May 15, 2017

CBP Climate Resiliency Workgroup

Work Plan Updates

Cross Goal Climate Resiliency Analysis Matrix Project

- 3-Case Studies (Black Duck/Tidal Wetlands, SAV & Toxic Contaminants)
- Deliverables: Decision-Making Matrices and Implementation Methodologies (3 CBP Planning Levels)
- Workshops/Events
  - Climate-Smart Habitat Restoration Workshops – November, 2016
  - Black Duck/Tidal Wetlands and SAV Webinar - May 31, 2017
  - Toxic Contaminants Steering Committee – May 31, 2017
  - Toxic Contaminants Climate Adaptation Workshop – Summer, 2017
- Project Completion – September, 2017

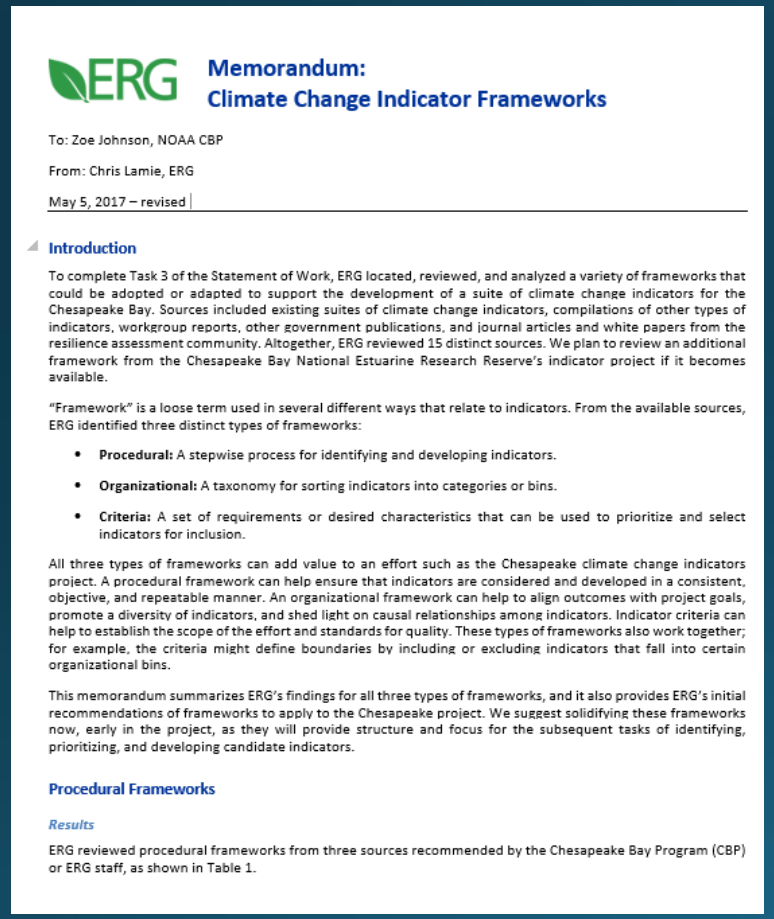
CBP Climate Indicators & Metrics

Status:

- Chesapeake Bay Trust contract awarded to Eastern Research Group
- Project goals: Develop a recommended suite of indicators in 3-categories (trends, impacts and progress) along with development of 1-2 indicators in each category
- Implementation Status:
  - Task 1: Project Kick-Off (completed)
  - Task 2: Work Plan (completed)
  - Task 3: Assess frameworks (nearing completion)
  - Task 4 (underway): Analyze Existing CBP Indicators and Metrics
  - Task 5 (underway): Review Existing Data and Studies
  - Task 6 (underway): Review Monitoring and Tracking Data
  - Task 7: Conduct Participatory Process (July – Sept., 2017)
  - Task 8: Recommend Suite of Indicators (November, 2017)
  - Task 9: Develop Implementation Plan (December, 2017)
  - Task 10: Prepare documentation (Spring, 2018)
  - Task 11: Deliver Draft Report (April , 2018)
  - Task 12: Present Results (June, 2018)
  - **Task 13: Prepare final report (August, 2018)**

Request for CRWG Input

1) Provide feedback on CBP Indicator Criteria



ERG

Memorandum:
Climate Change Indicator Frameworks

To: Zoe Johnson, NOAA CBP

From: Chris Lamie, ERG

May 5, 2017 – revised

Introduction

To complete Task 3 of the Statement of Work, ERG located, reviewed, and analyzed a variety of frameworks that could be adopted or adapted to support the development of a suite of climate change indicators for the Chesapeake Bay. Sources included existing suites of climate change indicators, compilations of other types of indicators, workgroup reports, other government publications, and journal articles and white papers from the resilience assessment community. Altogether, ERG reviewed 15 distinct sources. We plan to review an additional framework from the Chesapeake Bay National Estuarine Research Reserve's indicator project if it becomes available.

