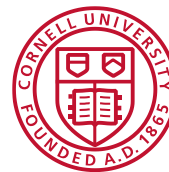


Cornell Cooperative Extension  
Cornell Garden-Based Learning



# Gardening in a Warming World Facilitator's Notebook

For Garden-Based Educators, Volunteers, and Peer Learning Networks



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*Impacts from climate change are already affecting every part of New York State—water, energy, agriculture, ecosystems, and other social and economic systems—and all its 20 million inhabitants.<sup>1</sup>*  
~NYSERDA Climate Change in NYS, 2014

## **Preface**

Cornell Cooperative Extension (CCE) is committed to educating stakeholders about climate change and helping citizens implement the strategies that are needed to adapt to and mitigate impacts.

Gardeners everywhere are seeing the impacts of the changing climate on their gardens. Gardening means dealing directly with drought conditions, flooding and water-logging; unseasonable cold and freezing conditions; increases in new pests; changes in plant diseases; variability in heat and hardiness zones; and extreme weather events. Our *Gardening in a Warming World* materials aim to provide guidance and resources to support garden-based educators and volunteers as they are increasingly called upon for information in the face of this new gardening challenge.

This *Facilitator's Notebook* accompanies *Gardening in a Warming World: A Climate Smart Gardening Course Book* to provide more detailed information for garden-based educators and volunteers to use in educating the public on climate change and gardening. It synthesizes for you the key elements of the Course Book and offers core ideas and helpful tips for your presentations and other educational outreach efforts.

The Notebook begins with a general overview of key elements and tips to create a presentation and facilitate a session on the topic of climate change and gardening. It then offers brief outlines of sessions with different time durations and a section on how to facilitate dialogue on this occasionally challenging topic. The last sections of this Notebook contain handouts and group and individual activities you may find useful for creating presentations and effectively sharing them with the public, along with notes for an accompanying Power Point presentation that can be found at <http://climatechange.cornell.edu/gardening>.



### *Building Strong and Vibrant New York Communities*

Diversity and Inclusion are a part of Cornell University's heritage. We are a recognized employer and educator valuing AA/EEO, Protected Veterans, and Individuals with Disabilities.

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Questions, group exercises and other activities for use during presentations; these are arranged by relevance to the Units in the Course Book.

### **Resources that can be downloaded for free at [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)**

- Climate Smart Gardening Course Book
- Facilitator's Notebook (this document)
- Companion presentation
- Presentation notes

## Section 1: Major Elements of Gardening in a Warming World

This chart offers a quick summary of each of the units in the accompanying *Gardening in a Warming World Course Book*, and suggests content from the units for discussion sessions you may facilitate.

### Overview of the Gardening in a Warming World Course Book

| <u>Unit</u>   | <u>Purpose</u>  | <u>Presentation Content</u>   |
|---|---|---|
| <b>Benefits of Systems Thinking for Sustainable Gardening</b> | Embracing habits of systems thinking in the face of the complexity of our changing world is critical to sustainable gardening.  | <ul style="list-style-type: none"> <li>✓ Overview of systems thinking.</li> <li>✓ Exploration of how to expand habits of a systems thinker to enhance gardening success.</li> </ul>   |
| <b>Knowing our Garden Systems</b>                             | Documenting observations deepens an understanding of our garden systems and prepares us to make effective and informed management decisions.  | <ul style="list-style-type: none"> <li>✓ Overview of the benefits to making and documenting garden observations.</li> <li>✓ Strategies for recording including journaling and mapping.</li> </ul>   |
| <b>Climate Change Basics</b>                                  | Understanding the fundamentals of climate and weather systems as well as the observed changes and subsequent impacts is critical to developing climate science literacy, identifying reliable sources, and talking with peers about gardening in a warming world. | <ul style="list-style-type: none"> <li>✓ Weather &amp; climate data.</li> <li>✓ Using this data in gardening.</li> <li>✓ Greenhouse effect.</li> <li>✓ Role of human activity in climate shifts.</li> <li>✓ Climate change indicators and impacts – global, NYS, garden.</li> <li>✓ Talking with others about gardening in a warming world.</li> </ul>              |
| <b>Climate-Smart Sustainable Garden Audit</b>                 | Considering current gardening practices through the lens of mitigation and adaption actions builds the foundation for creating a garden action plan focused on environmental stewardship and gardening success in a warming world.                                | <ul style="list-style-type: none"> <li>✓ Mitigation and adaptation.</li> <li>✓ Garden audit around major practices to consider current best strategies.</li> <li>✓ Connecting habits of systems thinking with mitigation and adaptation actions in the garden.</li> <li>✓ Connecting local knowledge with additional scientific and technical knowledge.</li> </ul> |
| <b>Selected Resources</b>                                     | A list of reliable sources related to topics in each of these units is provided.  | <ul style="list-style-type: none"> <li>✓ Consider this a launching point for finding &amp; using reliable sources of information.</li> </ul>  |

## Section 2: Workshop Preparation

For a smooth and effective session on climate change and gardening, you will want to give some thought to logistics, your audience, and the session itself. Consider a team approach and recruit others to assist behind the scenes or with specific aspect of the workshop.

### Quick Tips for Preparing and Delivering Your Session

- ✓ Read *Gardening in a Warming World: A Climate Smart Gardening Course Book*. This resource will give you basic background for your session and lists excellent resources and additional sources of information. Read for understanding and enriching your knowledge about how climate affects gardens and your role as a gardener in helping your community mitigate and adapt to climate change.
- ✓ Determine what your intended audience wants to know – for example, if you're asked to present at a local garden club, you can inquire from the club representative what their members might most be interested in knowing about the topic. This feedback will be very helpful in selecting the information you want to share. Also consider what key points you want to get across to your audience.
- ✓ Know your time frame – this will clearly determine how much you can cover and which, if any, activities you can use.
- ✓ Use the activities found in the Appendix of this Facilitator's Notebook – they are designed for peer-to-peer learning. But don't be afraid to use your own creativity and imagination in designing an activity that will provide enjoyment and good food for thought.
- ✓ Use the PowerPoint slides provided at <http://climatechange.cornell.edu/gardening/> – or create your own – just be sure to double check for accuracy any facts you plan to present to the group and make sure to use images that are your own or are free to use without citation. Include no more than 3-4 points per slide. Type your notes about the slide to the bottom of the slide. This is easily done with Power Point and serves as a reminder for you about what you want to say about the slide.
- ✓ Read the suggested Facilitation Process – the steps listed in this Notebook provide you with a guide for how your session can flow.
- ✓ Check the Sample Sessions – the four sample sessions in this notebook give you a sense of what you might include in a presentation based on time frames ranging from 30 minutes to 2 ½ hours.



