

Climate Change, Development, and Nature-based Solutions



**Shaping
the Future
of Your
Community**

April 26, 2018 Concord, MA

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Shaping the Future of Your Community Program

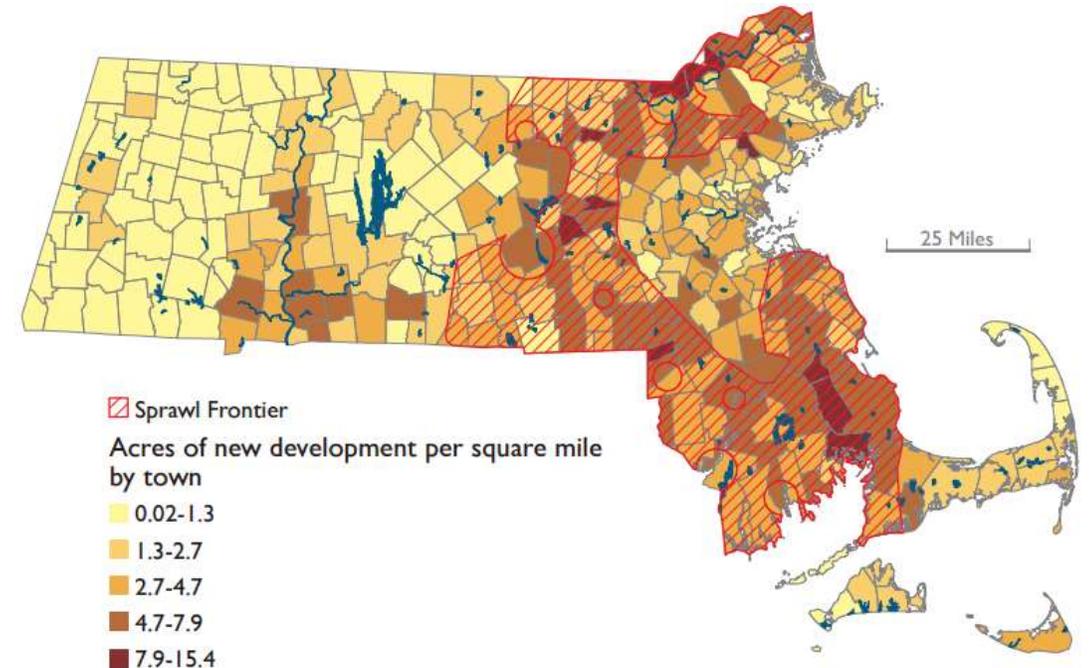
massaudubon.org/shapingthefuture

Shaping the Future of Your Community

- Created in 2009 in response to *Losing Ground*
- Help the fastest-developing communities chart a more **sustainable future** through customized community workshops and direct assistance



Shaping
the Future
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Community



Key changes already observed in Massachusetts.

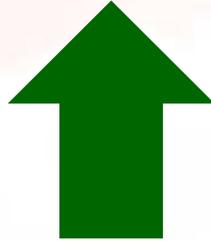
Temperature:



2.9°F

Since 1895

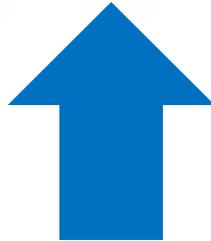
Growing Season:



11 Days

Since 1950

Sea Level Rise:



11 inches

Since 1922

Strong Storms:



55% >precip

Since 1958

What's in a degree?



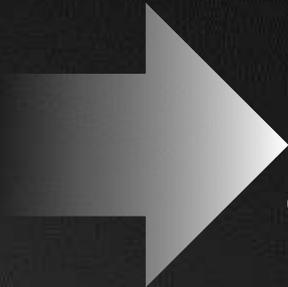
During the last ice age, temperatures were 9°F cooler than today.

**Why do rising temperatures also
bring more precipitation?**



...consider your
morning coffee.

**More
evaporation**



**More
fuel for storms**



**More
precipitation**

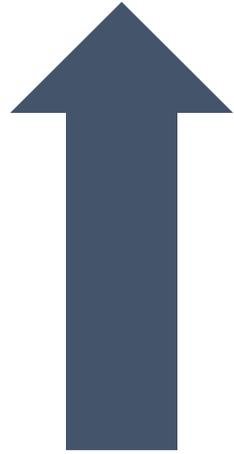
*warmer air holds
more moisture aloft*



**More
Heat**

How Much More Precipitation?