"Framework" is a loose term used in several different ways that relate to indicators. From the available sources, ERG identified three distinct types of frameworks:

- **Procedural:** A stepwise process for identifying and developing indicators.
- **Organizational:** A taxonomy for sorting indicators into categories or bins.
- **Criteria:** A set of requirements or desired characteristics that can be used to prioritize and select indicators for inclusion.

All three types of frameworks can add value to an effort such as the Chesapeake climate change indicators project. A procedural framework can help ensure that indicators are considered and developed in a consistent, objective, and repeatable manner. An organizational framework can help to align outcomes with project goals, promote a diversity of indicators, and shed light on causal relationships among indicators. Indicator criteria can help to establish the scope of the effort and standards for quality. These types of frameworks also work together; for example, the criteria might define boundaries by including or excluding indicators that fall into certain organizational bins.

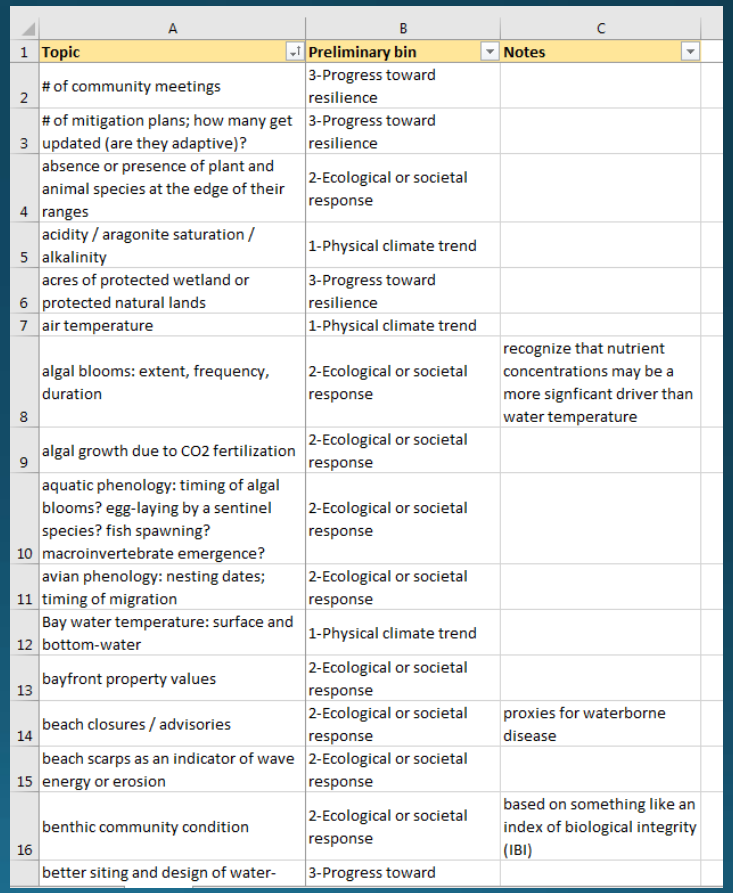
This memorandum summarizes ERG's findings for all three types of frameworks, and it also provides ERG's initial recommendations of frameworks to apply to the Chesapeake project. We suggest solidifying these frameworks now, early in the project, as they will provide structure and focus for the subsequent tasks of identifying, prioritizing, and developing candidate indicators.

Procedural Frameworks

Results

ERG reviewed procedural frameworks from three sources recommended by the Chesapeake Bay Program (CBP) or ERG staff, as shown in Table 1.