## Planning and Materials Checklist

- Send out an announcement of your presentation – you will want to give your potential audience about 2-4 weeks' notice of your session. If you are preparing to give a talk to a library group, garden club or other similar audience, contact them several months in advance to discuss your presentation. Many organizations plan their events a full season in ahead.
- Keep an up-to-date list of participants – be sure you give your potential participants a method of letting you know if they will attend and a date by which they should RSVP or register. If you will be presenting at a Cornell Cooperative Extension office, perhaps you can work with staff to coordinate RSVPs for the event and other details. For most sessions, it is helpful to know about a week ahead of time how many participants you may have. This allows you time to copy handouts and finalize the number of tables/chairs required; always anticipate a few last-minute attendees and have some extra copies of handouts and a few extra chairs on hand. Note: Depending on the size of your facility, you may need to limit the number of participants. Make sure to include this in any online or written materials announcing your presentation.
- Arrange for a room with a computer and screen; tables and chairs/seating for expected number of participants with 5-7 people per table (this group number works best for small group discussion).
- Design your presentation, including your activities.
- Prepare PowerPoint slides - a good rule of thumb is no more than 3-4 bulleted points or items per slide. Make sure to include images to complement your content and meaning. The accompanying Power Point presentation to this facilitator's guide can be found at <http://climatechange.cornell.edu/gardening/>
- Practice your presentation with a trusted colleague – you will want to be very familiar with your material, keep within your time frame and receive some suggestions for changes. The more you practice the more comfortable you will be with the material – and the less stress you'll feel.
- Prepare handouts which can include: session agenda; brief outline of key take-away points; activity directions; copies of your Power Point slides and: feedback form.
- Make copies of handouts and collate as a packet.
- Put handout packet into folders, and/or staple together, or three-hole punch and put in loose leaf notebooks.
- Make copies of *Gardening in a Warming World: A Climate Smart Gardening Course Book* – one per table or small group, or one general copy.
- Prepare supplies: markers, plain paper; pens/pencils; large news print; flip chart and easel.
- Arrive at least 30 minutes before your session to check room arrangements and computer equipment, and to check any outdoor activity site.
- Place handout packets on participant tables/chairs before they arrive. This gives participants an opportunity to become familiar with the session content before it begins.
- Greet participants as they arrive.

**List your additional items:**

## Section 3: Tips for a Winning Workshop

### Support Active Participation

Ideally you will want to make your session as interactive as possible. The more you can actively engage your participants in your topic the more easily and quickly they will learn. The following are general strategies to lead exercises and guide discussions which will engage your participants in learning about the topics of your session:

- ✓ Understand the reason for the activity and how it fits with the learning objectives you have set for your session.
- ✓ Give very clear directions and ask if anyone has questions.
- ✓ Provide a time frame for the activity.
- ✓ Provide necessary tools or equipment to conduct the activity.
- ✓ Have groups share what they learned from the activity.
- ✓ Focus the group, and keep things moving.
- ✓ Summarize the discussion.

### Encourage Conversation and Dialogue

Getting your participants to share their ideas and questions in a discussion requires you to think of yourself as a facilitator, i.e. one who enables people to be comfortable with each other and learn by sharing their ideas. A good facilitator:

- ✓ Serves as a guide – assisting participants in talking with one another – does not “teach” or “preach”
- ✓ does not have to be a subject matter expert - is familiar with the main elements of a topic
- ✓ asks open-ended questions to stimulate dialogue – uses how, what and why questions
- ✓ helps group members make connections and be “systems thinkers”
- ✓ brings out points of view that haven’t been talked about; and helps everyone participate.

To learn more about group facilitation, read “Zen of Facilitation” by Joellen Killion and Lynn Simmons. This article from the Journal of Staff Development details the differences between trainers and facilitators and how belief systems influence facilitation.<sup>2</sup>

<https://learningforward.org/docs/jsd/killion133.pdf?sfvrsn=0>

### Consider the Learning Environment

If you are planning an **indoor activity** be sure you have:

- ✓ good lighting and acoustics
- ✓ comfortable seating
- ✓ table(s) to work on if activities require tabletop work
- ✓ access to any equipment or supplies for the activities you’re conducting and;
- ✓ a comfortable room temperature (good heat or air conditioning)

If you are planning on an **outdoor activity** be sure to:

- ✓ Select a suitable site – safe and convenient; easily accessible, fairly even terrain; be sure and alert participants if there are obstacles at the site (for example, a long way from parking, rocky or uneven soil, icy or muddy walkways or trails).
- ✓ Obtain any permissions necessary to use the site.
- ✓ Have any activity tools and equipment readily available at the site for easy access.
- ✓ Notify your participants if there is any special clothing, equipment or materials they will need to bring for the activity.
- ✓ Have an alternative option prepared in case of inclement weather.

## Section 4: Examples of *Gardening in a Warming World* Sessions

This section provides workshop session agendas as a place for you to start. Do adapt to suit your style and local needs. The 2½ hour session is an excerpt from the core preparation curriculum of Cornell Cooperative Extension Master Gardener Volunteers. It is more typical to get an audience of adult learners for a shorter time, so we include outlines for 60, 45, and 30-minute sessions. Regardless of the time frame, we encourage to consider how you make your session “learner-led.” That is, you facilitate participants’ learning through conversation and activities with their peers. Your guidance keeps the session on track while allowing participants time to learn from each other.

### **2 ½ hour Session** **Climate Change and Gardening**

This session is based on units in *Gardening in a Warming World: A Climate Smart Gardening Course Book*. Encourage participants to read the course book in advance. The *Facilitator’s Notebook* provide guidance on facilitation as well as specific activities and supplemental handouts. The *Companion Presentation* serves as outline for moving through the key points and activities. Find all these materials at: [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)

#### **Learning Objectives**

By actively participating in this Gardening in a Warming World session, participants will:

- Understand systems thinking as it applies to your garden system.
- Be familiar with the basics of climate change.
- List current and future possible impacts of climate change on New York State.
- Identify ways to manage gardens to mitigate and adapt to climate impacts.
- Have the tools to be a peer educator around Gardening in A Warming World.

**Agenda** (take a 15-minute break at some point so total time here is 135 minutes or 2¼ hours)

#### **Opening and Introduction** **20 minutes**

Welcome everyone, review agenda, housekeeping and ground rules. Engage participants in the ice breaker activity in the *Presentation* or another. Provide time for very brief introductions. Review learning outcomes.