**Total annual precipitation
has increased by:**



15%

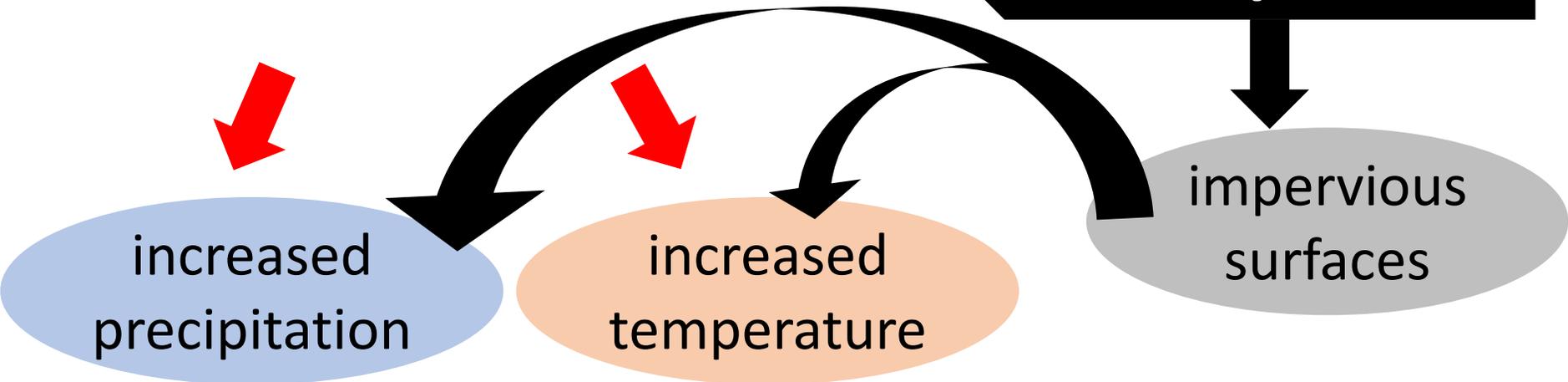
***1.2 trillion more gallons of
water or equivalent snow falling
on Massachusetts each year.***

~9,700 filled Prudential Towers



Climate change

Sprawling Development



stormwater & WQ issues

flooding & infrastructure damage

heat-related illnesses

more cooling shelters



Nature-Based Solutions

Nature-Based Solutions use natural systems, *mimic* natural processes, or *work in tandem with* traditional approaches to address natural hazards like **flooding**, **erosion**, **drought**, and **heat islands**.



**Green
Infrastructure**



**Low Impact
Development (LID)**

Nature based solutions at every scale

Rural, suburban, or urban

Conserve available open space providing ecosystem services



Integrate low impact development (LID) designs into new development at neighborhood scales



Restore resilience in urban areas at site specific scale

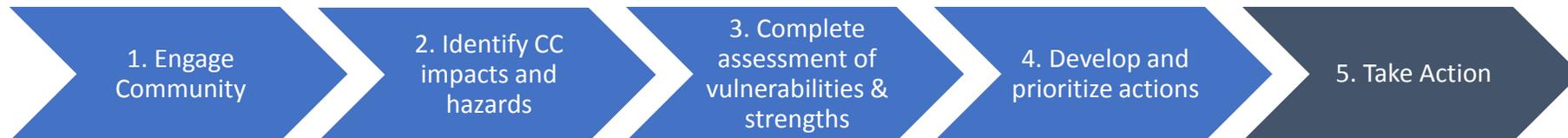




Municipal Vulnerability Preparedness (MVP)



State and local partnership grant to build resiliency to climate change



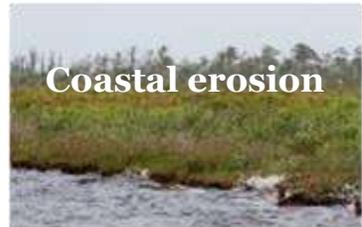
<https://www.mass.gov/municipal-vulnerability-preparedness-mvp-program>

Baker Administration's Support



EO Language:
“...strategies that **conserve and sustainably employ the natural resources** of the Commonwealth to **enhance climate adaptation, build resilience and mitigate climate change...**”