2) Add additional topic areas to matrix (particular attention given to "resilience progress" indicators or a proxy for resilience)



	A	B	C
1	**Topic**	**Preliminary bin**	**Notes**
2	# of community meetings	3-Progress toward resilience	
3	# of mitigation plans; how many get updated (are they adaptive)?	3-Progress toward resilience	
4	absence or presence of plant and animal species at the edge of their ranges	2-Ecological or societal response	
5	acidity / aragonite saturation / alkalinity	1-Physical climate trend	
6	acres of protected wetland or protected natural lands	3-Progress toward resilience	
7	air temperature	1-Physical climate trend	
8	algal blooms: extent, frequency, duration	2-Ecological or societal response	recognize that nutrient concentrations may be a more signficant driver than water temperature
9	algal growth due to CO2 fertilization	2-Ecological or societal response	
10	aquatic phenology: timing of algal blooms? egg-laying by a sentinel species? fish spawning? macroinvertebrate emergence?	2-Ecological or societal response	
11	avian phenology: nesting dates; timing of migration	2-Ecological or societal response	
12	Bay water temperature: surface and bottom-water	1-Physical climate trend	
13	bayfront property values	2-Ecological or societal response	
14	beach closures / advisories	2-Ecological or societal response	proxies for waterborne disease
15	beach scarps as an indicator of wave energy or erosion	2-Ecological or societal response	
16	benthic community condition	2-Ecological or societal response	based on something like an index of biological integrity (IBI)
	better siting and design of water-	3-Progress toward	

Key Project Dates

- CRWG – May 15
  - Feedback on draft criteria **(by May 19, 2017)**
  - Request for additional topics/indicators of resilience **(by May 19, 2017)**
- Integrated Monitoring Network Meeting – May 17
  - Solicit input on monitoring data to support indicator development
- STAR Meeting – May 25
  - Solicit input on monitoring data to support indicator development
  - Review draft indicator matrix
  - Inform development of stakeholder engagement process
- CRWG – June 19
  - Review final draft indicator matrix
  - Inform stakeholder engagement process
- CRWG – Sept 18
  - Undertake formal stakeholder engagement process

CRWG Workgroup Members

Individual Work Plan Updates

STAC Workshop: Aligning CBP Climate Monitoring Efforts to Support Adaptive Management

Workshop Goals

- Design a conceptual model of climate impacts on the Oysters, Blue Crab and SAV targeted outcomes;
- Recommend plan for collection and analysis of monitoring data, including spatial and temporal parameters, over the subsequent period of management strategy implementation;
- Identify existing sources of information, how it can be assessed and reported as well as gaps in the monitoring network important for assessing long-terms impacts or ecological response and adaptive management; and
- Prioritize data needs to inform Bay Program monitoring activities.

Preliminary Results

Monitoring Parameter	Blue Crab	Oyster	Submerged Aquatic Vegetation	Commonalities or Overall Ranking
Sea Surface Temp	1	1	1	1
Water Column Temp		1	Not specified	1
Bottom Temp	1	1	Not specified	1
Salinity	1	1	1	1
Wind Stress, Circulation, Currents	1	1	2	1
CO_2	Not specified	1	1	1
Oxygen/ Dissolved Inorganic Carbon	Not specified	1		1
pH	3	1	1	1
Total Alkalinity	Not specified	1	1	1
Water Level Depth Changes	Not specified	Not specified	1	1
Chlorophyll	2	2	Not specified	2
Tropical Storms - Turbidity	2	2	2	2
Precipitation – River Flow	2	2	3	2
Extreme Rain Events – Turbidity/Flow	2	2	3	2
Sea Level Rise	4	3	3	3

Update on Climate Change Components

2017 TMDL Midpoint Assessment

Climate Change & the TMDL
Mid-Point Assessment: 3 Major Components

Assessment Procedures

(PSC Approved)

- Assess how climate change may affect current water quality standards (i.e., nutrient and sediment source loads over time and attainment)
  - Watershed Model
  - WQ Sediment Transport Model

Guiding Principles

(PSC Approved)

- WIP Development
- WIP Implementation

Policy Options

(PSC Consideration)

- Quantitative (Option #2)
- Qualitative (Options #5,6,7)

WQGIT Presentation
(May 8, 2017)

- **Modeling Team presented latest climate change assessment findings**
  - **WORK IN PROGRESS!!** Need to run the analysis on the final Phase 6 Watershed and WQSTM models as well as additional climate scenarios to bound range of possible future conditions.