#### **Benefits of Systems Thinking for Sustainable Gardening** **10 minutes**

Consider definitions of “systems” and “systems thinker”; refer to “System Thinker” handout from appendix in *Facilitator’s Notebook* and reflect on how systems thinking could lead to great success in pest management.

#### **Knowing Our Garden Systems** **20 minutes**

Identify ways people are observing and documenting their gardens. Return to ice breaker your garden activity for participants to add details using “Knowing your Garden System” from appendix in *Facilitator’s Notebook*. Lead into next unit by briefly voicing observations that may be associated with climate change impacts.

#### **Climate Change Basics** **25 minutes**

Present the basics around weather, climate, using weather and climate data in gardening, greenhouse effect as well as indicators of a warming world and impact of a changing climate. Refer to these handouts from appendix in *Facilitator’s Notebook*; “What is the Greenhouse Effect?”, “What Happens in New York State When the Climate Changes?” and “Reliable Resources Matrix.”

#### **Climate-Smart Garden Audit** **45 minutes**

Define mitigation and adaptation; participants complete and reflect on worksheet “Climate-smart gardening put into action” from appendix in *Facilitator’s Notebook*. Outline the elements of a climate smart garden audit from and engage in a small group activity described in Appendix under Unit 4 activities.

#### **Conclusion** **15 minutes**

Review key take home points and reflect on talking with others about Gardening in a Warming World.



## **60 Minute Session** **Climate Change and Gardening**

This session is based on units in *Gardening in a Warming World: A Climate Smart Gardening Course Book*. Encourage participants to read the course book in advance. The *Facilitator's Notebook* provide guidance on facilitation as well as specific activities and supplemental handouts. The *Companion Presentation* serves as outline for moving through the key points and activities. Find all these materials at: [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)

### **Learning Objectives**

By actively participating in this Gardening in a Warming World session, participants will:

- Understand systems thinking as it applies to your garden system.
- Be familiar with the basics of climate change.
- List current and future possible impacts of climate change on New York State.
- Identify ways to manage gardens to mitigate and adapt to climate impacts.

### **Agenda**

#### **Opening and Introduction**

**5 minutes**

Welcome everyone, review agenda, housekeeping and ground rules. Engage participants in the ice breaker activity in the *Presentation* or another brief one. Review learning outcomes.

#### **Benefits of Systems Thinking for Sustainable Gardening**

**5 minutes**

Consider definitions of "systems" and "systems thinker"; refer to "System Thinker" handout from appendix in *Facilitator's Notebook* and reflect on how systems thinking could lead to great success in pest management.

#### **Knowing Our Garden Systems**

**10 minutes**

Identify ways people are observing and documenting their gardens. Return to ice breaker your garden activity for participants to add details using "Knowing your Garden System" from appendix in *Facilitator's Notebook*. Lead into next unit by briefly voicing observations that may be associated with climate change impacts.

#### **Climate Change Basics**

**15 minutes**

Present the basics around weather, climate, using weather and climate data in gardening, greenhouse effect as well as indicators of a warming world and impact of a changing climate. Refer to these handouts from appendix in *Facilitator's Notebook*; "What is the Greenhouse Effect?", "What Happens in New York State When the Climate Changes?" and "Reliable Resources Matrix."

#### **Climate-Smart Garden Audit**

**20 minutes**

Define mitigation and adaptation; participants complete a small portion of worksheet "Climate-smart gardening put into action" from appendix in *Facilitator's Notebook*. Outline the elements of a climate smart garden audit from and engage in a small group activity described in Appendix under Unit 4 activities.

#### **Conclusion**

**5 minutes**

Review key take home points.



## **45 Minute Session** **Climate Change and Gardening**

This session is based on units in *Gardening in a Warming World: A Climate Smart Gardening Course Book*. Encourage participants to read the course book in advance. The *Facilitator's Notebook* provide guidance on facilitation as well as specific activities and supplemental handouts. The *Companion Presentation* serves as outline for moving through the key points and activities. Find all these materials at: [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)

### **Learning Objectives**

By actively participating in this Gardening in a Warming World session, participants will:

- Be familiar with the basics of climate change.
- List current and future possible impacts of climate change on New York State.
- Identify ways to manage gardens to mitigate and adapt to climate impacts.

### **Agenda**

#### **Opening and Introduction**

**5 minutes**

Welcome everyone, review agenda, housekeeping and ground rules. Engage participants in the ice breaker activity in the *Presentation* or another brief one. Review learning outcomes.

#### **Knowing Our Garden Systems**

**5 minutes**

Identify ways people are observing and documenting their gardens. Lead into next unit by briefly voicing observations that may be associated with climate change impacts.

#### **Climate Change Basics**

**10 minutes**

Present the basics around weather, climate, using weather and climate data in gardening, greenhouse effect as well as indicators of a warming world and impact of a changing climate. Refer to these handouts from appendix in *Facilitator's Notebook*; "What is the Greenhouse Effect?", "What Happens in New York State When the Climate Changes?"

#### **Climate-Smart Garden Audit**

**20 minutes**

Define mitigation and adaptation; participants complete a small portion of worksheet "Climate-smart gardening put into action" from appendix in *Facilitator's Notebook*. Outline the elements of a climate smart garden audit from and engage in a small group activity described in Appendix under Unit 4 activities.

#### **Conclusion**

**5 minutes**

Review key take home points.



## **30 Min Session** **Climate and Gardening**

This session is based on units in *Gardening in a Warming World: A Climate Smart Gardening Course Book*. Encourage participants to read the course book in advance. The *Facilitator's Notebook* provide guidance on facilitation as well as specific activities and supplemental handouts. The *Companion Presentation* serves as outline for moving through the key points and activities. Find all these materials at: [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)

### **Learning Objectives**

By actively participating in this Gardening in a Warming World session, participants will:

- Be familiar with the basics of climate change.
- List current and future possible impacts of climate change on New York State.
- Identify ways to manage gardens to mitigate and adapt to climate impacts.

### **Agenda**

#### **Opening and Introduction**

**3 minutes**

Welcome everyone. Review learning outcomes.

#### **Climate Change Basics**

**7 minutes**

Refer to these handouts from appendix in *Facilitator's Notebook*; "What is the Greenhouse Effect?", "What Happens in New York State When the Climate Changes?" Briefly highlight main points, focusing on impacts in gardens.

