NOAA Office of Education Environmental Literacy Program

Resilience Education Theory of Change

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Background

This document contains the latest version of NOAA’s Environmental Literacy Program (ELP) Resilience Education Theory of Change. The Resilience Education Theory of Change is a living document that will be updated regularly to reflect progress made by ELP, as well as other contributions to the field of resilience education.

What is a theory of change?

ELP is developing a Resilience Education Theory of Change to communicate the overarching philosophy guiding our grants program. Theories of change, much like logic models, are tools for planning, implementation, and evaluation of an initiative. Theories of change are broad in scope and are typically focused at the program level rather than on an individual project. They communicate the essential components of a program, their relationship to each other, and how they support a long-term goal, focusing more on the “how and why” in the relationships.

Components of a theory of change include a problem statement and an end goal, as well as causal pathways depicting the necessary preconditions, or intermediate outcomes, that must be met in order to achieve the end goal. In our theory of change we have also included organization actions and program intervention to show how NOAA and our program are working to address the challenges laid out in the problem statement. Theories of change typically include an end goal that is idealistic and far-reaching. The end goal we have drafted is large in scope and it cannot be accomplished by NOAA or Environmental Literacy Program alone. Therefore, we have also drafted an intermediate goal that articulates how the NOAA Environmental Literacy Program contributes to the end goal.

We have identified six causal pathways based on the work of our program and the grantees. So far we have developed three causal pathways in detail. The causal pathways (depicted in colored boxes) are nested in relation to the other components of the theory of change, which are shown in the diagrams below. These diagrams can be read from bottom to top as pathways of necessary preconditions, or intermediate outcomes, which must be achieved in order to reach a long-term outcome or end goal. You will note in the first diagram below provides an overview of the theory of change, including our six causal pathways.

We acknowledge that the causal pathways we have identified for our theory of change are not the only means to achieve community resilience through education. Rather, the pathways highlight effective approaches supported by ELP to date.
How did we develop our theory of change?

The most successful and accurate theories of change are created with input from multiple stakeholders at every step of the development process. The resilience education projects funded by ELP were the basis for the theory of change. Published literature in related fields were consulted. Additionally, input was gathered from leadership and staff at NOAA’s Office of Education, program and project evaluators, and NOAA experts in climate resilience and education. Input was also gathered at the 2019 NOAA ELP Resilience Education Grantee Workshop, and again at the August 2019 NOAA Education Council meeting.
Problem Statement

Communities in the United States are facing challenges of not only recovering from extreme weather events and other environmental hazards, but also preparing for a future of more frequent and damaging events caused by climate change (NCEI 2019; Lempert 2018; Weather-ready Nation: NOAA’s National Weather Service Strategic Plan 2019-2022). Climate change threatens human health and safety, the conservation of ecosystems, and social and economic well-being (USGCRP 2018). The geographic distribution of impacts of climate change is uneven, and long-standing socio-economic inequities heighten vulnerabilities for underserved groups. These threats become even greater with the current high rate of greenhouse gas emissions (USGCRP 2018). The severity of future climate impacts will depend largely on national-scale and community-level actions taken to reduce greenhouse gas emissions and to adapt to the changes that will continue to occur.

To prepare for a future of increasing hazards, communities need to implement policies and practices that allow their members, regardless of socioeconomic status, to thrive and be resilient. These policies and practices should be informed by engaged community members and leaders who understand the causes of climate change and its impacts on their own lives now and in the future. Decisions about how to build more resilient and equitable communities must be based on scientific and other forms of knowledge (e.g. traditional and community knowledge), and represent the values of society. Such decisions can lead to more robust policies that will be better accepted by society if they truly reflect the values of society (Bozeman and Sarewitz 2011).

Increasing environmental literacy among community members ensures that they comprehend the complex ways that human and natural systems interact, both globally and locally, and have the required skills and confidence to participate in socio-scientific decision making that informs public policy.