- **Discussed planned approach for identifying and implementing resilient BMPs**

- **Presented revised language for combining policy options 5-7**
  - Addressing climate change qualitatively in the Phase III WIPs

PSC Approved
Climate Change Assessment Procedures

- Partition the influence of climate change into separate elements:

Watershed (WSM)

- Increased Precipitation
- Increased temperature
- Increased evapotranspiration
- Storm intensity
- **Modeling Results: Influence on watershed flows and loads**

Estuary (WQSTM)

- Increased watershed loads
- Increased estuarine temperatures
- Increased sea level rise
- Loss of tidal wetlands
- **Modeling Results: Influence on water quality standards**

- Run climate change scenarios based on estimated 2025 and 2050 conditions

- Run a range of scenarios to bound the range of uncertainty

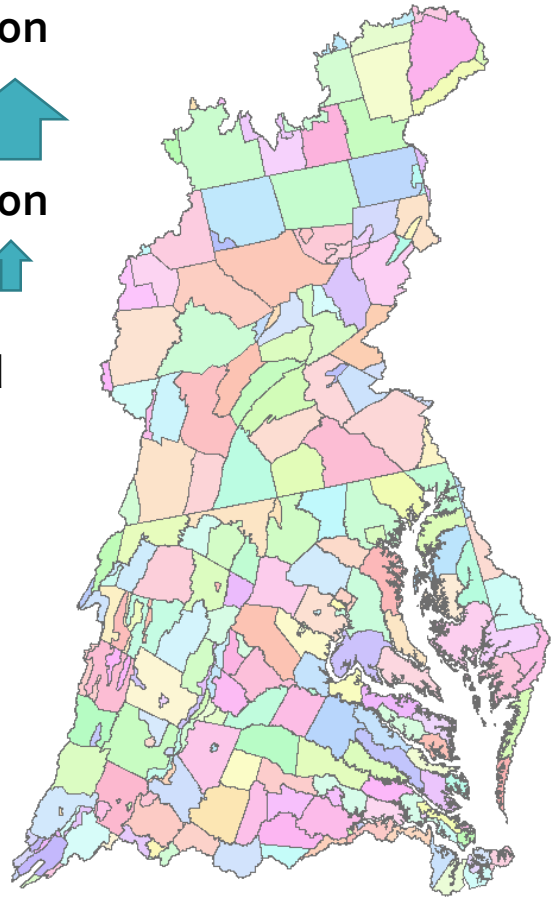
Preliminary Results

In the Watershed

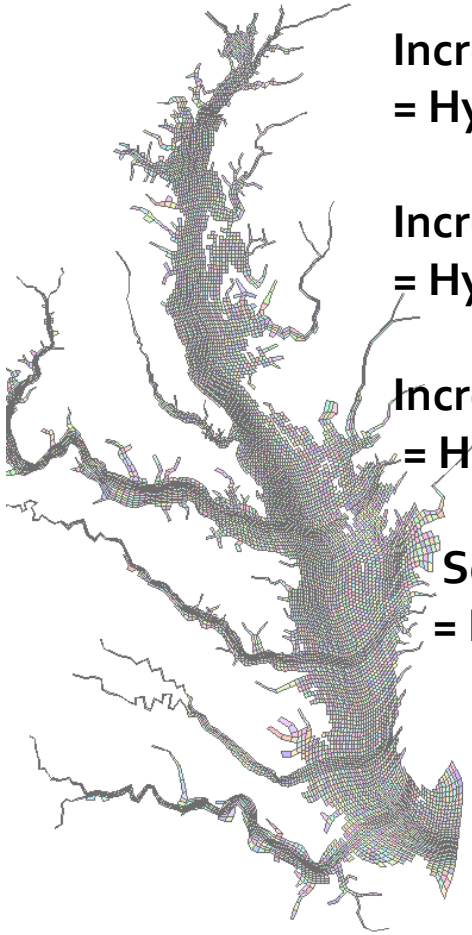
Increased Precipitation Volume = Hypoxia