#### **Climate-Smart Garden Audit**

**15 minutes**

Define mitigation and adaptation; participants complete a small portion of worksheet "Climate-smart gardening put into action" from appendix in *Facilitator's Notebook*. Outline the elements of a climate smart garden audit from and engage in a small group activity described in Appendix under Unit 4 activities.

#### **Conclusion**

**5 minutes**

Review key take home points.



## Section 5: Creating a Study Circle for Gardening in a Warming World

Study circles can be an excellent way to bring gardeners together on a regular basis to discuss the issue of how best to garden in the face of climate change impacts. It offers an excellent format for peer to peer learning. In a study circle, gardening participants would read the *Gardening in a Warming World: A Climate Smart Gardening Course Book* and come together over a period of time to discuss each unit and participate in the unit activities. For example, your study circle may choose to meet once for 1½ hours once a month for 4 months to discuss a unit each month or do an activity associated with a unit (see the appendix activity section for ideas). Use the course book as your main reading and the discussion questions as well as the activities found in appendix of this notebook.

A typical study circle consists of a small group of between five and fifteen people meeting in a comfortable location once or twice a month for several months to learn about an issue of interest, much the same as when a book club gathers to discuss and explore a book they have selected to read. The group shares ideas, concerns, insights, questions and concerns over coffee. Everyone accepts the ground rules for discussion suggested by the facilitator whom the group chooses to lead the discussion.

Some study circles alternate facilitators for each session. That means you would be responsible for overseeing the group but would not have to lead the discussion each time your group meets. The facilitator guides the conversation and is responsible for maintaining the respectful tone of the discussion and ensuring that everyone has an opportunity to be heard. All participants come prepared for the discussion by reading the material and resources chosen for each session.

For your first study group, you may want it to be among your peer Master Gardener Volunteers or gardeners. That way you will be able to discover what works and what doesn't among in a comfortable setting. In subsequent study circles, you could then introduce the concept to the general gardening public in your community by announcing the circle at Cornell Cooperative Extension horticulture events, garden club meetings or in other similar settings. In any case, the study circle is a proven method for effectively engaging people in complex and important issues. The Center for Courage and Renewal's *Circle of Trust Touchstones* offers some excellent tips on how to create good ground rules for small groups such as a study circle: <http://www.couragerenewal.org/touchstones/><sup>3</sup>

Study circles are designed to bring members of a community together to deliberate about an issue. In this process, which is valued as much for itself as for the actual content of the discussion, emphasis is on identifying participants' perceptions about an issue and sharing ideas and thoughts. No specific outcome is desired other than the participants' deepened understanding of an issue; however, the experience can lead to individual participants or the group taking some action after the study circle ends. The main purpose of the study circle then, is to deliberate over an issue so participants can bring their expertise and creativity to bear on solutions and strategies.



## Section 6: How to Talk About Gardening in a Warming World with Others

Frequently gardeners –particularly Master Gardener Volunteers- are relied upon to provide guidance about gardening in a changing climate to the public. Let us be prepared to welcome this opportunity to build public awareness of climate change risks and provide avenues for conversations around climate change impacts and the capacity of our community to adapt and be engaged. We need not have all the answers to play a critical role in addressing climate change. In fact, all the answers around the complex topic of climate change are simply not known. We can be facilitators of conversations and dialogue that allow people to process the emotional response – such as worry, fear, interest, and curiosity – that emerges in gaining understanding about climate change. We can inspire the use of scientific evidence when participating in discussions around the critical nature of the issue and offer strategies for curbing and adapting to climate impacts.

Rather than persuading,  
**audiences are better served by discussing and sharing information**  
to convey **trustworthy** intentions.

From *Gaining trust as well as respect in communicating to motivate audiences about science topics*, by Fisk and Dupree in Proceedings of the National Academy of Sciences 2014 vol. 111.<sup>4</sup>

As with gardening, jumping in and doing provides the practice to build your expertise. Use the background information, discussion questions, and activities in this guide as a springboard for finding your own words to engage your audience on the topic of climate change and gardening. Here we also offer a few additional keys to success in facilitating meaningful discussions and effectively presenting climate change and gardening information.

### Principles of Climate Change Communication

Here are several key guiding principles and techniques for giving presentations, facilitating discussions, and having general conversations about climate change and gardening. These techniques and strategies are adapted from *Connecting on Climate: A Guide to Effective Climate Change Communication*, a publication from the Center for Research on Environmental Decisions, Earth Institute, Columbia University.<sup>5</sup> There is also a series of activities listed at the end of this section for use in facilitating group sessions.

#### ➤ **Put yourself in your audience's shoes.**

People collect evidence and selectively hear information that supports their values and beliefs largely from people they trust. Recognize your messages may challenge people's deeply held beliefs or those of the group with which they most identify. Learn about your audience and become familiar with people's perspectives, values and beliefs. Discover how they see the world. Appealing to key values held by your audience will make it easier for participants to recognize climate change as an issue that personally affects them. For example, someone who values security may be interested in learning more about how growing food can help make her family more secure in the face of climate impacts.

#### ➤ **Channel the power of groups.**

People generally act differently in groups. As social beings, humans feel empowered in the company of others and can become energized by the dynamic of being with others –especially those with whom they share common values and interests – such as gardening. You can leverage this energy to motivate people to learn more about climate change and take actions.

➤ **Emphasize solutions and benefits.**

Climate change can seem for many to be an issue that is too big to resolve. Giving your audience tips and strategies to deal with the challenge can be empowering. For example, showing gardeners how they might protect their plants through adaptation measures can help gardeners feel a part of the solution.

➤ **Bring climate impacts close to home.**

Climate change can be perceived by your audience as global in nature, that is, far from their own backyards, and involving a great deal of uncertainty. Relating global change to local impacts will help your audience relate to the consequences of climate change and help them see how climate connects with their everyday lives. Gardeners will not have too much difficulty understanding the local aspect of climate change since they are already observing impacts from extreme weather events or warming temperatures in their own yards and gardens.

➤ **Connect climate change to issues that matter to your audience.**

Do avoid framing your message from a detailed or lengthy scientific perspective. This will be too abstract or technical for most people and they may tune you out. Frame climate change and solutions in ways that link them to issues people consistently care about – the economy, their family, their health and safety – and in our case – their gardens. Cultivate an exchange of information. Share personal experiences with climate impacts to personalize the issue and minimize the disconnect between what people read about climate change from experts and their own lives. Gardeners can share the changes they have observed in their gardens (ex. rise in invasive species), as well as extreme weather events (ex. flooding) they have experienced.

