significantly increases perception of fire risk
- Mitigation actions are influenced by perception of risk, autonomy, neighbors
- Future actions are influenced by worldviews and interaction with technical experts
- Receptivity to incentives influenced by ideology and NR worldview

Alternative Futures Scenario Analysis



Conceptual Structure of Envision – An Agent-based Model

Actors

Decision-makers managing the landscape by selecting policies responsive to their objectives

Landscape Feedbacks

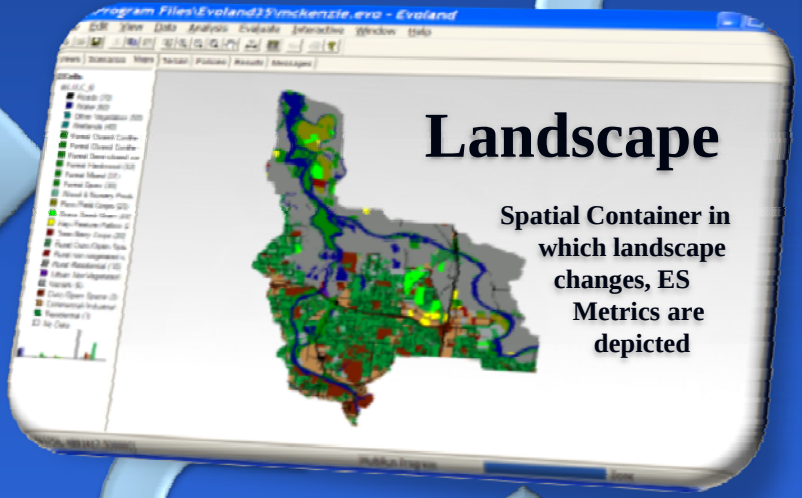
Landscape Production Models

Generate Landscape Metrics Reflecting Ecosystem Service & Economic Productions

Scenario Definition

Multi-agent Decision-making

Select policies and generate land management decision affecting landscape



Policies

Fundamental Descriptors of constraints and actions defining land use management decision making

Autonomous Change Processes

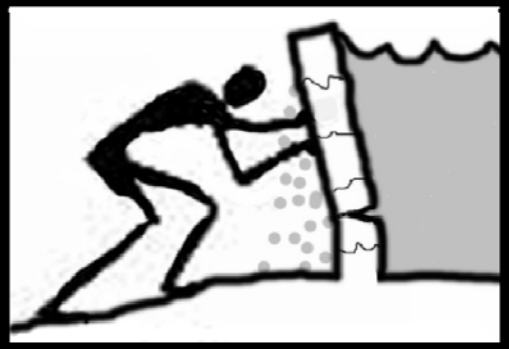
Models of Non-anthropogenic Landscape Change

Slide Courtesy John Bolte

Associate Values with Adaptation Strategies

Resistance:

Manage landscapes to oppose changes and impacts associated with climate change and wildfire



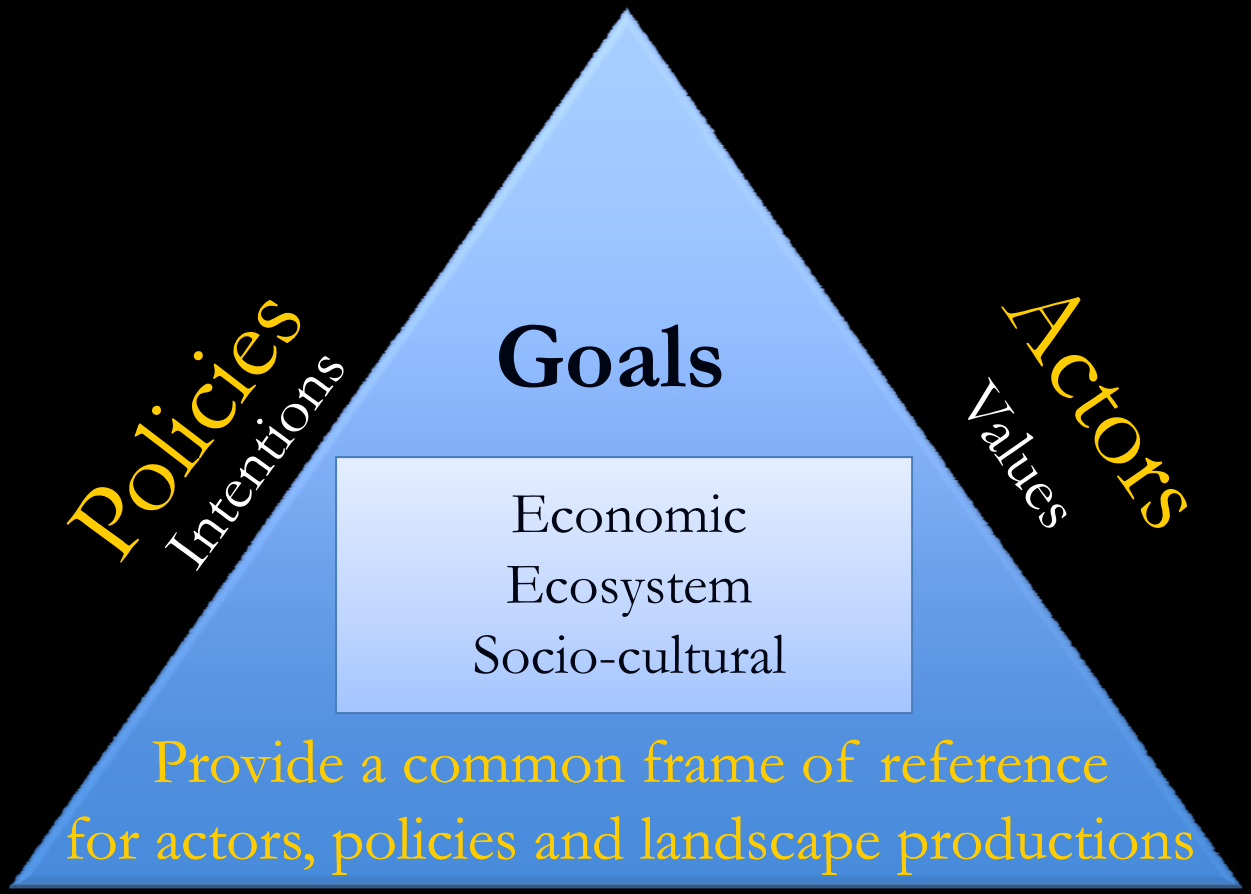
Resilience:

