

Town of Harvard

Community Resilience Building Workshop
Summary of Findings
June 2019

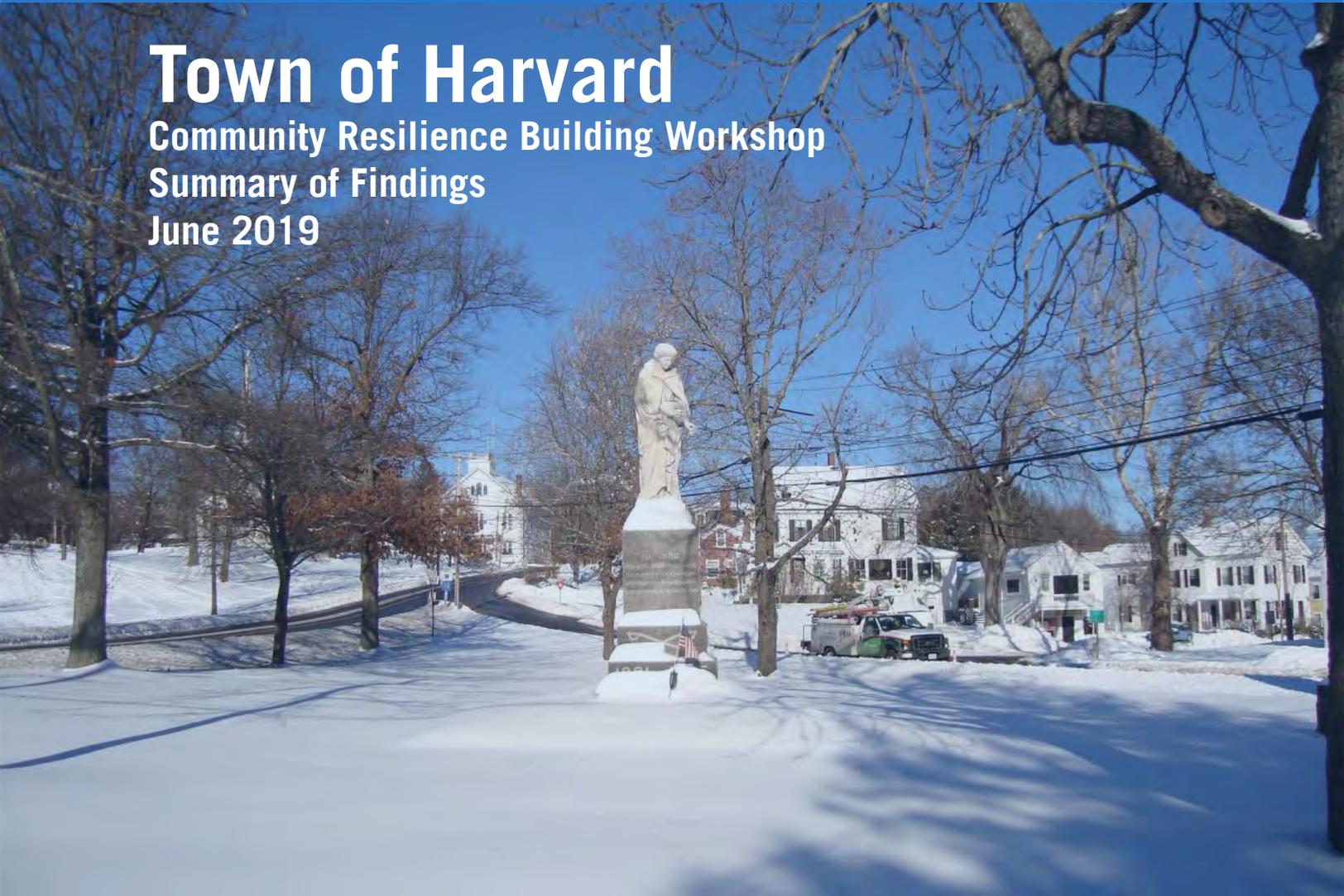


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RECOMMENDED CITATION

Town of Harvard. (2019). Community Resilience Building Workshop Summary of Findings. Harriman. Harvard, Massachusetts.

OVERVIEW

Governor Baker signed Executive Order 569 (EO 569) *Establishing an Integrated Climate Change Strategy for the Commonwealth* in September 2016. EO 569 included components for the Secretary of Energy and Environmental Affairs and the Secretary of Public Safety to “establish a framework for each City and Town in the Commonwealth to assess its vulnerability to climate change and extreme weather events, and to identify adaptation options for its assets” and “provide technical assistance to Cities and Towns to complete vulnerability assessments, identify adaptation strategies, and begin implementation of these strategies.” The Massachusetts Executive Office of Energy and Environmental Affairs (EEA) subsequently developed the Municipal Vulnerability Preparedness (MVP) program, designed to provide support for municipalities to begin planning for climate change resiliency and implementing priority projects.

This process requires a community to define for itself those priority projects that will help it adapt to or mitigate the impacts of climate change. EEA is posting the completed reports from each community on their website; the reports from the 2017-2018 grant round can be found here: <https://www.mass.gov/service-details/2017-2018-mvp-planning-reports>. This website will become a database of the priorities by region and across the state as a whole.

Harvard’s MVP process identified a strong desire to understand best practices for implementation across the state. As the EEA continues to compile reports from communities and begins to fund specific resiliency strategies, adding information to resilientMA.org on best practices for specific adaption or mitigation strategies that have been implemented in Massachusetts is a critical resource for communities with limited resources in terms of funding sources and time, both staff and volunteer.

COMMUNITY NEED

Harvard is experiencing increasingly more unpredictable and severe weather that can potentially cause damage to the community, and, in particular, its economic base and history as an agricultural community. In recognition of the need to plan for future climate change and extreme weather events, Harvard applied for, and was awarded, a \$35,000 grant from the MVP program to complete an assessment and develop a resiliency plan using the Community Resilience Building (CRB) Framework (www.communityresiliencebuilding.com). The two CRB workshops and this Summary of Findings were prepared according to the CRB process and report template. The Town retained Harriman, a design and engineering firm, to facilitate the overall MVP process. Daniel Cooley, Professor of Plant Pathology at the Stockbridge School of Agriculture at the University of Massachusetts-Amherst, joined the team for the survey, workshops, and report focused on the impacts of climate change

on agriculture. The Harriman team included a State-certified MVP provider who oversaw the planning and workshop facilitation during the CRB process.