Increased Precipitation Intensity = Hypoxia

Increase in Temp and Evapotranspiration = Hypoxia



In the Estuary



Increased WS Loads = Hypoxia

Increased WS Flows = Hypoxia

Increased Temperature = Hypoxia

Sea Level Rise = Hypoxia

CRWG SLR Recommendations: Request for additional analysis

- CRWG Recommendations: Apply a plausible range of sea level rise projections for CBWQSTM modeling efforts, with upper and lower limits, for the years 2025 and 2050. Specifically, the CRWG recommended that the following range of sea level rise projections for 2025 (.2 - .4 m) and 2050 (.3-.8 m) be applied in the CBWQSTM.
- Preliminary modeling results were derived based on a 2025 SLR of .3 meters. Additional scenario runs have not been initiated.
- Given the sensitivity of the CBWQSTM to SLR and the conservative methodology to derive 2025 precipitation inputs (based on linear trends); the CRWG has been asked to provide additional guidance on the lower SLR bound.

Site	Background RSL rate (mm/yr)	Background 1995-2025 RSL Estimate (mm)	1995-2025 GMSL rate (mm/yr)	1995-2025 SLR Estimate (cm)
BALTIMORE	1.4	42.0	3.0	13.2
LEWES	1.7	51.9	3.0	14.2
ANNAPOLIS	1.7	49.8	3.0	14.0
WASHINGTON DC	1.4	40.5	3.0	13.1
PORTSMOUTH	2.3	68.4	3.0	15.8
SOLOMON'S ISLAND	1.9	57.0	3.0	14.7
GLOUCESTER POINT	2.0	61.2	3.0	15.1
KIPTOPEKE BEACH	1.8	53.1	3.0	14.3
CAMBRIDGE II	1.7	52.2	3.0	14.2
CHESAPEAKE BAY BR. TUN.	2.2	67.2	3.0	15.7
SEWELLS POINT	2.5	74.4	3.0	16.4

2025 Estimates of Total Sea Level Rise in the Chesapeake Bay

GMSL Scenario: Low

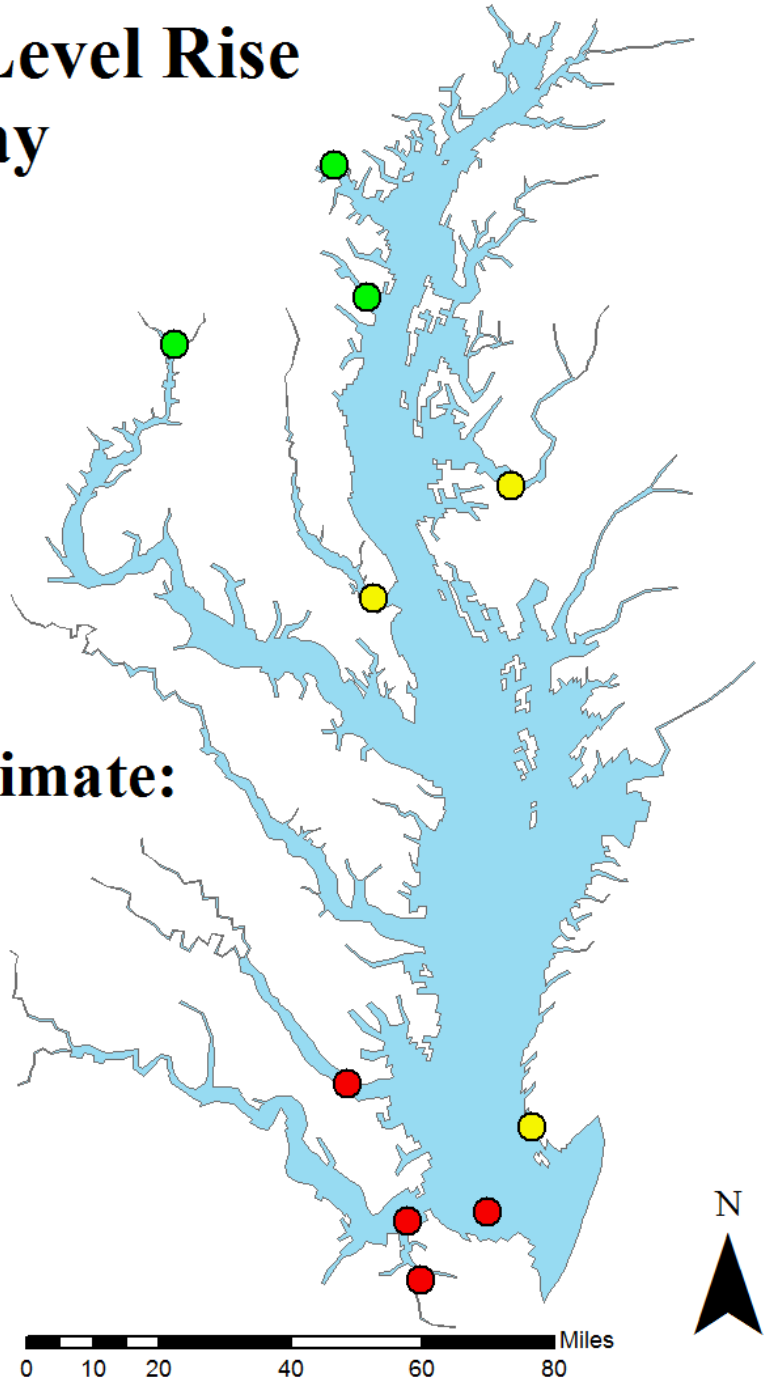
Median Estimates (cm)

