# Corporate Climate Change Vulnerability, Resource Dependence, and Corporate Environmental Performance: A Longitudinal Study in the U.S. Ski Resort Industry

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# Goals of the study

- **Corporate climate change adaptation** is concerned with firm responses to the ecological form of climate change and the vulnerability it creates

- **Goal of study:**

Assess Corporate Climate Change Vulnerability – Corporate Environmental Performance (CEP) relationship

- Context: industry that is dependent on renewable natural resources (already vulnerable)
- Adding "inside-out" perspective to study of climate change adaptations
- Extending resource dependence theory to account *natural* resource dependence

# Climate change as an ecological threat to firms

- Corporate climate change vulnerability a form of risk and uncertainty from firms' **ecological** environments (IPCC, 2001)
  - Vulnerability – product of exposure and sensitivity to the phenomenon (Adger, 2005; Hoffman et al., 2009)
- Renewable natural resource industries particularly vulnerable
  - They depend on natural capital, stable climate stimuli (Nitkin, Foster and Medayle, 2009)
- Vulnerability a result of firm dependence on its biophysical environment, climate change creates uncertainty associated ecosystem functioning, provisioning of resource
- Apparently, a problem of **(natural) resource dependence**
  - In this case, direct resource dependence on, and caused by, natural environment

# Adaptation options and ecological impacts

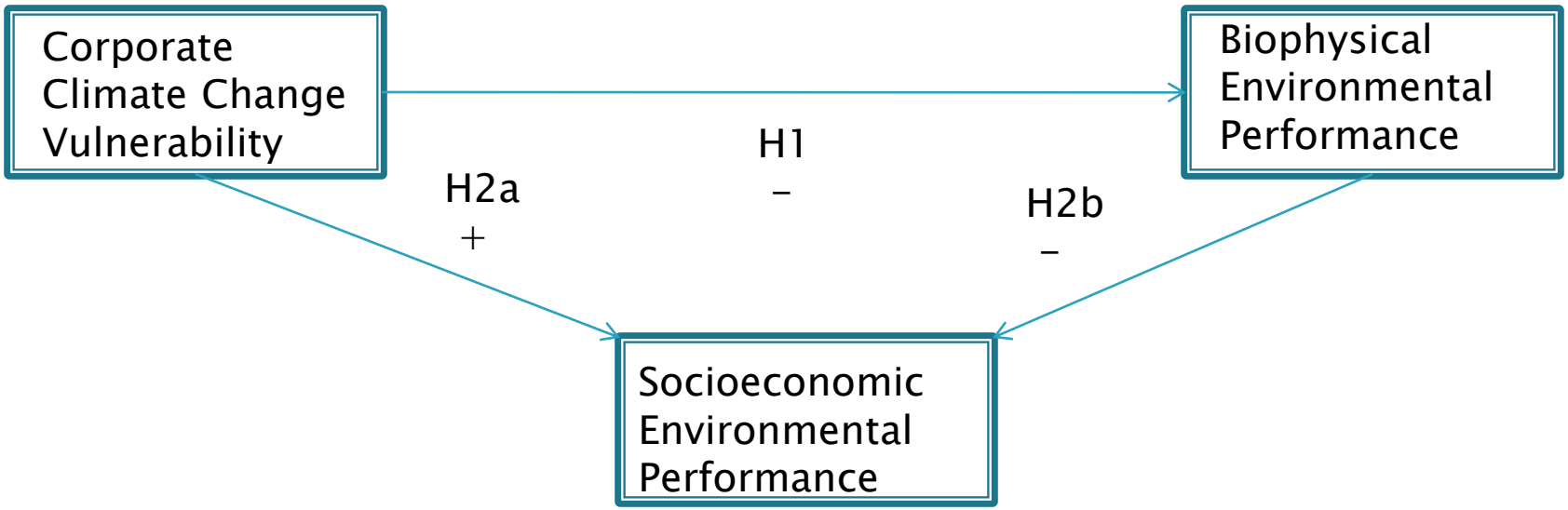
- Adaptation options? Firms cannot stop climate change, but they can manipulate ecosystems containing threatened resources

- …AND, ecosystem services from biophysical environment can help firm adapt

  - Biophysical environment unique, valuable
  - Contains ecosystem services that can buffer, substitute threatened resources
  - Supports new competencies that are not vulnerable to climate change
  - Consuming ecosystem services under direct firm control is often cheap

- Unfortunately, ecosystem service consumption can perturb the ecosystems that provision them

# Conceptual model



# Methods: Population, sample, data

- Population and Sample: The U.S. Ski Resort Industry
  - Between 57-76 firms between 2001-2009; 612 firm-year observations

- Data sources:

Independent Variable

  - (NOAA) NWS weather station networks (climate)[1]

Dependent Variables

  - Ski Area Citizen's Coalition (SACC) (environmental performance data)

1. Weather stations matched to ski areas selected were each within 10 miles of ski area, within elevation range of resort and at least 500 vertical feet above the ski area base.

# Methods: Independent variable

**Corporate Climate Change Vulnerability**
**(the joint pressures of exposure and sensitivity)**

*Interaction of **exposure** and **sensitivity***

- **Exposure**: annual rate of **change** in firms' average annual winter snowpack depth

- **Sensitivity**: measured as the average annual winter snowpack depth for the firm
- Both measures centered

1. Change in snowpack depth has used been used as the focal climate measure in winter studies of the climate change vulnerability [illegible]ecological systems (e.g. Band, MacKay, Creed, Semkin and Jeffries (1996), Hauer, Baron, Campbell, Fausch, Hofstet[illegible]avesly, Leavitt, Mcknight, and Stanford (1997) and Taylor (1995)).