PREPARATION FOR WORKSHOPS

A Core Group was established for this planning process:

- Christopher Ryan, Director of Community and Economic Development
- Liz Allard, Land Use Administrator/Conservation Agent
- Kara McGuire Minar, Select Board
- Sharon McCarthy, Board of Health
- Eric Broadbent, Harvard Energy Advisory Committee (HEAC)
- Kerri Green, Agricultural Advisory Commission
- Justin Brown, Planning Board
- Jarrett Rushmore, Planning Board

The Core Group and Harriman held a kick-off meeting during the initial stages of the planning process to discuss previous planning efforts, characterize preliminary hazards and areas of concern, and begin to develop a list of key stakeholders to invite to participate in the CRB workshops. Discussions also included logistics of the workshops, including the invitation process and format of the half-day workshops.

To prepare workshop materials, the Core Group and Harriman reviewed various resources and publications, including:

- *Massachusetts State Hazard Mitigation and Climate Adaptation Plan* (2018), Massachusetts Emergency Management Authority and the Executive Office of Energy and Environmental Affairs
- *State of the Climate* (2018), National Oceanic and Atmospheric Administration (NOAA)
- *NOAA Technical Report NESDIS 149-MA* (2017), North Carolina Institute for Climate Studies
- *Massachusetts Climate Change Projections* (2017), Massachusetts Executive Office of Energy and Environmental Affairs
- *Montachusett Region Natural Hazard Mitigation Plan 2015 Update* (2015), Montachusett Regional Planning Commission
- *Town of Harvard Open Space and Recreation Plan* (2016), Town of Harvard

WORKSHOP PROCESS

As an agricultural and residential community, Harvard is faced with a unique set of challenges and impacts related to climate change. For this reason, the Town sponsored two half-day agricultural workshops on February 2, 2019 and March 9, 2019 to focus specifically on these issues. These were followed by two three-hour CRB workshops on Thursday,

April 11, 2019, and Thursday, April 25, 2019, which addressed the broader impacts of climate change on Harvard outside of the agriculture industry. All workshops were held at Harvard Town Hall. The agendas, handouts, and presentations for the two CRB workshops are included in *Appendix B: Workshop Agendas and Presentations*. The goals of the workshops were to:

- Define top local, natural, and climate-related hazards of concern
- Identify existing and future strengths and vulnerabilities
- Develop prioritized actions for the community
- Identify immediate opportunities to collaboratively advance actions to increase resilience

AGRICULTURAL WORKSHOP #1

The first agricultural workshop, held on February 2, 2019, focused on characterizing Harvard's hazards and identifying their vulnerabilities and strengths. The workshop began with a presentation by Harriman which introduced the Core Group and facilitators and then went on to provide an overview of the MVP program and the Agricultural and CRB Workshop processes, followed by an



AGRICULTURAL WORKSHOP #1

overview of climate change. The presentation also reviewed recent climate events within the United States, climate projections for Massachusetts, and climate projections and potential impacts on Harvard. At this point, consultant team member Daniel Cooley, Professor of Plant Pathology at the University of Massachusetts Amherst, gave a presentation on the relationship between climate change and agriculture in Harvard. The information about the impacts of climate change on agriculture in the Northeast as currently understood included data on current and projected extremes in rainfall and precipitation. Professor Cooley then discussed the Harvard Agricultural Survey which provided specific data on the agricultural industry in Harvard. The survey polled Harvard farmers on how climate change has already impacted their businesses and their concerns for the future. After summarizing this information, Harriman introduced the workshop activities.

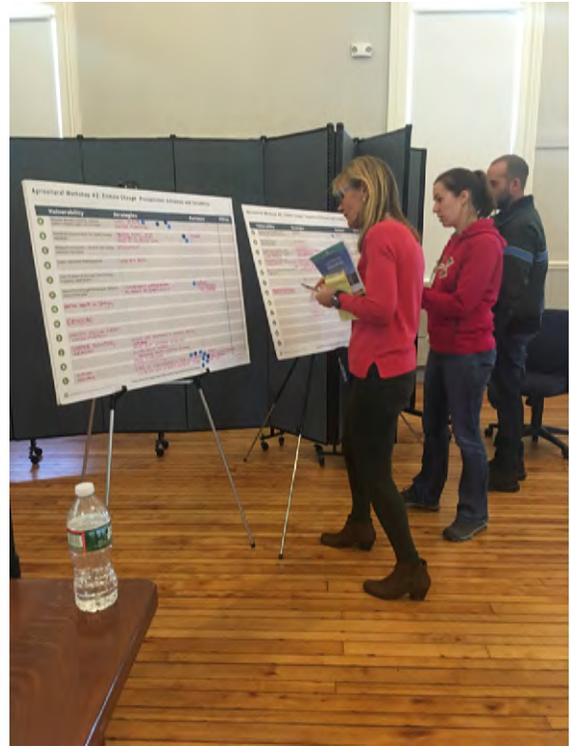
The participants were asked to brainstorm past, current, and future hazards related to agriculture and climate change in Harvard. The workshop participants formed three small groups for focused discussions. Participants were asked to characterize their top four priority hazards in Harvard and identify community vulnerabilities and strengths of Harvard's

infrastructural, societal, and environmental features. Each group filled in the corresponding portion of the CRB Risk Matrix after identifying the priority hazards and community features.

The groups were also asked to identify and map the community vulnerabilities and strengths using the two base maps, one which showed water and FEMA flood zones and the other which showed agricultural properties (see *Appendix C Community Resilience Building Workshop Participatory Mapping* for the results). Workshop participants reunited in a large group and a representative from each small group reported a brief summary of their group's discussion, top priority hazards, and community vulnerabilities and strengths.