Hazards



Nature-based solutions

Open space preservation

Ecosystem restoration

Low Impact Development

Municipal benefits



Avoided Costs



Enhanced Safety



Environmental Services

Co-benefits

Low Impact Development

Benefit	Reduces Stormwater Runoff				Increases Available Water Supply	Increases Groundwater Recharge	Reduces Salt Use	Reduces Energy Use	Improves Air Quality	Reduces Atmospheric CO ₂	Reduces Urban Heat Island	Improves Community Livability					Improves Habitat	Cultivates Public Education Opportunities
	Reduces Water Treatment Needs	Improves Water Quality	Reduces Grey Infrastructure Needs	Reduces Flooding								Improves Aesthetics	Increases Recreational Opportunity	Reduces Noise Pollution	Improves Community Cohesion	Urban Agriculture		
Practice																		
Green Roofs	●	●	●	●	○	○	○	●	●	●	●	●	◐	●	◐	◐	●	●
Tree Planting	●	●	●	●	○	◐	○	●	●	●	●	●	●	●	●	◐	●	●
Bioretention & Infiltration	●	●	●	●	◐	◐	○	○	●	●	●	●	●	◐	◐	○	●	●
Permeable Pavement	●	●	●	●	○	◐	●	◐	●	●	●	○	○	●	○	○	○	●
Water Harvesting	●	●	●	●	●	◐	○	◐	◐	◐	○	○	○	○	○	○	○	●

Yes
 Maybe
 No

Avoided costs

Land Protection as Water Protection

- Quabbin & Wachusett Reservoirs serve 2.5 million
- Over 20 years, Massachusetts Water Resources Authority spent \$130M to protect 22,000 acres of watershed lands
- Avoided ratepayer cost of \$250M on a filtration plant and \$4M/yr in operations



Avoided Costs

Preserve Services

Massachusetts Forests Mitigate Climate Change

- MA forests **sequester 14%** of the state's gross annual carbon emissions
- Average acre stores **85 tons carbon**
- Capacity **increases** over time as forests mature



**Environmental
Services**

Floodplain Buyout: Woloski Park, Middleborough, MA

- 10 home buyout in Taunton River floodplain
- FEMA's Hazard Mitigation Grant Program funded 75% of ~\$1Million cost
 - 25%: Town and The Nature Conservancy

Benefits:

- Avoided safety risk
- Avoided emergency evacuation and property recovery costs
- High quality habitat is restored, floodplain and ecosystem services recovered