➤ **Use images and stories to make climate change real.**

Using images such as devastating floods or droughts can serve to get your audience's attention but keep fear-based messages in check. Fear can help people prioritize the issue of climate change, but it is not effective as the main message. Fear has a way of disempowering people, especially with an unprecedented challenge like climate change. Fear can make people feel there is nothing they themselves can do about it – the challenge is just too big. Playing the fear card can also make people feel manipulated. We are already overwhelmed these days with countless fear messages that saturate our daily lives. Balance fear-based images with empowering solutions-based images. Gardening photos and films that illustrate practical methods, such as xeriscaping and community-level or civic actions such as community gardening can help people envision themselves fruitfully managing climate impacts.

People make meaning of the science they encounter in their lives using different narratives based on **culturally relevant prior knowledge, that may or may not include science**. A person's ability to reach informed decision will be based not on a first-hand evaluation of "what is true?" but on a second-hand evaluation of "**whom to trust?**"

From *Bridging Science Education and Science Communication Research* by Baram-Tsabari and Osborne in *Journal of Research in Science Teaching* 2015 vol. 52.<sup>6</sup>

➤ **Make climate science meaningful.**

There is strong evidence that more and better knowledge about climate change does not necessarily engage people in the topic. The findings of the Yale Cultural Cognition Project indicate that ideology generally trumps facts. You may be providing solid data, but to be truly engaged people need to have a real sense of caring and an emotional attachment to the topic. Select a few key facts that are pertinent to your audience to help them focus on what is really important and relevant to them. For example, presenting data on the likely hydrological changes in their region will be relevant and useful for a gardener.

➤ **Acknowledge uncertainty but show what you know.**

There is room for uncertainty in your presentation. The science of climate change is evolving, and scientists will agree there is much uncertainty about the exact timing and extent of climate impacts. There are however key facts of climate change that are known with great certainty, and that is: climate change is happening, and our human activities are causing the climate to change.

➤ **Approach skepticism carefully.**

Science by its very nature is skeptical as it involves the open-minded consideration of something based on the evidence. We want to cultivate skepticism in examining issues as it can lead to deeper understanding and expose unconscious bias. When skepticism in our climate change conversations shifts to a strong position of denial it can quickly disrupt the group. There are a number of reasons why a person might be in denial about climate change such as it is frightening or disempowering, or proposed solutions are seen to threaten her way of life or its the position of the people a person most values and trusts. Regardless of the source of the desire to interpret the evidence to suit the preferred answer, we must address the position respectfully. We might simply state there is scientific certainty that rapid climate change is occurring, and that we humans are causing this accelerating change by our activities, principally through burning fossil fuels (driving our cars, heating our homes, using power equipment, etc.). If someone with a strong position of denial wants to engage in a conversation that begins to feel too lengthy, simply suggest that you could discuss it further at the end of the session or set up a time to do so later.

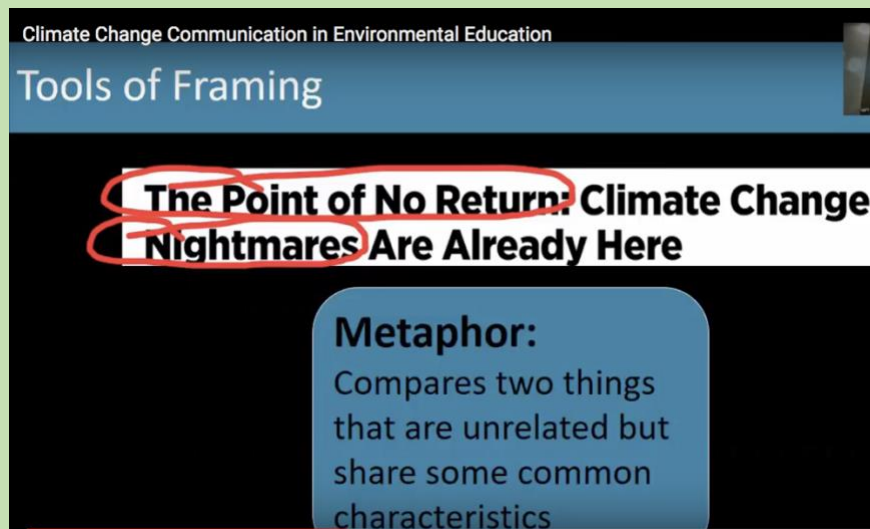
➤ **Make behavior change easy.**

Present solutions that are practical and share stories of how others have found them to be successful. Gardeners will be especially interested in what other gardeners are doing and are likely to be empowered by feeling part of a proactive gardening community.

### Climate Change Communication in Environmental Education

If you are interested in delving more into the science behind how individuals respond to different approaches to education on climate change, watch Cornell PhD candidate Annie Armstrong present her research finding on this topic:

<https://www.youtube.com/watch?v=cRizQPEq9Ws&feature=youtu.be>



## Activity Ideas: How to Talk About Gardening in a Warming World with Others

### Inspire Understanding with Discussion

Consider breaking up into small teams of about 5 people and reflect on these questions. As you and others gain additional experience revisit these questions again to continually build your skill sets and support network.

Take a moment to consider a time when you were in a public setting during which you felt mistrust (*didn't feel right*). What was it about the space, who was there, or the words spoken that contributed to your feelings of mistrust? After some minutes thinking about this, shift to considering a public setting in which you felt comfortable, at ease and a real sense of trust (*felt like you belonged there*). What was it about this setting that contributed to your feeling of trust?

Each group is assigned one of the following concepts. Briefly converse around what the concept is, then consider how the concept might shape a person's sense of trust and safety, and meaningful relationships/connections with others. The list below is adapted from Baram-Tsabari et al.'s article *Bridging science education and science communication research*<sup>7</sup>:

- **Personal values** - the things that are important in the way a person lives and works
- **Cultural values** - the core principles and ideals upon which an entire community exists
- **Ideology** – the set of opinions or beliefs of a group or an individual
- **Social identity** – a person's sense of who he is based on their group membership(s)
- **Cultural identity** – the identity of an individual, influenced by belonging to a culture
- **Trust** - in scientific or other institutions

What is your major fear/uncertainty about communicating on the topic of climate change and gardening? (*Dig into considering personal barriers and perceived weaknesses in communicating climate change*).

How familiar are you with the topic of climate change? What would you most like to learn more about regarding the topic of climate change and gardening? (*These questions give you an idea of the topic competence of the group and what they are most interested in learning about - it gives you a heads-up on what to focus on in your session*).

What are some successful ways you've shared your knowledge about climate change? What have been some barriers you've encountered in communicating effectively about climate change and gardening? (*Gaining comfort around sharing experiences can empower participants by encouraging their unique expertise*).

