TOWARDS A VERMONT RESILIENCY MATRIX?

VERMONT CLIMATE COUNCIL
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CHRISTOPHER KOLIBA, PH.D.
PROFESSOR, COMMUNITY DEVELOPMENT & APPLIED ECONOMICS
DIRECTOR, UVM OFFICE OF ENGAGEMENT
ASSOCIATE DIRECTOR, VT EPSCOR
GUND FELLOW
Sources of today’s content:

• VT EPSCoR’s Research on Adaptation to Climate Change (RACC) and Basin Resilience to Extreme Events (BREE)

• PA 317 Systems Analysis for Community Resiliency / Certificate of Graduate Study in Community Resilience and Planning

• International Joint Commission (ICJ) Lake Champlain Richelieu River Flood Reference

• Economic Resilience Assessment Roundtables
New publication results in important impacts for Vermont floodplains:...

BREE Graduate Research Assistant Jesse Gourreivitch and Ecological Systems Team Member Beverley Wemple, PhD are among the authors on a new paper, “Improving flood hazard datasets using a low-complexity, probabilistic floodplain mapping approach.” The article, whose authors also include Rebecca Diehl, PhD of the UVM Department of Geography and Stephanie Drago of the UVM Rubenstein School of...

https://epscor.w3.uvm.edu/#data
Regional Downscaled Climate Model Dashboard – under construction

Sliders:
- GCMs
- RCPs
- Temperature
- Precipitation

Contributors: B. Beckage, J. Winter, P. Clemins, E. Clark
Regional Downscaled Climate Model Dashboard – under construction

- Days above 90 degrees F
- First/last frost
- Drought indices

Contributors: B. Beckage, J. Winter, P. Clemins, E. Clark
What is resilient?

- Resilient ecosystems
- Resilient people
- Resilient places (rural, urban, social ecological systems)
- Resilient things (infrastructure)
- Resilient organizations and institutions (governments, NGOs, businesses)
- Resilient communities
INTERCONNECTIVITY OF THE NATURAL, BUILT, & SOCIAL SYSTEM

NATURAL
- Soil
- Watershed
- Topography

SOCIAL
- Social capital
- Governance institutions
- Policy tools
- Human behavior

BUILT
- Roads & bridges
- Drainage systems

“HOT SPOTS” and connectivity caused by extreme events

Land use decisions

Investment decisions

Ecological and structural vulnerabilities

Resiliency & optimization goals

Climate change induced extreme events
What does it mean to be resilient? (it’s a tricky question)

- **Ecological**: “... the capacity of a system to experience shocks while **retaining essentially the same function**, structure, feedbacks, and therefore identity”

- **Social-ecological**: “...the ability of a system to **cope** with a disturbance, responding, or **reorganizing** to anticipated or past events...”

- **Disaster**: “... the measure of a system’s, or part of a system’s, capacity to **absorb** and **recover** from the occurrence of a hazardous event”

- **Urban**: “... the ability of a city or urban system to **withstand** a wide array of shocks and stresses, and return to normal...”

- **Community**: “... the existence, development and engagement of community resources by community members to thrive in an environment characterized by change, **uncertainty**, unpredictability and **surprise**”

ELEMENTS OF RESILENCY CAPACITY BUILDING

- Community connectedness
- Risk and vulnerability
- Available resources
- Planning and procedures

Resilience
THE COMMUNITY RESILIENCY RECOVERY CURVE(S)

Service Capacity

High

Prior-state

Shock

Recovery

Time

COIVD-19 Pandemic

Opportunity Gaps for Vulnerable Populations/Industries

"Resiliency Dividend"

The K-Shaped Recovery

(A1)

(B)

(A2)
Social Vulnerability

- Part of understanding resilience/absorptive capacity of a community
  - Geospatial analysis of census data
- Helps to target resources to areas of greatest impact
- Social vulnerability indicators
  - Social Sensibility Score
    - Sensitive populations
    - Precarious situation
    - Limited Resources
City of Burlington, VT

- Sensitive populations
  - Vulnerable age groups
  - Percentage of households that have children
  - Individuals inactive in labor market
  - Individuals living alone

- Useful for flood hazards
  - In the response phase

SOURCE: Thayer, 2020
City of Burlington, VT

- Precarious situations
  - Single parent families
  - Rental/tenant status households
  - Households spending >30% of income on housing costs
  - Households with <$30,000 annual income
  - Unemployment rate

- Useful for flood hazards
  - In the recovery phase

SOURCE: Thayer, 2020
City of Burlington, VT

- **Limited Resources**
  - Houses built prior to 1960
  - Percentage of individuals 25+ without a high school diploma
  - Percentage of households receiving social assistance
  - Median value of housing
  - Median household income