Enhanced Safety



Avoided Costs



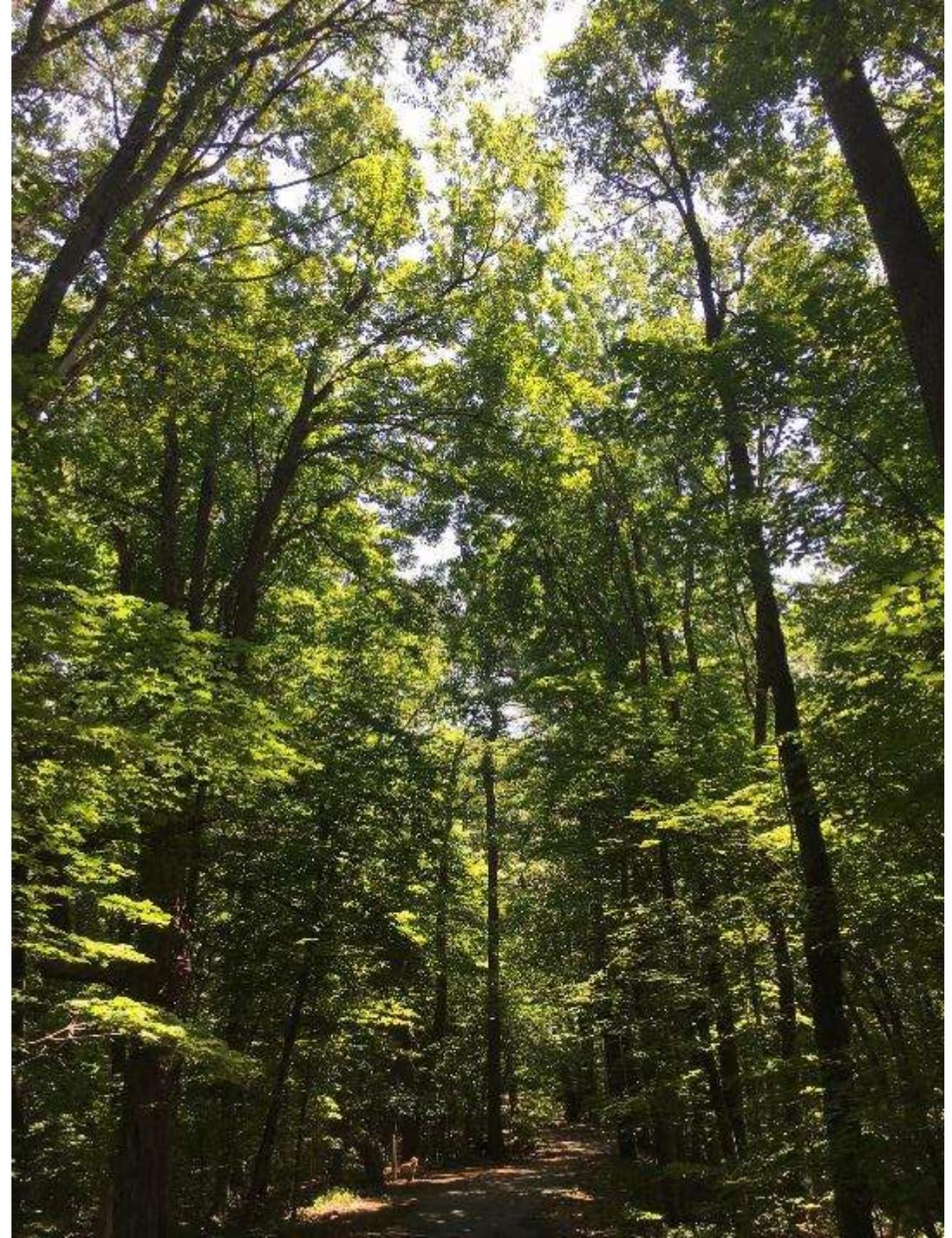
Environmental Services



Return on Investment Studies in MA

Trust for Public Land

- Outdoor recreation generates:
 - \$10 billion in consumer spending
 - \$739 million in state and local tax revenue
 - 90,000 jobs
 - \$3.5 billion in annual wages and salaries
- Agriculture, forestry, commercial fishing, and related activities generate:
 - \$13 billion in output
 - 147,000 MA Jobs
- **Conservation Projects Return \$4 : \$1 spent**



Return on Investment Studies in MA

Dept. Ecological Restoration

DER aquatic restoration projects produce an average employment demand of **12.5 jobs** and **\$1.75 Million** in total economic output from each \$1 Million spent, contributing to a growing “restoration economy” in Massachusetts

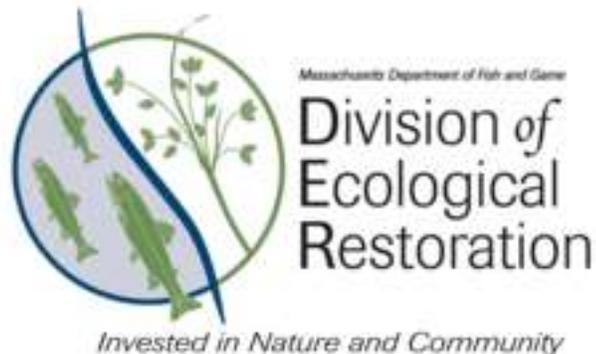


Photo Credits: SRPEDD

Return on Investment Studies Northeast US Scientific Reports

- In Hurricane Sandy, wetlands reduced \$625,000,000 in direct flooding damages in New Jersey
- In New England, wetlands reduce storm damage by approximately 16%



Resources for Nature-Based Solutions

Guidance/Case Studies

- [Naturally Resilient Communities](#) successful project case studies from across the country to help communities learn and identify nature-based solutions
- [EPA's Soak Up the Rain](#) stormwater outreach tools, how-to guides and resources
- [EPA's RAINE](#) database of vulnerability, resilience and adaptation reports, plans and webpages at the state, regional and community level.
- [Climate Action Tool](#) explore adaptation strategies and actions to help maintain healthy, resilient wildlife communities in the face of climate change.

Mapping/Planning

- [Mapping and Prioritizing Parcels for Resilience \(MAPPR\)](#) ID priority parcels for protection and climate change resilience
- [Living Shorelines in New England: State of the Practice](#) and [Profile Pages for Solutions](#) are case studies, siting criteria, and regulatory challenges for coastal resilience in New England.
- [Low Impact Development Fact Sheets](#) cover valuing green infrastructure, conservation design, development techniques, regulations, urban waters, and cost calculations.

Cost/Benefit

- [EPA's Green Infrastructure cost/cost-benefit/tools](#) Database of tools for comparing solution costs
- [Massachusetts Division of Ecological Restoration's](#) economic benefits of aquatic restoration based on MA case studies