AGRICULTURAL WORKSHOP #2

The second agricultural workshop was held on March 9, 2019 and focused on prioritizing strategies for climate change mitigation and adaptation. The workshop opened with a presentation by Harriman which provided overviews of the MVP process and climate change, concepts related to risk and risk management, a summary of the first agricultural workshop as well as the farmer interviews that took place afterward. There was a pause in the presentation to allow participants an opportunity to add to the list of vulnerabilities that was generated at the first workshop. After that, Professor Cooley gave a presentation on climate change mitigation and agriculture in Harvard which provided information and resources



AGRICULTURAL WORKSHOP #2

on potential adaptation strategies, tactics, and tools related to agriculture, precipitation variability and extremes with a focus on soil health, an overview of irrigation, an erosion case study, temperature variability and extremes including frost and heat, growing-season length, and chilling, challenges in pest management, and planning specific adaptation tactics.

Following the presentations, participants broke into small focus groups for continued discussion. Matrices were provided with the first column, “vulnerabilities,” completed with the identified vulnerabilities from the prior workshop. The focus groups then discussed

and filled in the “strategies” and “partners” columns for each vulnerability. There were separate matrices for temperature, precipitation, economic/market, regulatory, and other. After the matrices were filled out, each person was given five sticker dots to place on the strategies that they felt should be given the highest priority. The following discussion questions guided the prioritization of the strategies:

- Vulnerabilities: How are you vulnerable to these pressures?
- Strategies: How could you mitigate/adapt to these pressures?
- Partners: Whose help do you need and what is that help?
- Prioritize: What are the five most important strategies to you?

The workshop concluded with each group reporting back the strategies that got the most votes for prioritization. The data, analysis, results, and recommendations from the Agricultural Workshops are presented in a companion report: *The Impact of Climate Change on Agriculture: Harvard Massachusetts*.

CRB WORKSHOP #1

The first CRB Workshop focused on characterizing the Town’s top hazards and determining if identified community features were strengths, vulnerabilities, or both, given the potential effects of the identified hazards. The workshop on April 11, 2019 began with an overview by Harriman of the workshop’s agenda, introduced the Core Group and facilitators, and described the MVP program and the CRB



CRB WORKSHOP #1

workshop process. The presentation also reviewed recent climate events within the United States, climate projections for Massachusetts, and climate projections and potential impacts on Harvard. Finally, the presentation concluded with the hazards in Harvard identified during the Agricultural Workshops and introduced the small group exercises.

Participants then brainstormed additional priority hazards and voted on the top four. After this, the attendees divided into two groups and were asked to identify community vulnerabilities and strengths of Harvard’s infrastructural, societal, and environmental fea-

tures. Feedback was used to fill in the corresponding portion of the CRB Risk Matrix after identifying the priority hazards and community features.

Each group was also asked to identify and map the community vulnerabilities and strengths using the base maps (base maps are in *Appendix A: Preparatory Information* and the results are in *Appendix C: Community Resilience Building Workshop Participatory Mapping*). The two groups reunited into a single group and a representative of each small group reported a brief summary of their group's discussion and community vulnerabilities and strengths. Harriman wrapped up the workshop by presenting a brief preview of the second CRB workshop.

The input from this workshop has been incorporated into *Top Hazards, Areas of Concern, Specific Categories of Concerns and Challenges*, and *Current Strengths and Assets* below.

CRB WORKSHOP #2

Workshop #2 focused on building upon the findings of Workshop #1 to develop action steps the Town can take to be more resilient to the projected impacts of climate change. The workshop on April 25, 2019 began with a review of Workshop #1's findings and an overview of Workshop #2. The presentation included a brief review of climate change and the impacts on the region around



CRB WORKSHOP #2

Harvard, and then provided examples of actions identified by other towns participating in the MVP program for each of the categories: infrastructural, societal, and environmental, as well as information about MVP action grants. Participants were asked to briefly review the top four priority hazards and community vulnerabilities and strengths in Harvard from the first CRB Workshop. Attendees divided into three groups by interest: Infrastructural, Societal, and Environmental. The matrices were partially completed with the strengths and vulnerabilities identified in CRB Workshop #1. Each group identified actions to address community vulnerabilities and reinforce strengths and time-frames to address those actions.

The small groups reunited into a single group. Each person was given four sticker dots and asked to place a dot next to their top priority action items, based on the top four priorities identified by the small groups. Facilitators then concluded the workshop describing next

steps for the MVP process and the community. The results of this workshop are provided in *Top Recommendations to Improve Resilience*.

PUBLIC LISTENING SESSION

The findings from the workshops were presented to the public at a listening session on May 30, 2019. A copy of the public notice is included in Appendix E. The listening session preceded the Third Annual Town of Harvard Environmental Forum. Topics at the forum included how to reduce the Town's carbon footprint and the need to consider the environmental impacts of Town activities and decisions. To encourage participation and celebrate the end of the planning process, the meeting was catered by Sorrento's Pizza.



LISTENING SESSION

Chris Ryan and Eric Broadbent presented the MVP process and results on behalf of the Town and the MVP Core Committee. Attendees at the Listening Session participated fully in the questions and answer period that followed; those questions and responses are summarized in Appendix E.

TOP HAZARDS AND VULNERABLE AREAS

PROJECTED IMPACTS

When scientists talked about global warming in the 1990s, they focused on the average annual global temperature and sea level rise. Scientists now have more data, better computational models, and better observations to record and analyze the most significant effects of climate change. Wildfires, hurricanes and associated extreme rainfalls, flooding, drought, and heat waves have all worsened due to climate change, in addition to the increase in global temperatures and sea level rise.

Public health is also being affected; the Centers for Disease Control and Prevention (CDC) has found that illnesses from mosquito, tick, and flea bites more than tripled in the United States from 2004-2016. New disease vectors are possible from newly invasive species, such as the Asian long-horned tick – the first invasive tick in the United States in approximately 80 years.