What are you already doing that is cultivating trust and meaningful connection with an audience? How do we set the stage for community dialogue about climate change? What can we do to cultivate a diverse and well-functioning community where an individual does not need to know all about a particular topic as long as she/he is meaningfully connected to someone who does?

The National Oceanic and Atmospheric Administration and National Science Foundation support the website <http://climateinterpreter.org/>. This resource provides invaluable information on climate change communication. Browse the site and jot down any points or information that you might find helpful in talking about climate change with others; find an opportunity to test these concepts in a friendly conversation. Did certain kinds of information or values improve your ability to share important facts about climate change?



## Role-play

Recruit two volunteers to simulate an encounter between 1) garden-based educator/volunteer and 2) a program participant who is skeptical about some aspect of climate change, its impacts, or mitigation or adaptive strategies. Consider what people shared in the above questions to create a real-world scenario that allows people opportunity to create a number of thoughtful and respectful responses to skeptics.

You might also check out the Skeptical Science resource to see what the most used myths around climate change science and approaches to debunk the myth. Keep in mind, building trust can be more valuable than more science information. <http://skepticalscience.com/Welcome-to-Skeptical-Science.html><sup>8</sup>



### **Our garden-based learning volunteers play a vital role as change agents among peers.**

- Most individuals do not make decisions about undertaking a behavior change on the basis of scientific studies of the consequences of making the change.
- Most people depend mainly upon subjective evaluations of ideas that are new to them; and rely on other individuals like themselves who have previously adopted the idea or behavior.

From **Diffusion of Innovations** by Everett Rogers 2003<sup>9</sup>

## Section 7: Concluding Remarks

As a gardener, you are your garden's caretaker. You provide the love and nurturing that is required to grow beautiful and healthy plants. As a garden-based educator or volunteer, your role is also one of steward. You take care that your community has the information and resources that will support the collective gardening efforts of all community members.

Given the serious consequences of climate change that your community faces, it is important that you understand this unprecedented crisis. With this understanding, you can better serve in your role as educator and volunteer, to help your fellow community members discover sustainable ways to meet this challenge of our changing climate.

## Appendix - Table of Contents

### Appendix A - Handouts

The following pages include handouts that you may find useful in your outreach efforts on the topic of gardening in a warming world:

- Handout#1 – ***Being a Systems Thinker***  
This 2-page handout is adapted from author Linda Booth Sweeney’s *12 Habits of Mind* lists the key characteristics of a systems thinker on one page and pictures on the next.
- Handout #2 – ***Knowing your Garden System***  
This 2-page handout is a checklist of ways to map your garden landscape.
- Handout #3 – ***What is the Greenhouse Effect?***  
These images on a 1-page handout depict the general concept of how greenhouse gases warm the planet.
- Handout#4 – ***What Happens in New York State When the Climate Changes?***  
This 1-page handout provides an image of warming indicators and lists a the variety of NYS climate change impacts.
- Handout#5– ***Reliable Resources Matrix***  
This 2-page worksheet provides a tool to document and quantify the value of each resource, how accurate it is, and how reliable.
- Handout #6 – ***Climate-smart gardening put into action***  
This 4-page worksheet has a list of actions to reduce your carbon footprint. Reflect on their contribution to mitigation or/and adaptation.

### Appendix B - Activities

*Inspire Understanding with Discussion* are questions that encourage reflection on the Unit content; activities range in titles and are included for both individuals and groups.

- **Unit 1-** *Inspire understanding with discussion, Garden Clinic, Ball of Yarn Interconnections, Mind Map*
- **Unit 2-** *Inspire Understanding with Discussion, Garden Journaling Exercise, Cataloging Your Garden Site, A Close Look: Cultivating Plant Observation Skills, Creating a Garden Calendar, Are the Bloom Dates Changing and More?, Create Your Own Garden Landscape Maps, Where’s the Pattern? Mapping Exercise*
- **Unit 3-** *Inspire Understanding with Discussion, Identify Reliable Sources About Climate Change Reliable Resources Matrix, Hot Globe, How Do You Feel?, Role Play*
- **Unit 4-** *Inspire Understanding with Discussion, Right Plant Right Place*

Resources that can be downloaded for free at [climatechange.cornell.edu/gardening](http://climatechange.cornell.edu/gardening)

- Climate Smart Gardening Course Book
- Facilitator’s Notebook (this document)
- Companion presentation
- Presentation notes

## Being a Systems Thinker








Systems thinking considers the formulation, diagnosis, and resolution of issues that arise from complex forms of interaction in systems. Different parts of a system are so interconnected that if we alter one part of a system it will change other parts. Fundamentally, systems thinkers focus on wholes rather than on parts. Within the context of the whole, they concern themselves with relationships more than objects, and with networks more than hierarchies.

### A Systems Thinker:

- Sees the whole: sees the world in terms of interrelated “wholes” or systems, rather than as single events, or snapshots.
- Looks for connections: assumes that nothing stands in isolation; and so tends to look for connections among nature, ourselves, people, problems, and events.
- Pays attention to boundaries: “goes wide” (uses peripheral vision) to check the boundaries drawn around problems, knowing that systems are nested and how you define the system is critical to what you consider and don’t consider.
- Changes perspective: changes perspective to increase understanding, knowing that what we see depends on where we are in the system.
- Looks for stocks: knows that hidden accumulations (of knowledge, carbon dioxide, debt, and so on) can create delays and inertia.
- Challenges mental models: challenges one’s own assumptions about how the world works (our mental models) — and looks for how they may limit thinking.
- Anticipates unintended consequences: traces loops of cause and effect and always asks “what happens next?”
- Looks for change over time: sees today’s events as a result of past trends and a harbinger of future ones.
- Sees self as part of the system: looks for influences from within the system, focusing less on blame and more on how the structure (or set of interrelationships) may be influencing behavior.
- Embraces ambiguity: holds the tension of paradox and ambiguity, without trying to resolve it quickly.
- Finds leverage: knows that solutions may be far away from problems and looks for areas of leverage, where a small change can have a large impact on the whole system.
- Watches for win/lose attitudes: knows dichotomous attitudes usually make matters worse in situations of high interdependence.