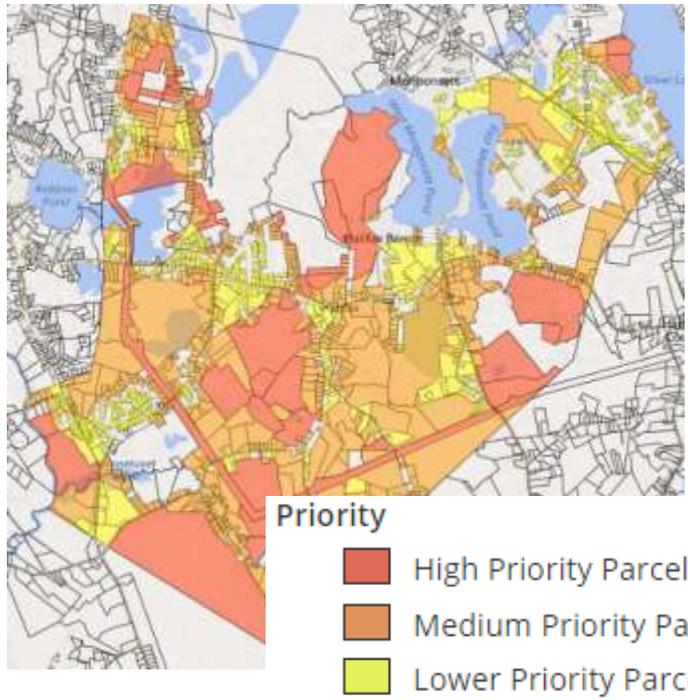
Bylaws/Ordinances

- [EEA's Smart Growth Toolkit](#) access to information on planning, zoning, subdivision, site design, and building construction techniques
- [Guide for Supporting LID in Local Land Use Regulations](#) provides a framework for communities to review their zoning, rules, and regulations for a number of factors.

Nature-based solutions at every scale & resources for every solution

Conserve

MAPPR: Mapping And Prioritizing
Parcels for Resilience
www.massaudubon.org/mappr



Integrate

Tool to review bylaws and encourage NBS:
www.massaudubon.org/lidcost

Factors	Conventional	Better	Best	Community's Zoning
GOAL 1: PROTECT NATURAL RESOURCES AND OPEN SPACE				
Soils managed for revegetation	Not addressed	Limitations on removal from site, and/or requirements for stabilization and revegetation	Prohibit removal of topsoil from site. Requires rototilling and other prep of soils completed during construction	(Not applicable)
Limit clearing, lawn size, require retention or planting of native vegetation/natural seed areas	Not addressed or general qualitative statement not tied to other design standards	Encourage minimization of clearing/grubbing	Require minimization of clearing/grubbing with specific standards	
Require native vegetation and trees	Requires or recommend	Not addressed, or mixture of required plantings of native and nonnative	Require at least 75% native plantings	
GOAL 3: PROMOTE EFFICIENT, COMPACT DEVELOPMENT PATTERNS AND INFILL				
Lot size	Required minimum lot sizes	OSRD/NRPZ preferred. Special permit with incentives to utilize	Flexible with OSRD/NRPZ by right, preferred option	
Setbacks	Required minimum front, side, and rear setbacks	Minimize, allow flexibility	Clear standards that minimize and in some instances eliminate setbacks	
Frontage	Required minimum frontage for each lot/unit	Minimize especially on curved streets and cul-de-sacs	No minimums in some instances, tied into other standards like OSRD design and shared driveways.	
Common driveways	Often not allowed, or strict limitations	Allow for 2-3 residential units	Allow for up to 4 residential units, preferably constructed with permeable pavers or pavement	

Restore

Identify best NBS for you:
www.naturallyresilientcommunities.org

HELP ME CHOOSE

Hazard Types

- Coastal Erosion
- Tidal Flooding
- Coastal Flooding
- Riverine Erosion
- Inverse Flooding
- Stormwater Flooding

Region

- Coastal West
- Great Lakes
- Gulf of Mexico
- Mid-Atlantic
- Midwest
- Northeast
- Pacific Northwest
- Rocky Mountain West
- Southeast
- Southwest

Community Type

- Rural
- Suburban
- Urban

Scale

- Community
- Neighborhood
- Site

Cost

- \$
- \$\$
- \$\$\$
- \$\$\$\$



Open Space Preservation through Land Acquisition

This strategy focuses on the public acquisition of undeveloped land to lessen...



Urban Trees + Forests

Urban forestry is the planned installation and management of trees within an...



Green Streets

Green streets incorporate depressed planted areas, typically located between the roadway pavement...



Floodwater Detention and Retention Basins

A detention basin is an area that has been designed and designated...

Ten things local homeowners & citizens can do

1. Divert your downspouts
2. Plant a rain garden
3. Replace impervious surfaces
4. Adopt a drain – and encourage others to
5. Don't wash your car in the driveway



6. Pick up pet waste
7. Reduce fertilizer and pesticide use
8. Replace lawn with native plants
9. Reduce lawn watering and mowing
10. Pick up leaf litter (compost/dispose of properly)

Thank you!



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