The Town of Harvard, like many communities in Massachusetts, has already been impacted by and is expected to face further impacts from two major changes: the shift from more heating days to more cooling days and the increase in the intensity of precipitation events. Some of the impacts include the following:

- Services the Town needs to provide to its residents, such as cooling shelters for those who cannot cool their homes, increased public health awareness and prevention, and emergency services during and after storm events
- The viability of agriculture, part of the Town’s economic base, which faces threats from drought, variable temperatures during a single season, and pest activity
- The future of significant natural resources such as ponds, wetlands, and forests that are threatened by storm damage, drought, invasive pets and plants, and diseases

The presentations during CRB Workshops 1 and 2 reviewed recent climate events within the United States, climate impacts within Massachusetts, and climate projections and potential impacts on Harvard. For example, data for Massachusetts from *NOAA Technical Report NESDIS 149-MA* (2017) show average annual temperatures increased almost 3°F between 1900-2014 and the number of days when the maximum temperature was above 90°F has been consistently above average since the 1990s. The report also noted that all precipitation metrics (e.g., observed extreme precipitation events) have been highest during the most recent decade of data (2005–2014).

Data from the Massachusetts Executive Office of Energy and Environmental Affairs’ clearinghouse of climate science maps, data, documents (resilientMA.org) was also presented during CRB Workshop #1. ResilientMA provides climate projections from the Northeast Climate Adaptation Science Center. Downscaled to the level of major watershed basins, these projections provide a more focused look at what specific municipalities may experience in the future. The Nashua Basin is composed of 32 municipalities, including the majority of the land area in Harvard. Some key projections for the Nashua Basin include:

Average, maximum, and minimum temperatures are expected to increase

- Seasonally, maximum summer and fall temperatures are expected to see the highest projected increase
- Days with daily maximum temperatures over 90°F are expected to increase
- Days with daily minimum temperatures below 32°F are expected to decrease

	Baseline (1971-2000)	Mid-century (2050s)	End of Century (2090s)
Average annual temperature (°F)	46.8°F	+ 3.0 to 6.4°F	+ 3.9 to 11.0°F
Annual days max temperature >90°F	4 days	9 to 30 more days	13 to 70 more days
Annual days min temperature <32°F	156 days	19 to 38 fewer days	23 to 64 fewer days

Source: resilientMA.org, 2018

Precipitation will be more variable

- “Extreme” precipitation events are likely to occur more frequently. Extreme weather includes blizzards, nor’easters, and hurricanes. According to resilientma.org, the Commonwealth’s clearinghouse of climate data, the trend of more intense thunderstorms and downpours in the Northeast is likely to continue
- Winter is expected to see the greatest change in precipitation (increase 2-22% by 2050s, increase 6-39% by 2090s)
- Given projected increase in average temperatures, this precipitation is more likely to be rain
- Snow is likely to be wetter and heavier
- Fall and summer are expected to continue to have the most consecutive dry days



SNOW ON THE SMALL TOWN COMMON
CREDIT: TOWN OF HARVARD

CRB Workshop #1 also reviewed the following hazards previously identified in the *Montachusett Region Natural Hazard Mitigation Plan 2015 Update*:

- A high risk for heavy rain, snow melt, high winds, nor’easters, heavy snow, and wildfire.
- A moderate risk for hurricanes, tornadoes, severe thunderstorms, ice storms, blizzards, drought, and extreme temperatures.

Hazards identified at recently held agricultural workshops:

- High and low temperatures, and too much or too little precipitation.

Hazards identified by participants who filled out an online survey:

- High temperatures and heat waves, temperature fluctuations, drought, high winds, and soil and water contamination by salts and other contaminants.

TOP HAZARDS

In CRB Workshop #1, the large group identified the following hazards in Harvard within the context provided by the presentation on potential impacts of climate change and the hazards identified in the Agricultural Workshops. The original hazards were as follows:

- Flooding
- Large storm events
- Wind
- Ice storms
- Pests/invasive species
- Drought

- Extreme temperature/ temperature swings (from the Agricultural Workshops)
- Extreme Precipitation (from the Agricultural Workshops)
- Sea Level Rise (e.g. migration)
- Extreme thunderstorms
- Tornadoes
- Extreme heat
- Wildfire

Of these identified hazards, the four (4) priority hazards were:

- Pests/Invasive Species (8 votes)
- Extreme Precipitation (7 votes)
- Extreme Temperatures and Temperature Swings (6 votes)
- Ice Storms (6 votes)

See *Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions* for the results of this discussion. *Current Concerns And Challenges Presented by Hazards and Climate Change* provides more information about the impact of recent hazards in Harvard.

AREAS OF CONCERN

The identified hazards will impact much of Harvard, given the broad distribution of natural ecosystems and agricultural lands adjacent to residential and other developed spaces. In CRB Workshop #1, the participants identified the following as specific geographic areas and facilities of concern:

- **Environmental** – All public byways and waterways, including trails, roadsides, and Bare Hill Pond
- **Facilities** – All municipal sites including the police station and the Department of Public Works, schools (Hildreth Elementary School and The Bromfield School), the Harvard Library, and the area behind Town Hall
- **Infrastructure** – Town Center Sewer, various culverts (including one off Littleton Road, the recently replaced culvert on Stow Road, and the one between Turner Lane and Willow Road)

The maps from CRB Workshop #1 are included in *Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions* and the vulnerabilities and strengths participants identified are discussed in *Specific Categories of Concerns and Challenges*, and *Current Strengths and Assets*.

CURRENT CONCERNS AND CHALLENGES PRESENTED BY HAZARDS AND CLIMATE CHANGE

The impacts of climate change have already been felt in the Town of Harvard, especially by the agricultural community. The majority of the impacts have been from significant weather events, including power losses from winter storms and agricultural losses from unseasonal temperature swings.

In 2008, the governor of Massachusetts declared a state of emergency following an ice-storm that devastated northern Worcester county. Many residents in the southern part of Harvard lost their power for over a week after the December storm as a result of fallen trees and downed limbs. The loss of electricity was minor in the northern part of Harvard which is served by a transmission line originating in Ayer.