- **Useful for flood hazards**
  - In the mitigation phase

SOURCE: Thayer, 2020
LCRR BASIN FLOOD HAZARD SOCIAL-ECOLOGICAL SYSTEM

SOCIAL, POLITICAL & ECONOMIC SYSTEM

hydR-o-ecoLOGICAL SYSTEM

THEME 1: Structural

THEME 2: Wetland preservation

THEME 4: Flood Maps, Models and Simulations

THEME 4: Policy tools (land use; insurance)

THEME 3: Forecasts / Early Warning

THEME 3: Coordinated responses

FLOOD MITIGATION

FLOOD RESPONSE & RECOVERY

Individuals

Institutions

Preferences: Decision Criteria

Preferences: Decision Criteria

SOCIAL-ECOLOGICAL SYSTEM

HYDRO-ECOLOGICAL SYSTEM
Frequency of Flood Hazard Mitigation Measures

In VT and NY State Hazard Mitigation Plans &

In Lake Champlain Adjacent VT Towns & NY Counties

SOURCE: Thayer, 2020
Type of Approach of Flood Mitigation Actions

SOURCE: Thayer, 2020
Why Resilient Rural Communities?

• We invest in rural America to protect and restore the environment.
• We invest in rural America to produce high-quality, de-commodified food and fiber.
• We invest in rural America as a laboratory of social innovation.
• We invest in rural America to produce healthy, well-educated future citizens.
• We invest in rural America to maintain population distribution and prevent urban overcrowding. (Stauber, 2001, P.60)
Goals and Questions of Roundtables

1. Defining Success

Observation:
There is a “Vermont way” of defining successful community economic development.

Research Questions:
• What is the relationship between economic impact and other indicators of community health and well-being?
• What performance metrics should guide strategic investments?

1.2 Helping Vermont’s rural economy compete in a post-pandemic world

Observation:
Vermont is one of the most rural states with regions that are struggling to build a thriving economy after the pandemic.

Research Questions:
• What are the highest priority post-pandemic economic and community development initiatives?
• How can rural Vermont innovate economic development efforts to accelerate recovery?
• How has the pandemic highlighted emerging needs and opportunities?
**ROUNDTABLE RESULTS: Key Challenges**

<table>
<thead>
<tr>
<th>Lack of Adequate Workforce</th>
<th>Lack of Social Equity, Cultural Diversity, and Inclusivity Stifles Economic Development and Innovation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leads to High Levels of Job Vacancies</td>
<td>Low Levels of Public and Private Investment, Levels of Risk and Patient Capital within Rural Communities Challenges Innovation</td>
</tr>
<tr>
<td>Cost of Universal Early Childcare and Preschool Places Burdens on Working Parents, and Provides Inequitable Starts for Young Vermonters</td>
<td>Poor Broadband Access Hinders Vermonters’ Abilities to Work and Learn from Home, and Limits the Capacities of Small Rural Businesses</td>
</tr>
<tr>
<td>The Emerging “Digital Economy” is Leaving Rural Communities Behind</td>
<td>Educational Systems are Not Sufficiently Designed for Preparing Young People to Find Meaningful and Well-Paying Career Pathways</td>
</tr>
<tr>
<td>Vermont's Aging Rural Population</td>
<td>Churally Poor Housing and Commercial Property Availability Limits Population Growth and Creates Inequitable Access to Affordable Housing</td>
</tr>
<tr>
<td>Lack of Access to Healthcare and Poor Health Outcomes for Rural Communities and Low-Income Households</td>
<td>Lacking and/or Aging Infrastructure for Town Centers Serves as a Limiting Factor for Sustainable Growth</td>
</tr>
<tr>
<td>High Transportation Costs and Inadequate Public Transportation Infrastructure Hamper Vermont’s Affordability</td>
<td>Threatened Working Landscapes and Waterways Compromises One of Vermont’s Greatest Virtues</td>
</tr>
<tr>
<td>High Economic and Environmental Costs of Heating and Cooling Hamper Vermont’s Affordability</td>
<td>Gaps in Coordination and Governance Built to Address Prior Conditions Are Not Well Suited to Address Existing Conditions</td>
</tr>
</tbody>
</table>
### ROUNDTABLE RESULTS: Key Opportunities