Environmental literacy is the possession of knowledge and understanding of a wide range of environmental concepts, problems, and issues; cognitive and affective dispositions toward the environment; cognitive skills and abilities; and appropriate behavioral strategies to make sound and effective decisions regarding the environment. Environmental literacy includes informed decision making both individually and collectively, and a willingness to act on those decisions in personal and civic life to improve the well-being of other individuals, societies, and the global environment (Hollweg et al. 2011). Environmental literacy exists on a continuum and different levels of it can be attained both individually (Roth 1992) and as a community. It is imperative that all communities achieve a certain level of collective environmental literacy. Education is the primary means for building environmental literacy over time. In the United States, life-long learning among children, youth, and adults occurs through formal K-12 education, higher education, and free-choice learning. Therefore, education plays a critical role in building the environmental literacy necessary for achieving community resilience to climate change.
Nevertheless, despite decades of efforts to educate about climate change, many community members do not prioritize climate change mitigation and adaptation solutions, and this is evident in the lack of political will and civic action to address the issue (Leiserowitz 2019). While there are many reasons for this inaction that are not related to education, most educational approaches to date have been ineffective to inspire change because they have been too focused on the causes, the global scale of the problem, and impacts too distant from the learners (Flora et al. 2014; Leiserowitz et al. 2019). Further, as learners acquire more knowledge about climate change, they are often stifled by feelings of hopelessness and anxiety caused by comprehending the magnitude of the impacts and the complexity of the problem (Doherty and Clayton 2011; Ojala 2012; Clayton, Manning, and Hodge 2014). Together, these challenges call for new approaches to educating for community resilience to climate change.

**Organization Actions**

NOAA focuses on four long-term goals that make important contributions to resilient ecosystems, communities, and economies. These goals include: Climate Adaptation and Mitigation, Weather-ready Nation, Healthy Oceans, and Resilient Coastal Communities and Economies.

**Program Intervention**

In response to the great need throughout the United States, NOAA’s Environmental Literacy Program (ELP) supports the development and strengthening of resilient communities through competitive grants, in-kind support (including NOAA personnel and other scientific assets) and an ELP Resilience Education Community of Practice.

**Causal Pathways**

- **Causal Pathway 1**: ELP Resilience Education Community of Practice Advances Effective Approaches*
- **Causal Pathway 2**: Student-driven Action Projects Implement Resilience Measures*
- **Causal Pathway 3**: Resilience Planning and Policies Integrate Education*
- **Causal Pathway 4**: Social and Active Learning Foster Community Engagement
- **Causal Pathway 5**: Solutions-focused and Place-based Approaches Inspire Hope and Empower Agents of Change
- **Causal Pathway 6**: Students Conduct Field Analyses of Local Environmental Hazards to Reason About Human and Natural Interactions

*These pathways have been developed in detail and are shared below.*
Intermediate Goal

Communities have sufficient collective environmental literacy to take action on climate change mitigation and adaptation policies and practices that build resilience in ways that contribute to community health, social cohesion, and socio-economic equity. These communities are composed of individuals who are supported by formal and informal education that develop their knowledge, skills, and confidence to:

(1) reason about the ways that human and natural systems interact globally and where they live, including the acknowledgement of disproportionately distributed vulnerabilities;

(2) participate in scientific and/or civic processes; and

(3) consider scientific uncertainty, cultural knowledge, and diverse community values in decision making.

Although individuals need not have all these capabilities, collectively these individuals leverage shared environmental literacy toward implementing strategies that build resilience over the short- and long-term.

End Goal

Communities are resilient to current and future environmental hazards in that they have the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment. Environmental literacy—along with community health, civic engagement, social cohesion, and equity—enhance resilience. Stewardship of healthy ecosystems, a low-carbon economy, and climate-smart and inclusive decision making further reduce risks from current and future environmental hazards.