In 2016, temperature swings went unnoticed by most in Massachusetts, but for Harvard had a devastating impact on the agricultural economy. This weather event, or in this case series of events, is a textbook example of the types of weather changes that are expected to become more frequent and less predictable as climate change worsens. Milder-than-usual temperatures in early February encouraged peaches to bud early. Then, around February 14, the temperatures swung dramatically to reach near-record-lows. This frost killed all of the early peach buds, decimating what some estimated to be 99% of the peach crop in Massachusetts that year, an event that came to be known as



2008 ICE STORM
CREDIT: ROCHELLE GREAYER, PITH AND VIGOR



2008 ICE STORM
CREDIT: ROCHELLE GREAYER, PITH AND VIGOR



FRANK W. CARLSON FINDS NO SURVIVING PEACHES ON
HIS 25-ACRE FARM
CREDIT: THE BOSTON GLOBE - JONATHAN WIGGS

“The Valentine’s Day Massacre.” Massachusetts produced 1,455 tons of peaches in 2015, and almost none in 2016. Plums, nectarines, apricots, and cherries were also impacted. The Connecticut Peach Festival even had to re-brand to a Corn Festival that year. While this type of event is expected to occur more often in the future, many area farmers had never experienced anything like it before this. Diane Ventura, a fifth-generation farmer at Ashley’s Peaches in Acushnet was quoted in the Boston Globe exclaiming that her family hadn’t lost an entire crop in a century of farming.

More recent weather events have been less severe but still posed some serious challenges to the Harvard community. A June hail storm in 2017 damaged the apple crop at Carlson and Westward Orchards, as well as some of the blueberry crop at Westward. A 2018 snow-storm brought record-low temperatures, high winds, and drifting snow forcing schools and town buildings to shut down for two days.

As recently as this year (2019) the fire department had to respond to several reports of fallen trees on utility wires following the February 25 wind storm. This storm also led to the explosion of a transformer in Ayer which caused wide-spread power-outages leaving around 2,000 homes in the dark. This was the worst power-failure since the 2008 storm.

SPECIFIC CATEGORIES OF CONCERNS AND CHALLENGES

The small groups discussed specific infrastructural, societal, and environmental concerns and challenges during the workshop. Some of the specific concerns were characterized as vulnerabilities, though some were considered both vulnerabilities and strengths depending on the hazard or impact. A full listing of vulnerabilities is found in the CRB risk matrices in *Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions*.

INFRASTRUCTURAL

Climate change can have significant impacts on infrastructure, causing wear and tear above normal levels or actually destroying important assets. Continual maintenance and replacement can be a drain on municipal budgets. Meanwhile, critical infrastructure, such as major roads or utilities, can create public safety hazards when impaired.

However, infrastructure, particularly green infrastructure, can be an important mitigation or adaptation resource. Properly designed stormwater management systems can help clean water runoff before it reaches surface water or drinking water supplies. Wetlands can act as flood storage, buffering uplands from the impact of more intense precipitation events. The following sections discuss some of the concerns related to Harvard’s infrastructure in terms of climate change as identified by the participants in CRB Workshop #1.

STORMWATER MANAGEMENT

Several features related to stormwater management were identified as vulnerabilities in the Town of Harvard. In an effort to manage invasive plant species in the pond, the Bare Hill Pond Watershed Management Committee has been periodically conducting drawdowns of the pond since 2002. Drawdowns have ranged in depth from 1.5' in 2002, to as high as 7' in 2011, when more depth was needed for a beach excavation project. In 2013, the pond was left alone to see if a lower drawdown frequency would work, but there was a minor resurgence of some invasives. The impacts of climate change could have a major impact on this method of invasive species control. In order to conduct a drawdown, ideal conditions are consistently cold consecutive days with little rain or snow, which will be increasingly unlikely as climate change causes more extreme and less predictable weather.¹ Additionally, the dam system is in need of higher capacity for storm-water detention and drainage in general. Other identified vulnerabilities related to storm-water management are erosion and the runoff of contaminants from nearby properties into the water supply and wetlands, which further compounds the problem of invasive species growth.

MUNICIPAL SERVICES

The lack of designated cooling and warming shelters for extreme temperature events is a significant vulnerability for the community. There are air conditioners and generators at the library and the police training room, but neither has the capacity to hold a large number of people if necessary. Participants also noted that the distribution of fire stations and the location of the Department of Public Works (DPW) can limit the capacity for emergency response, especially if major roads are blocked by fallen trees. While Harvard is close to Nashoba Valley Medical Center, Emerson Hospital, and several urgent care centers in neighboring towns, no medical centers are located within the Town. The final major infrastructural vulnerability identified is the utility systems. Power lines are highly susceptible to damage from fallen branches and trees during storm events. Coupled with the inadequate number of alternative power sources (generators and batteries) in Harvard, this has been known to lead to town-wide power failures and road closures.

ROADS

Undersized culverts contribute to flooding by not having the capacity to move enough water during storm events. This compounds many of the issues previously discussed related to storm-water management and could lead to further road closures as a result. Another vulnerability participants identified is the degradation of the paving on the roads town-wide, but particularly on Massachusetts Avenue.

¹ Aquatic Restoration Consulting, LLC. (2017). Bare Hill Pond In-Lake Water Quality and Plant Surveys. Bare Hill Pond Watershed Management Committee, Town of Harvard. Retrieved May 10, 2019

SEPTIC/SEWER SYSTEMS

The Town of Harvard has primarily private septic systems with leach fields and a very limited Town sewer district. This means maintenance is the responsibility of the property owner. Rising ground-water levels and intense precipitation can damage septic tanks and leach fields. Expanding the Town sewer system might be necessary if the Town wishes to add development; such expansion could address failing residential and commercial systems if that becomes an issue.