<table>
<thead>
<tr>
<th>Blue</th>
<th>Focus on Racial Equity, and Building Inclusion and Belonging Communities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Blue</td>
<td>Invest in a Skilled Workforce</td>
</tr>
<tr>
<td>Green</td>
<td>Appreciate the Role of the Nonprofit Sector as a Critical Feature of the Vermont Economy</td>
</tr>
<tr>
<td>Green</td>
<td>Invest in Childcare, Preschool, and Education</td>
</tr>
<tr>
<td>Green</td>
<td>Leverage Vermont’s Quality of Life as a Critical Feature in Jobs Attraction</td>
</tr>
<tr>
<td>Red</td>
<td>Promote and Sustain a Remote Workforce While Maintaining Thriving Town Centers</td>
</tr>
<tr>
<td>Red</td>
<td>Invest in Broadband, Housing, Transportation, Water, and Energy Infrastructure</td>
</tr>
<tr>
<td>Red</td>
<td>Pursue a Collective Impact Approach to Economic and Workforce Development Rooted in Social Equity</td>
</tr>
</tbody>
</table>
Figure 5. Broadband Availability by E911 Building. Retrieved from Vermont Department of Public Service.
Integrated Assessment Modeling: Projecting Land Use

(Source: Tsai et al., 2015)
Nebraska regions also are compared with peers on five indexes of economic conditions:

**Demographic Growth & Renewal Index**
Measures long-run population growth, dependency ratio, median age, millennial and Gen Z balance change and population diversity. See Table 4 on page 9 and Appendix 4 online.

**Education & Skill Index**
Measures high school, community college and 4-year college attainment, labor force participation and employment in knowledge-based occupations. See Table 5 on page 10 and Appendix 5 online.

**Infrastructure & Cost of Doing Business Index**
Measures access to broadband, interstate highways and 4-year colleges as well as wage rates, marginal income tax rates and the presence of opportunity zones. See Table 6 on page 10 and Appendix 6 online.

**Quality of Life Index**
Measures the appeal of living and working in a region including commute times, age of housing stock, relative wage rates, public safety, climate amenities, access to healthcare and national parks. See Table 7 on page 11 and Appendix 7 online.

**Social Capital Index**
Measures involvement with volunteer organizations, programs to build the community environment, and voter participation. See Table 8 on page 11 and Appendix 8 online.
Table 1  Multifunctionality and global indicators (selection) of well- and poorly developed economic, social and environmental capital

<table>
<thead>
<tr>
<th>Multifunctionality of rural communities</th>
<th>Economic capital</th>
<th>Weathy developed capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly developed capital</td>
<td></td>
<td></td>
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<tr>
<td>• Economic well-being</td>
<td></td>
<td>• Poverty/debt</td>
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<tr>
<td>• Diversified income streams</td>
<td></td>
<td>• Over-dependency on agricultural production</td>
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<td>(e.g. phararmcivity)</td>
<td></td>
<td>• Poor infrastructure</td>
</tr>
<tr>
<td>• Low dependency on external funds</td>
<td></td>
<td>• High dependency on external funding (e.g. subsidies, remittances from abroad) (?)</td>
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<tr>
<td>(e.g. agricultural subsidies)</td>
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<td>• Community is not imports of food</td>
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<tr>
<td>• Multifunctional businesses</td>
<td></td>
<td>• etc.</td>
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<tr>
<td>• Integration into global capitalist system (?)</td>
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<td>• Happiness (?)</td>
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<td>• etc.</td>
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<tr>
<td>• Close interaction between rural people (tight-knit communities)</td>
<td></td>
<td>• Outmigration of young people (giving of rural communities)</td>
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<tr>
<td>• Availability of skills training and education</td>
<td></td>
<td>• Servitude</td>
</tr>
<tr>
<td>• Good health and sanitation</td>
<td></td>
<td>• Lack of leadership</td>
</tr>
<tr>
<td>• Multifunctional services</td>
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<td>• Lack of control over destiny of rural community</td>
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<td>• Good communication between stakeholder groups</td>
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<td>• High death rates and low life expectancy</td>
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<td>• Female empowerment/empowerment of ethnic minorities in rural areas (?)</td>
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<td>• Strong governance structures at multiple geographical scales (democratic participation)</td>
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<td>Strongly developed capital</td>
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<td>• High levels of biodiversity</td>
<td></td>
<td>• Soil degradation</td>
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<td>• Good water quality and availability</td>
<td></td>
<td>• Desertification</td>
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<tr>
<td>• Sustainable soil management</td>
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<td>• Salinization</td>
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Source: author; afterPretty (1995); Parrwell (2007); Van Hayzenbroek et al. (2007); Now et al. (2008); Chaskin (2008); Cutter et al. (2008); Rigg et al. (2009).
Considerations:

Is there an interest/desire to develop a Vermont resiliency matrix?