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1 This is adapted from the United States Global Change Research Program definition, which is: "A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment" (USGCRP).
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Resilience Education Theory of Change

Overview of Causal Pathways

Communities are resilient to current and future environmental hazards in that they have the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment. Environmental literacy—along with community health, civic engagement, social cohesion, and equity—enhance resilience. Stewardship of healthy ecosystems, a low-carbon economy, and climate-smart and inclusive decision making further reduce risks from current and future environmental hazards.

Communities have sufficient collective environmental literacy to take action on climate change mitigation and adaptation policies and practices that build resilience in ways that contribute to community health, social cohesion, and socio-economic equity. These communities are comprised of individuals who are supported by formal and informal education that develops their knowledge, skills, and confidence to:

1. Reason about the ways that human and natural systems interact globally and locally and the context of our places, including an understanding of disproportionate burdens on vulnerable communities.
2. Participate in scientific and/or civic processes; and
3. Consider scientific uncertainty, cultural knowledge, and diverse community values in decision making.

Although individuals need not have all these capabilities, collectively these individuals leverage shared environmental literacy toward implementing strategies that build resilience over the short- and long-term.

In response to the great need throughout the U.S., NOAA's Environmental Literacy Program (ELP) supports the development and strengthening of resilient communities through competitive grants, in-kind support (including NOAA personnel and other scientific assets), and an ELP Resilience Education Community of Practice.

NOAA focuses on four long-term goals that make important contributions to resilient ecosystems, communities, and economies. These goals include:
- Climate Adaptation and Mitigation
- Weather-Ready Nation
- Healthy Oceans
- Resilient Coastal Communities and Economies

Problem Statement

- Climate change is a worsening threat and communities are not prepared;
- Some groups are more vulnerable than others;
- Policies and actions that promote adaptation and GHG mitigation are needed; and
- Policies are more robust when they reflect the values of community members and are informed by engaged community members.

Therefore...

- Communities need the skills, knowledge, and confidence to address these challenges (i.e., environmental literacy);
- Education is the way we achieve environmental literacy;
- Civic engagement around climate solutions is insufficient;
- Most education approaches to date have not stimulated action; and
- New education approaches are needed.
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Resilience Education Theory of Change

Causal Pathway 1: ELP Resilience Education Community of Practice Advances Effective Approaches

END GOAL

Communities are resilient to current and future environmental hazards in that they have the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social, economic, and the environment. Environmental literacy—along with community health, civic engagement, social cohesion, and equity—enhance resilience. Stewardship of healthy ecosystems, a low-carbon economy, and climate-smart and inclusive decision making further reduce risks from current and future environmental hazards.

Boundary of ELP’s sphere of influence

INTERMEDIATE GOAL

Communities have sufficient collective environmental literacy to take action on climate change mitigation and adaptation policies and practices that build resilience in ways that contribute to community health, social cohesion, and socio-economic well-being. These communities are comprised of individuals who are supported by formal and informal education that develop their knowledge, skills, and confidence to:

1. Reason about the ways that human and natural systems interact locally and regionally and globally and where they have, including the acknowledgement of disproportionately distributed vulnerabilities;
2. Participate in scientific and/or civic processes; and
3. Consider scientific uncertainty, cultural knowledge, and diverse community values in decision-making.

Although individuals need not have all three capabilities, collectively these individuals leverage shared environmental literacy toward implementing strategies that build resilience over the short- and long-term.

PROGRAM OUTCOME

NOAA’s ELP Resilience Education Community of Practice advances effective environmental education by:

1. Sharing and disseminating approaches identified and used as part of NOAA ELP Resilience Education Community of Practice.
2. Supporting other members of the NOAA ELP Resilience Education Community of Practice to seek the expertise of its members to assist non-education resilience practitioners or professionals.

LONG-TERM OUTCOMES

- Resilience educators who are not funded by ELP are influenced by and use approaches identified by NOAA ELP Resilience Education Community of Practice.
- Other members of the NOAA ELP Resilience Education Community of Practice seek the expertise of its members to assist non-education resilience practitioners.