Manage landscapes so that ecosystems and people can quickly recover from climate or wildfire impacts with few dramatic changes

Facilitation:

Help ecosystems and people transition toward new states that are better adapted to changing climatic and wildfire conditions

Agent-based Modeling



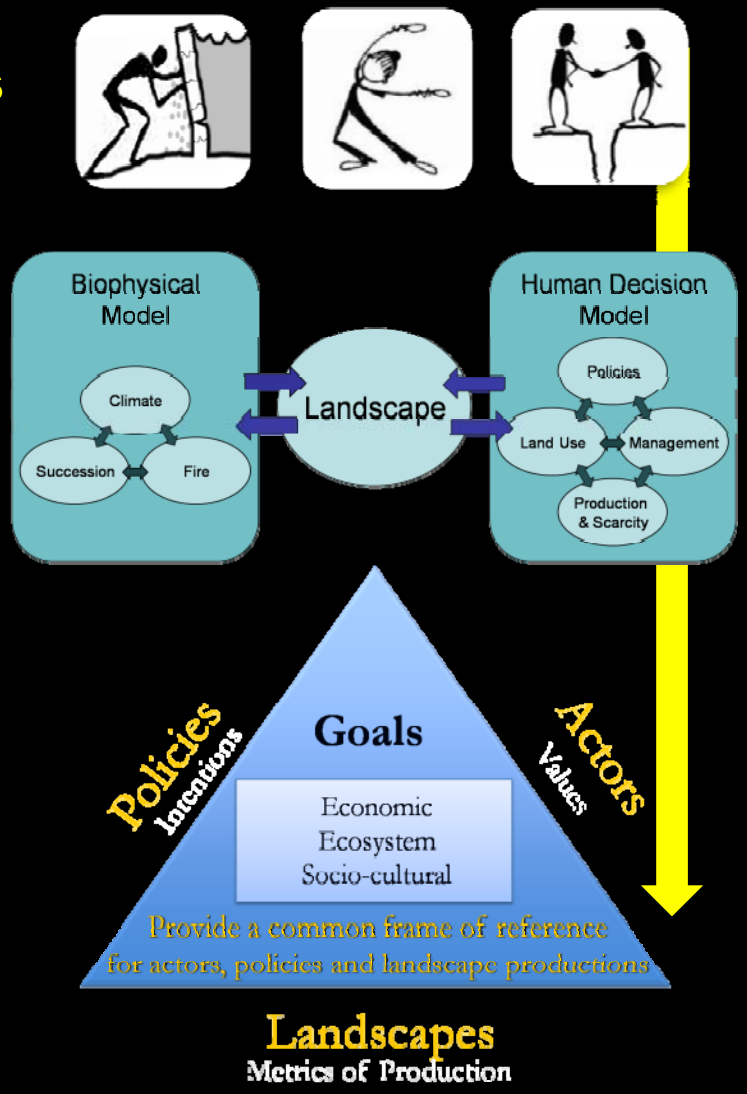
Landscapes

Metrics of Production

Coupled Natural Human Ecosystems

Which values drive human decisions for managing wildfire risk?

- Model interactions of biophysical and human processes
- Understand what **plausible alternative futures** lie ahead




Thank You!
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