This listing is adapted from ***Thinking About Systems: 12 Habits of Mind*** by Linda Booth Sweeney, online at: <http://www.lindaboothsweeney.net/thinking/habits>

# Being a Systems Thinker

|   |  |   |
|---|--|---|
| <p>Seeks to understand the big picture</p>                                       | <p>Observes how elements within systems change over time, generating patterns and trends</p>  | <p>Recognizes that a system's structure generates its behavior</p>                   |
| <p>Identifies the circular nature of complex cause and effect relationships</p>  | <p>Makes meaningful connections within and between systems</p>                                | <p>Changes perspectives to increase understanding</p>                                |
| <p>Surfaces and tests assumptions</p>   | <p><b>Habits of a Systems Thinker</b></p>    | <p>Considers an issue fully and resists the urge to come to a quick conclusion</p>  |
| <p>Considers how mental models affect current reality and the future</p>       | <p>Uses understanding of system structure to identify possible leverage actions</p>         | <p>Considers short-term, long-term and unintended consequences of actions</p>      |
| <p>Pays attention to accumulations and their rates of change</p>               | <p>Recognizes the impact of time delays when exploring cause and effect relationships</p>   | <p>Checks results and changes actions if needed: "successive approximation"</p>    |

## Knowing your Garden Systems

Mapping a garden landscape is a common approach that utilizes systems thinking. A base map with overlays can shift focus from the parts to the whole and be a tool for considering relationships, connectedness, and context that are the essence of systems thinking. These maps need not be professional drawings or elaborate. Sketches with colored pencils on graph and tracing paper will do. Take some time to try to create some maps of a real garden place. It may be a landscape on a property you or friends or relatives own or rent; a community garden; a school garden; or another public space you can access.

### Base map

An accurate base map is the result of a series of direct field observations of your site. Using colored pencils and graph paper draw the property to scale. Include on the base map footprints of houses or buildings; driveways, paths, decks, patios or other hardscape features; utility lines; an arrow pointing North; and the scale of the map (e.g. 1 foot in real life = 1/4 inch on graph paper).

### Soil map

Using tracing paper over the base map, outline the following characteristics: > Areas of erosion and compaction > Low areas that are commonly wet > Exposed rock > Shallow soils > Areas where the soil abruptly changes texture or structure > pH or soil test results, which include:

- Texture, structure, consistence profile, drainage
- Topsoil Fertility: pH, % OM (organic matter), N, P, K, Ca
- Toxins: lead, mercury, asbestos, cadmium

### Water map

- Existing sources of supply: location, quality, quantity, dependability, network
- Watershed boundaries and flow patterns: roof runoff, driveway and road runoff, storm drains, flood- prone areas, vernal pools or temporary ponds
- Pollution sources: autos, neighbors, nearby commerce, industry or farms, entry points on the site
- Potential sources of water supply: location, quality, quantity, cost to develop
- Existing infrastructure: on site & nearby culverts, wells, water lines, tanks, sewage lines, septic tanks, leach fields, cisterns
- Erosion: existing and potential
- Domestic sources: wells, streams, ponds

### Vegetation map

Your gardening experiences no doubt has already shown that you need to know the characteristics/cultural needs of each species of plant you have in your garden. My lavender plants for example, didn't like the small space I gave them, and let me know when their roots were too wet. Mapping out the following characteristics will help you to understand the present needs and plan for the future as conditions change.

- Existing Plant Species: locations, size, quantity, patterns, uses
- Habitat Types: food/water/shelter availability
- Animal Species: domesticated, wildlife, pests
- Old Trees
- Established Communities
- Invasive/Non-native
- Rare/Medicinal Plants
- Native Species

# Knowing your Garden Systems

## Light, air flow, temperature map

Make note of your regional climate and the micro-climate of your own back yard. Identify the hardiness zone for your region. Note your observations of the beginning dates of seasons. Where does the wind usually blow in your yard, how much sunlight does your garden get, and at what time of day?

- Plant Hardiness Zone
- Annual Precipitation, Seasonal Distribution
- Latitude
- Wind: prevailing, seasonal, storms, effect on vegetation, change with time of day
- Frost free dates (average, extremes)
- Fire: evidence of former fires, direction, pyriscent (fire-loving)-species, hazardous areas
- Flood: evidence, vulnerable areas, use for capturing/storing energy
- Temperature Fluctuations
- Sunshine
- Weather patterns, including precipitation and fog