MID-TERM OUTCOMES

- Future projects are proposed to ELP funding solicitations that represent an amalgamation of approaches from other funded projects or themes.
- Grants used in conjunction with the EPA’s Climate Change Fellowship program to increase the awareness of and access to these approaches to and expand professional audiences.
- Grants used in conjunction with the EPA’s Climate Change Fellowship program to increase the awareness of and access to these approaches.
- Topics emerge from summations of environmental literacy themes incorporated into ELP funding solicitations and addressed through learning opportunities.

SHORT-TERM OUTCOMES

- Effective approaches for resilience emergent and are shared.
- Similitudes of approaches are made evident.
- Effective approaches are incorporated into currently-funded projects and individual projects improve.
- Increased efficiency in adoption of effective approaches for projects and the program.
- Collective needs are continuously identified and attended.
- A community is built that supports its members through peer-to-peer support, leadership, and other resources.

PROJECT INTERVENTION

ELP-funded projects collaborate as part of NOAA’s ELP Resilience Education Community of Practice.

In response to the great need throughout the U.S., NOAA’s Environmental Literacy Program (ELP) supports the development and strengthening of resilient communities through competitive grants, in-kind support (including NOAA personnel and other scientific assets), and an ELP Resilience Education Community of Practice.

PROGRAM INTERVENTION

NOAA focuses on four long-term goals that make important contributions to resilient ecosystems, communities, and economies. These goals include: Climate Adaptation and Mitigation, Weather-Ready Nation, Healthy Oceans, Resilient Coastal Communities and Economies.

PROBLEM STATEMENT

- Climate change is a worsening threat and communities are not prepared;
- Some groups are more vulnerable than others;
- Policies and actions that promote adaptation and GHG mitigation are needed; and
- Policies are more robust when they reflect the values of community members and are informed by engaged community members.

Therefore...

- Communities need the skills, knowledge and confidence to address these challenges (i.e., environmental literacy);
- Education is the way we achieve environmental literacy;
- Civic engagement around climate solutions is insufficient;
- Most education approaches to date have not stimulated action;
- New education approaches are needed.
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Resilience Education Theory of Change
Causal Pathway 2: Student-driven Action Projects Implement Resilience Measures

END GOAL

- Communities are resilient to current and future environmental hazards in that they have the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum adverse social, economic, and environmental impacts.
- Resilience education theory of change: Causal pathway 2, student-driven action projects implement resilience measures.

INTERMEDIATE GOAL

- Communities have sufficient collective environmental literacy to take action on climate change mitigation and adaptation policies and practices that build resilience in ways that contribute to community health, social cohesion, and economic equity. These communities are composed of individuals who are supported by formal and informal education that develop their knowledge, skills, and confidence to:
  1. Reason about the ways that human and natural systems interact locally and globally and where they live, including the acknowledgment of disparately distributed vulnerabilities;
  2. Participate in scientific and/or civic processes; and
  3. Consider scientific uncertainty, cultural knowledge, and diverse community values in decision making. Although individuals need not have all these capabilities, collectively these individuals leverage shared environmental literacy toward implementing strategies that build resilience over the short and long-term.

PROGRAM OUTCOME

- Educators and students have taken actions within their communities that reduce the risks associated with their chosen environmental hazards, making a positive impact on their community and providing a model for other members of their community to follow.

LONG-TERM OUTCOMES

- The active project has built confidence, skills, and knowledge in the students and their teachers that they are willing and able to apply in new situations.
- There is greater social cohesion within communities as a result of community members interacting with one another.
- There is evidence for reduced vulnerability to the identified hazards in a community.

MID-TERM OUTCOME

- Educators and students work with local experts to implement their action projects that aims to reduce risks/vulnerabilities and may produce other co-benefits.