# Methods: Dependent variables

**Biophysical Environmental Performance**: Standardized sum of six SACC ratings:

(i) maintaining existing area within the existing footprint;
(ii) protecting threatened and endangered species;
(iii) protecting wildlife habitats;
(iv) preserving environmentally sensitive areas;
(v) conserving water; and,
(vi) protecting water quality

**Socioeconomic Environmental Performance**: Standardized sum of five SACC ratings:

(i) renewable energy and energy efficiency;
(ii) transportation;
(iii) waste stream management;
(iv) purchasing;
(v) community sustainability

# Methods

## Panel Corrected Standard Errors (PCSE) Regression

- Suitable for time-series cross sectional data
- Corrects intra-panel correlation, inter-panel correlation, and/or inter-panel heteroskedasticity
- Works by adjusting variance-covariance matrix after OLS so that covariances consistent across panels and time periods

## Baron and Kenny's Procedure for Uncovering Mediation through Regression Analysis

# Results for H1

**Results of PCSE Regression of Biophysical Environmental Performance[a]**

| Variables | | |
|---|---|---|
| Intercept | 0.48 | |
| Membership in the Sustainable Slopes Program | -0.12 | |
| Baseline Size (Acres) | 0.00 | ** |
| Age | 0.01 | ** |
| Distance to Airport with Jet Service | 0.00 | * |
| Population within 75 Mile Radius[b] | -0.04 | *** |
| Number of Ski Areas within 75 Mile Radius | -0.02 | *** |
| Number of National Parks with 75 Mile Radius | -0.11 | *** |
| Public Land Dummy[c] | 0.11 | |
| Private Land Dummy[c] | 0.24 | * |
| Ownership by Horizontally Integrated Firm | 0.16 | ** |
| Ownership by Public Company[d] | -0.23 | |
| Ownership by Private Company[d] | 0.48 | * |
| State Environmentalism | 9.11 | *** |
| Exposure | -0.12 | *** |
| Sensitivity | 5.18 | *** |
| **Vulnerability (Exposure x Sensitivity)** | **-4.19** | *** |
| Wald $\chi^2$ | 845.30 | *** |
| $R^2$ | 0.34 | |
| $\Delta R^2$ | 0.02 | |

[a] n=612 observations for 76 firms
[b] Logarithm
[c] The reference group is Mixed Public and Private Land
[d] The reference group is Ownership by Non-Profit Organization.
* $p < .10$, ** $p < .05$, *** $p < .01$

# Results for H2a,b

**Results of PCSE Regression of Socioeconomic Environmental Performance[a]**

| Variables | | | | |
|---|---|---|---|---|
| Intercept | 1.58 | * | 1.58 | ** |
| Membership in the Sustainable Slopes Program | 0.20 | * | 0.19 | |
| Baseline Size (Acres) | 0.00 | | 0.00 | |
| Age | 0.01 | ** | 0.01 | *** |
| Distance to Airport with Jet Service | 0.00 | | 0.00 | |
| Population within 75 Mile Radius[b] | -0.19 | ** | -0.19 | *** |
| Number of Ski Areas within 75 Mile Radius | 0.01 | | 0.01 | |
| Number of National Parks with 75 Mile Radius | 0.09 | *** | 0.08 | *** |
| Public Land Dummy[c] | -0.07 | | -0.06 | |
| Private Land Dummy[c] | 0.27 | | 0.28 | |
| Ownership by Horizontally Integrated Firm | 0.15 | | 0.17 | |
| Ownership by Public Company[d] | -0.15 | | -0.15 | |
| Ownership by Private Company[d] | -0.06 | | -0.01 | |
| State Environmentalism | 6.28 | * | 6.59 | * |
| Exposure | 0.16 | *** | 0.15 | *** |
| Sensitivity | -7.80 | *** | -7.38 | *** |
| ***Biophysical Environmental Performance*** | | | ***-0.08*** | ***** |
| **Vulnerability (Exposure x Sensitivity)** | **6.55** | ******* | **6.21** | ******* |
| Wald $\chi^2$ | 344.43 | *** | 165.36 | *** |
| $R^2$ | 0.10 | | 0.10 | |
| $\Delta R^2$ | 0.02 | | 0.02 | |

[a] n=612 observations for 76 firms

[b] Logarithm

[c] The reference group is Mixed Public and Private Land

[d] The reference group is Ownership by Non-Profit Organization.

* $p < .10$, ** $p < .05$, *** $p < .01$

# Interpretation

- Support for H1: support for theory that climate change induces adaptations that harm firm's biophysical environment
- Support for H2a but not H2b: something other than legitimacy uncertainty inducing better Socioeconomic Environmental Performance
- New theory:

Interaction of industry norms and firm level attention (due to threat of climate change) associated with better Socioeconomic Environmental Performance?

# Implications

- For OT/Sustainability scholars, extends resource dependence theory by accounting for uniqueness of natural resource dependence
  - Tests a theory that explains direct firm-dependence on the natural environment

- For climate change adaptations scholars
  - Applying an outside-in (and inside-out) theoretical perspective
  - Measuring and modeling climate change vulnerability at firm level

- For policy makers and practitioners, suggestive of need for policy prescriptions; a role for sustainable innovation

# Limitations

- Climate measures may not capture timeframe that affects strategy
- Sample may not reflect population
- Findings not be generalizable beyond renewable natural resource industries
- One industry study

# Future research

- Repeat study in different renewable natural resource based industry with different ecological, regulatory and technological constraints
- Conduct study in that assesses socioeconomic influences on vulnerability – environmental performance relationships
- Develop theory explaining indirect climate change vulnerability – environmental performance relationship (i.e. how does biophysical vulnerability alter independence within organizational fields?)

# Thank you!

# References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