1995 - 2025

- 13 - 14
- 14 - 15
- 15 - 16.5

Average SLR Estimate:

14.7 cm



Coordinate System: NAD 1983 UTM Zone 18N
Projection: Transverse Mercator
Datum: North American 1983
False Easting: 500,000.0000
False Northing: 0.0000
Central Meridian: -75.0000
Scale Factor: 0.9996
Latitude Of Origin: 0.0000
Units: Meter

CRWG Recommended Policy Option:

Optimize Phase III WIP Development and Adaptively Manage BMP Implementation

- During the development of Phase III WIPs, jurisdictions will **prioritize BMPs that are more resilient** to future climate impacts over the intended design life of the proposed practices.
- During each two-year milestone development period, jurisdictions will **consider new information on the performance of BMPs and the programs that support them**, including the contribution of seasonal, inter-annual climate variability and weather extremes.
- Jurisdictions will **assess this information and adjust plans to implement their Phase III WIPs to better mitigate anticipated increases** in nitrogen, phosphorus or sediment due to climate change.
- Jurisdictions would **provide a narrative consistent with the Guiding Principles** that describes their programmatic commitments to address climate change in their Phase III WIPs.

What is a "Resilient" BMP?

1) **Assess vulnerability** of BMP's to projected impacts over intended design life
2) **Incorporate** resilient **siting and design principles**
3) **Monitor performance** over-time and adjust implementation, as necessary
4) **Research changes in BMP efficiencies** in response to extreme events or changing conditions.

STAC Workshop (Fall 2017): Monitoring and Assessing Impacts of Changes in Weather Patterns and Extreme Events on BMP Siting and Design

- What are the general principles of BMP siting and design to reduce the vulnerability of urban, agriculture, and coastal BMP's to future impacts of sea level rise, coastal storms, increased temperature, and extreme events?
- How flexible or adaptable are BMPs to anticipated changes in weather patterns and extreme events and what types of adjustments (e.g., retrofits) in BMP design to maintain structural integrity?
- What suite of BMPs are most robust (e.g., mitigate the anticipated increased nitrogen, phosphorus, and sediment loads) to anticipated changes in weather patterns and extreme events?
- What are the remaining gaps and highest priority needs (i.e., research, monitoring measures, programmatic efforts) to address in order to better inform and improve BMP development and implementation?

Resilient BMP's: A call for candidate projects

Objective: Identify one or more "resilient" BMPs within each CB jurisdiction

Purpose: 1) Showcase resilient practices; 2) Share lessons-learned; and 3) Compile information, tools and resources

Project Criteria:

- ✓ Completed or planned projects
- ✓ Coastal and inland practices; Range of practices (urban, agriculture, etc.)
- ✓ Address one or more of the PSC approved "Guiding Principles"
  - Capitalize on "Co-Benefits"
  - Align with existing climate resiliency plans and strategies
  - Account for and integrate planning and consideration of existing stressors
  - Manage for risk and plan for uncertainty
  - Reduce vulnerability to climate or extreme events over the project design life
  - Build in flexibility and adaptability

Information Needs:

- ✓ Brief project description
- ✓ Location
- ✓ Project Contact
- ✓ Photos or project plans (if available)

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Chesapeake Bay Program
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