DEVELOPMENT PATTERNS

Harvard falls within three different watersheds: Nashua, Concord, and Merrimack. As Harvard's residential development is widely distributed and intermingled with undeveloped lands, the environmental impacts of this development will be felt across Harvard's ecosystems. As new buildings are built, the location of that development relative to existing development, town services, and natural resources should be carefully considered to maximize the use of existing infrastructure and minimize the impact on natural resources.

SOCIETAL

A sustainable society is one in which connections are strong and supported by a network of municipal, nonprofit, and volunteer organizations. Goods and services necessary for survival are readily available. Vulnerable populations are identified and considered when planning for disasters and when disasters hit. Public health is integrated into planning both in terms of prevention of disease and reinforcement of healthy behaviors through the design of the environment. The sections below identify societal vulnerabilities identified by the participants in CRB Workshop #1.

EMERGENCY RESPONSE

Vulnerabilities related to emergency response capacity are also discussed as an infrastructural issue under *Municipal Services*. As a societal vulnerability, emergency response issues stem from missed opportunities in communication and regional collaboration. For this reason, it is listed as both a vulnerability and a strength in the community. While there is currently no official comprehensive emergency plan in place, Harvard is well-poised to establish one with the coordination of surrounding municipalities.

STEWARDSHIP

Workshop participants had an interesting discussion about the different attitudes toward stewardship within the community. New families have been attracted by Harvard's school system. As a Right-to-Farm community, agricultural practices are deeply ingrained within Harvard's fabric and identity. Some community members have a deep understanding of

the impacts of their practices on the environment and each other; others may be less aware of how their practices can affect Harvard's ecosystems and agricultural assets. For example, the use of pesticides to manage ticks and mosquitoes impacts all insects, including bees which are vital to the pollination and livelihood of the apple orchards. Other practices include the impact on water quality, which affects all, from over-fertilization of lawns and the use of pesticides. The forests of Harvard are an immense asset, but the lack of a town-wide forest management plan is a further hindrance to collective stewardship efforts.

DEVELOPMENT PATTERNS

Development patterns are discussed as both infrastructural and societal vulnerabilities. A lack of connections between certain roads means that blockages, such as fallen trees or downed power lines, may make certain areas inaccessible during emergencies. Development patterns have contributed to the isolation of certain vulnerable populations within the community, such as the elderly, the young, and those with limited mobility.

ENVIRONMENTAL

Environment is a large term, but in the context of this discussion, the term “environmental” includes natural resources such as wetlands, bodies of water, and forests. These resources are vulnerable to climate change; for example, pests and diseases can weaken trees, leading to an increased risk of forest fires over a large area or a higher likelihood of power loss from fallen trees on utility lines. However, they are also mitigation factors; those same trees act as carbon sinks and help with cooling during heat waves. The sections below identify the environmental vulnerabilities identified by the participants in CRB Workshop #1.

LAND MANAGEMENT

Many of the identified vulnerabilities associated with the environment pertain to various land management practices. One such vulnerability is the occurrence of abandoned apple trees. When not properly maintained, these trees harbor various diseases and pests which then travel to viable orchards. Forest management, previously discussed as a societal issue, is obviously an environmental one as well. While the forests are a tremendous strength for their ecological services, recreational opportunities, and beautification, the lack of coordinated management practices also make them a vulnerability. Beavers further contribute to forest vulnerability as a species with their own management plan and agenda (to dam and flood a habitat for themselves.) As the architects of the animal world, beavers come into frequent conflict with human efforts. Other land management issues include erosion control and groundwater quality. Poor ground water quality has a detrimental effect on both the agricultural industry and public health.

INSECTS

Disease-bearing insects threaten the health of plants, animals, and humans, leading to public health issues, such as the spread of the West Nile virus and Lyme disease that can spread from the animal population to the human population.

The presence of certain disease-bearing insect populations, such as ticks and mosquitoes, are a vulnerability that is often addressed by spraying pesticides. This creates a reciprocal problem by diminishing the populations of pollinators that are vital to the agriculture industry.

PLANTS

Invasive plant species crowd-out more ecologically-productive native flora. This has been a recurring problem at Bare Hill Pond. The current management strategy is to lower the water level each winter (see the prior discussion under *Infrastructural: Storm-water Management*.) Invasive plant species also occur town-wide, particularly along roadsides.

TREES

There are many vulnerabilities related to trees in Harvard. Forested areas may have trees of a similar age after pastures were reforested, making these areas vulnerable to simultaneous susceptibility to blight, drought, and storm damage. The lack of tree maintenance and blight from pests and diseases contribute to the likelihood of fallen trees and limbs causing power outages and road closures and the possibility of wildfires from dead trees and brush drying out during periods of drought. These issues are all vital to whether or not a forest or wooded area can properly perform as a carbon sink to absorb carbon dioxide from the atmosphere, cleaning the air and performing other vital ecological functions.

CURRENT STRENGTHS AND ASSETS

During CRB Workshop #1, participants identified strengths and assets within Harvard that could help the community mitigate or be more resilient to the impacts of hazards related to climate change and extreme weather events. Some of the strengths were also characterized as vulnerabilities, which were noted in the previous section, depending on the hazard or impact. A full listing of strengths and assets is found in the CRB risk matrices in *Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions*.

- **Private Septic Systems, Town Sewer** – While private septic systems and a limited Town sewer are listed as a hazard, they are also seen as strengths for a number of reasons. The Town's limited sewer district is both an asset and a limitation; future nonresidential development is likely to be clustered in the district making best use of

existing infrastructure. However, the remainder of the Town will remain reliant on septic systems which, if not properly maintained, can have a negative impact on the environment and public health. If properly installed and maintained, septic systems can be a sustainable approach to the Town's sewage needs as there is less need for the additional infrastructure (e.g., pump stations, paving operations, system maintenance) required for a centralized system.