SHORT-TERM OUTCOMES

- Educators understand how to access and apply locally relevant data from NOAA and other sources related to local environmental hazards.
- Educators and students identify environmental hazards of concern within their local and state resilience plans.
- Educators and students create learning experiences that help them understand place-based environmental hazards and their impacts, and potential solutions.
- Educators and students conduct vulnerability assessments that help them understand their exposure to environmental hazards and unique access to resources within their communities.
- Educators and students identify action projects that address the environmental hazards of their concern.
- Educators and students apply knowledge and skills to create an implementation plan for their student-driven action projects.
- Local experts are engaged and help develop student-driven action projects.

PROJECT-LEVEL INTERVENTION

- ELP-funded projects work with children, youth, and adults to create and implement action projects that help build resilient communities.

PROGRAM INTERVENTION

- NOAA focuses on four long-term goals that make important contributions to resilient ecosystems, communities, and economies. These goals include: Climate Adaptation and Mitigation, Weather-ready Nation, Healthy Oceans, Resilient Coastal Communities and Economies.

ORGANIZATION ACTIONS

- Climate change is a worsening threat and communities are not prepared;
- Some groups are more vulnerable than others;
- Policies and actions that promote adaptation and GHG mitigation are needed; and
- Policies are more robust when they reflect the values of community members and are informed by engaged community members.

PROBLEM STATEMENT

- Communities need the skills, knowledge and confidence to address these challenges (i.e., environmental literacy);
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Causal Pathway 3: Resilience Planning and Policies Integrate Education

**END GOAL**

Communities are resilient to current and future environmental hazards so that they have the capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social, well-being, the economy, and the environment. Environmental literacy, along with community health, civic engagement, social cohesion, and equity, enhances resilience. Stewardship of healthy ecosystems, a low-carbon economy, and climate-smart and inclusive decision making further reduce risks from current and future environmental hazards.

**INTERMEDIATE GOAL**

Intermediate Goal: Communities have sufficient collective environmental literacy to take action on climate change mitigation and adaptation policies and practices that build resilience. This way, they contribute to community health, social cohesion, and socio-economic equity. These communities are comprised of individuals who are supported by formal and informal education that develop their knowledge, skills, and confidence to:

1. understand the ways that human and natural systems interact globally and where they live, including the acknowledgement of disproportionately distributed vulnerabilities;
2. participate in scientific and/or civic processes; and
3. consider scientific uncertainty, cultural knowledge, and diverse community values in decision making.

Although individuals need not have all these capabilities, collectively, these individuals leverage shared environmental literacy toward implementing strategies that build resilience over the short- and long-term.

**PROGRAM OUTCOME**

Government policies and budgets provide resources (funding, personnel, etc.) to implement educational components of a resilience plan.

**LONG-TERM OUTCOMES**

- Resilience planners recognize and champion collective environmental literacy of children, youth, and adults as necessary to achieve community resilience.
- With community input, planners integrate K-12 and informal education goals and approaches into their community's resilience plan.

**MID-TERM OUTCOMES**

- Resilience planners and members of the project team have a robust relationship as evidenced by the regular involvement of the planner(s) in the implementation of the project.
- Planners acknowledge through their words and actions the value of education as a means to achieving environmental literacy and that environmental literacy is essential to building community resilience.

**SHORT-TERM OUTCOMES**

- Resilience education project incorporates elements of an existing community resilience plan.
- Resilience planners submit a letter of support to be an advisor on resilience education project.

**PROJECT INTERVENTION**

NOAA ELP requires all projects incorporate existing relevant resilience plans and partner with resilience planners.

**PROGRAM INTERVENTION**

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**ORGANIZATION ACTIONS**

NOAA focuses on four long-term goals that make important contributions to resilient ecosystems, communities, and economies. These goals include: Climate Adaptation and Mitigation, Weather-Ready Nation, Healthy Oceans, Resilient Coastal Communities and Economies.

**PROBLEM STATEMENT**

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References