- **Emergency Response Systems** – While Emergency Response and Management is discussed as a vulnerability for its lack of a comprehensive strategy, workshop participants praised Harvard's municipal officials and staff for their inter-departmental communication and coordination. The Town does not yet have a single shelter capable of holding a large population and providing all necessary services, but the generators Harvard does have available at various municipal buildings are a strength. In addition to police and fire departments, the Town of Harvard has a strong volunteer EMT base as well as a snowmobile club capable of reaching an emergency during severe weather.
- **Isolated Population** – The community's isolated population, also identified as a concern, creates a small-town identity that facilitates communication and cooperation. Harvard has a history of active resident volunteerism on numerous local committees and addressing significant community needs. The engaged residents can convey information from the Town to the public and assist neighbors when needed. The Council on Aging was one particular entity identified as a strength for its critical role in connecting the isolated elderly population with the rest of the community.
- **Trees and Forests** – The community of Harvard benefits from extensive tree cover and forested areas. Benefits include carbon sequestration, air filtration, rainwater retention, wildlife habitat, and cooling as a result of the shade provided by the canopy. Aging and ailing trees are listed under vulnerabilities due to their threat to power lines and utilities, especially during weather events. In spite of that risk, trees and forests are also one of Harvard's greatest assets. Not only do Harvard's trees provide vital ecological services, they beautify the environment and lend themselves to Harvard's identity. A further strength is the sense of stewardship that many Harvard residents have for the land and forests, as they understand their ecological and cultural significance.
- **Conservation** – Harvard enjoys extensive conservation areas with maintained trails. The website of the Harvard Conservation Trust (HCT) provides extensive and easily accessible information about the land and trails. The Harvard Conservation Commission and HCT also work closely with the Sudbury Valley Trustees, a collaboration which protects and enhances Harvard's natural resources, including the many wetlands and the critically important Bare Hill Pond Watershed.
- **Communication** – Workshop participants identified the local weekly newspaper (the Harvard Press) and a town e-bulletin board services ("Nextdoor Harvard") as vital avenues for communication and reinforcement of Harvard's identity.

TOP RECOMMENDATIONS TO IMPROVE RESILIENCE

Participants in CRB Workshop #2 focused on developing and prioritizing actions to reduce vulnerabilities and enhance strengths for the infrastructural, societal, and environmental

features identified in CRB Workshop #1. The participants were instructed to consider the following when determining the priority of a given action:

- Funding availability and terms
- Agreement on lingering impacts from recent hazard events
- Necessity for advancing longer-term outcomes
- Contribution towards meeting existing local/regional planning objectives

As is consistent with the CRB methodology, these priorities were based on the expertise of the people invited to participate in the workshops and their familiarity with the impacts of climate change on their areas of responsibility. A list of participants is found in *Acknowledgments*, below.

A full listing of actions, prioritization, and associated time frames is found in the CRB risk matrices in *Appendix D: Harvard Agriculture and Community Resilience Building Workshop Matrices and Top Priority Actions*. Each small group identified their top four priority actions, which were compiled for the large group to vote on their overall top priority action items. The top four actions receiving the most votes are listed as the highest priority, below.

HIGHEST PRIORITY (TOP 3)

Several priorities have been amalgamated into the creation of a Climate Action Plan.

- Create an implementation committee to manage the process of creating and monitor implementation of a comprehensive Climate Action Plan that would include, at minimum, the following planning modules:
 - A town-wide tree/forest management plan that would address trees on public lands and public rights-of-way
 - Land stewardship plan
 - Invasive species planning
 - An agricultural action plan
 - Coordinate emergency management planning with climate change vulnerabilities that includes vulnerable populations and road system interconnectivity
- Establish a Climate Vulnerability Liaison within Town government responsible for capital planning oversight.
- Create an emergency response network and a medical professional network to coordinate professional and volunteer-based emergency and medical response teams. This combined network should include Town public safety departments (police, fire, Board of Health, Council on Aging, DPW), existing or new CERTs (Civilian Emergency Response Teams), and existing volunteer organizations, such as Harvard's Snowmobile Club.

HIGH PRIORITY

- Establish and equip The Bromfield School as a stay-over shelter with a prepared management plan. Establish and equip Hildreth House as a cooling and warming shelter with amenities like phone charging and hot coffee.
- Add more alternative power sources (generators and batteries) to all municipal buildings.
- Strengthen the Town's website for cross-cultural communication, preparation, and coordination.
- Provide opportunities for cross-cultural exchanges to connect disparate groups. Implement public awareness and education programming pertaining to farm success planning.
- Monitor, manage, maintain, and preserve public lands. Educate private land-owners on best practices for collective stewardship.
- Remove invasive plant species from conservation lands and plant native species where ecological edges and buffer zones have been disturbed.
- Provide education in systems-thinking and stewardship (i.e. fertilizers and ecological buffers.)
- Create and implement a comprehensive regional strategy for land stewardship including best practices for bittersweet removal and deer fencing.
- Support the "Pond Committee" who oversees the monitoring and management of Bare Hill Pond.
- Continue and support the work of the Board of Health which provides educational programming pertaining to public health and disease control including tick control methods.
- Provide educational programming on pollinators and pollinator habitat and the impacts of spraying for ticks and mosquitoes on pollinator species.

MODERATE PRIORITY

- Evaluate, design, expand, and upgrade the culvert system and maintain a budget for emergency repairs and replacements.
- Evaluate, plan, and implement an expanded storm-water detention system and maintain a budget for emergency repairs and replacements.
- Adopt a by-law and seek funding for town-wide evaluation and recommendations for improving drainage and storm-water management.
- Plan for expanded emergency response capacity. Improve facilities and implement plans to coordinate the department of public works, fire, and EMT.
- Tamper roads to create crowns for water run-off.
- Implement vegetative buffers along roadsides.
- Improve erosion control.
- Create a shared information base to foster better community understanding.
- Provide educational programming on invasive species.
- Create, identify, and coordinate a "metagroup" of community groups and neighborhood organizations for improved cross-cultural communication.

- Provide education and monitor the proper disposal or conservation of older trees.
- Monitor Bare Hill Pond for algae blooms. Improve and expand infrastructure as needed.
- Provide educational programming on the rhododendron threat, soil health, integrated pest management (IPM), and inter-planting (planting companion plantings to maximize land use, reduce the impacts of disease and pests, and improve soil health).

LOWER PRIORITY

- Evaluate road conditions and secure funding as needed to improve infrastructural resilience.
- Evaluate private septic systems to identify problematic locations. Evaluate the vulnerabilities, advantages, and funding needed to expand the Town sewer system.
- Maintain a budget for shelter supplies.
- Collate strategies for hazards pertaining to settlement patterns in small New England towns.
- Evaluate and improve road connectivity and redundancies through systems planning.
- Include Devens' vulnerable populations in planning efforts.
- Assess and create a plan to connect all vulnerable populations to coordinate emergency response.
- Create and implement a Land Stewardship/Bare Hill Pond and Watershed Plan.
- Improve erosion control through use of silt fencing and hay bales; establish a by-law to enforce.
- Test wells and water sources for contamination, educate the public about risks and best practices for management. Prioritize land around wetlands, ecological buffers, and groundwater resources.
- Aid the Harvard Conservation Trust and the Sudbury Valley Trustees in conserving more land and implementing more public outreach and education.
- Build aquifer cisterns and fire ponds.
- Provide educational programming pertaining to crops and farming in Harvard. Topics to include adjusting crops to the growing season, using Hoop Houses (greenhouses), transitioning to more southern varieties of apples, using nutrient sprays such as Manganese to improve calcium uptake, micro-nutrients, raised plant beds, and smudge pots to prevent frost on small farms.
- Create a community water bank and appoint an agricultural liaison for expert consultations.

ACKNOWLEDGMENTS

Thank you to the Core Group members for planning and facilitating the MVP process:

- Christopher Ryan, Director of Community and Economic Development
- Liz Allard, Land Use Administrator/Conservation Agent

- Kara McGuire Minar, Select Board
- Sharon McCarthy, Board of Health
- Eric Broadbent, Harvard Energy Advisory Committee (HEAC)
- Kerri Green, Agricultural Advisory Commission
- Justin Brown, Planning Board
- Jarrett Rushmore, Planning Board

Special thanks to the Harvard community members and organizations who contributed their time and expertise during the workshops to make this a comprehensive document:

NAME	ORGANIZATION	FARM SIZE	COMMERCIAL / RECREATIONAL	WORKSHOPS ATTENDED
Beth Williams	Council on Aging			KO
C. Ron Ostberg				Ag1/Ag2/CRB1
Chris Ryan	Town/MVP Core			KO/Ag1/Ag2/CRB1/CRB2
David Durrant	Micheldever Farm	5-29.9 acres	Commercial	Ag1
Didi Chadran	Community Preservation Committee			CRB1
Eric Broadbent	HEAC/MVP Core			KO/Ag1/Ag2/CRB1/CRB2
Erin McBee	Planning Board	5-29.9 acres		Ag2
Fran Maiore	Council on Aging			KO
Fred Honchelle		5-29.9 acres	Commercial	Ag1
George Watkins				Ag1/Ag2
Gwen Leonard	Harvard Cons. Trust			CRB1
Jarrett Rushmore	Planning Board/MVP Core			CRB1
Jaye Waldron	Conservation Commission			CRB1/CRB2
Jennifer Finch	Finance Committee			CRB2
Jim Burns	Conservation Commission/ Harvard Maple	0-4.9 acres	Recreational	Ag1
Joan Eliyesil	Harvard Press			Ag1
Justin Brown	Planning Board/ MVP			CRB1
Kerri Green	Agricultural Advisory Committee/MVP Core			KO/Ag1/Ag2/CRB2
Chris Green	Westward Orchard	30+ acres	Commercial	Ag1/Ag2
Laura McGovern	Agricultural Advisory Committee/Dunroven Farm	5-29.9 acres	Commercial	Ag1
Libby Levison	Board of Health	0-4.9 acres	Recreational	Ag1/Ag2
Linda Hoffman	Old Frog Pond Farm	0-4.9 acres	Commercial	Ag2

NAME	ORGANIZATION	FARM SIZE	COMMERCIAL / RECREATIONAL	WORKSHOPS ATTENDED
Liz Allard	Planning Board/ Conservation Commission/ MVP Core			KO/Ag1/Ag2/ CRB1
Matthew Varrell	Harvard Alpaca Ranch	5-29.9 acres	Commercial	Ag1/Ag2
Megan Glen	Pond Committee			CRB1
Molly Cutler	Sudbury Valley Trustees			CRB1
Neil Angus	Devens Enterprise Commission			CRB1
Nicky Schmidt	AAC	0-4.9 acres	Recreational	Ag1/Ag2
Pam Durrant	Micheldever Farm	0-4.9 acres		Ag1
Pam Lawson	Doe Orchards	30+ acres	Commercial	Ag1/CRB2
Pat Natoli	Town/Police/Fire/DPW			KO/CRB2
Rene, Christiane Turnheim		5-29.9 acres	Commercial	Ag1
Rick Sicard	Fire			KO
Rob Traver	Agricultural Advisory Committee	0-4.9 acres	Recreational	Ag1
Sharon McCarthy	Board of Health/MVP Core			KO/CRB1
Stacia Donahue	Planning Board	0-4.9 acres		Ag1/CRB2
Stephanie O'Keefe	Westward Orchard	30+ acres	Commercial	Ag1/Ag2
Sydney Blackwell	Land Stewardship Subcommittee			CRB1
Tim Kilhorr	Department of Public Works			KO/ CRB1
Tom Cotton	Harvard Conservation Trust	30+ acres		Ag1/Ag2/CRB1/ CRB2
Vicky Lochiatto		5-29.9 acres	Commercial	Ag1
Wendy Sisson	Conservation Commission/ Land Stewardship Subcommittee			Ag1/CRB2

*Note: KO = Kick-off Meeting; Ag1 = Agricultural Workshop #1; Ag2 = Agricultural Workshop #2; CRB1 = CRB Workshop #1; CRB2 = CRB Workshop #2.