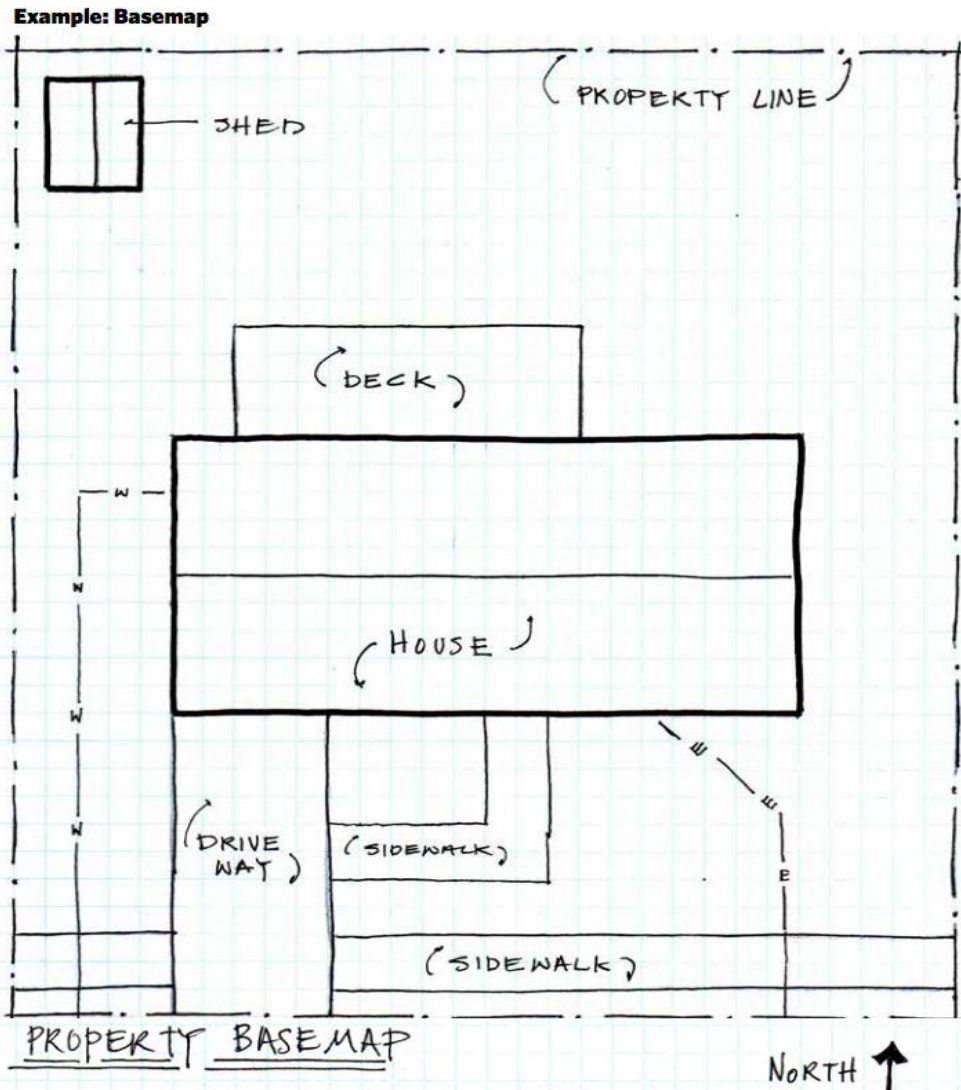
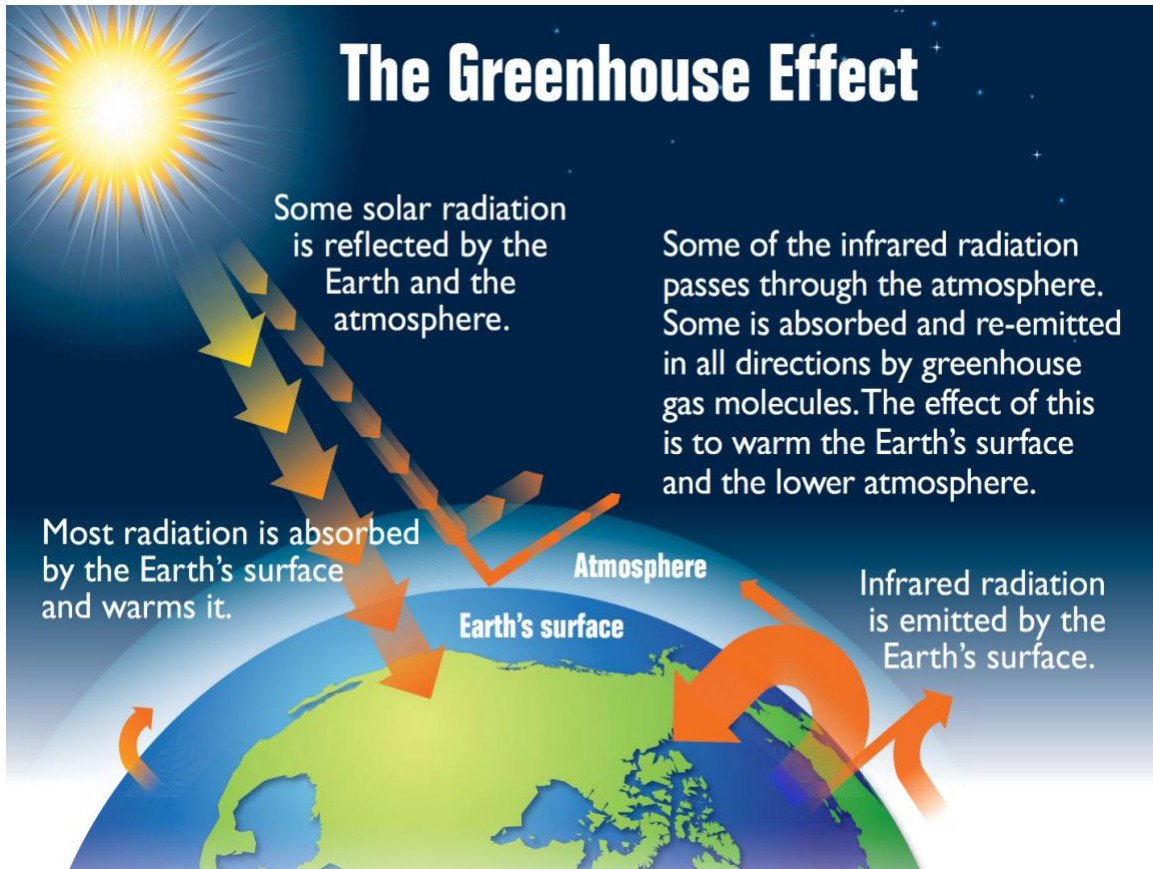
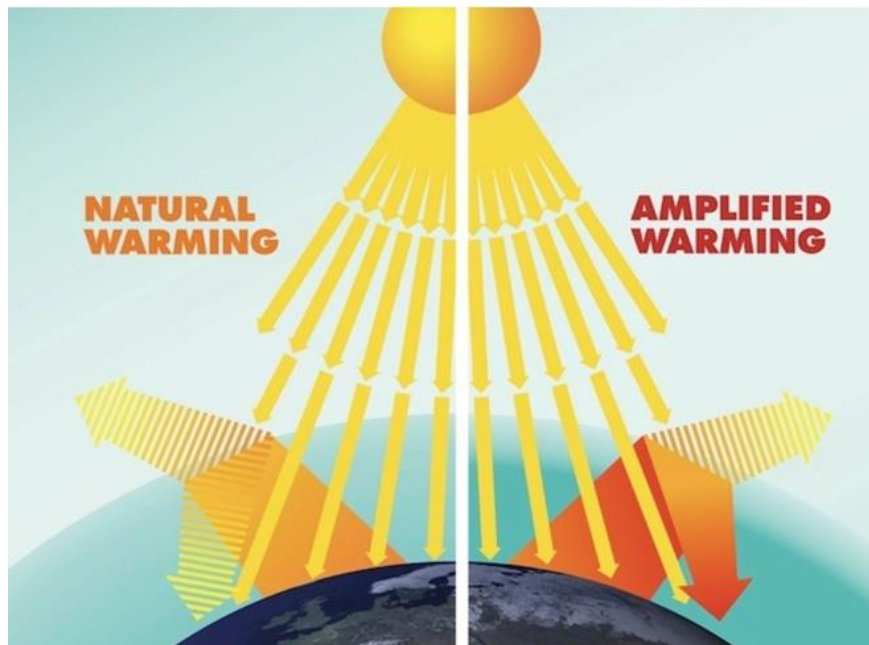


Image from Landscape for Life Manual; <https://landscapeforlife.org/>

## What is the Greenhouse Effect?



Course Book Figure 6. The Greenhouse Effect. Image credit: US Environmental Protection Agency.<sup>1</sup>



Presentation Figure on Slide 17. Image credit: U.S. Global Change Research Program.<sup>2</sup>

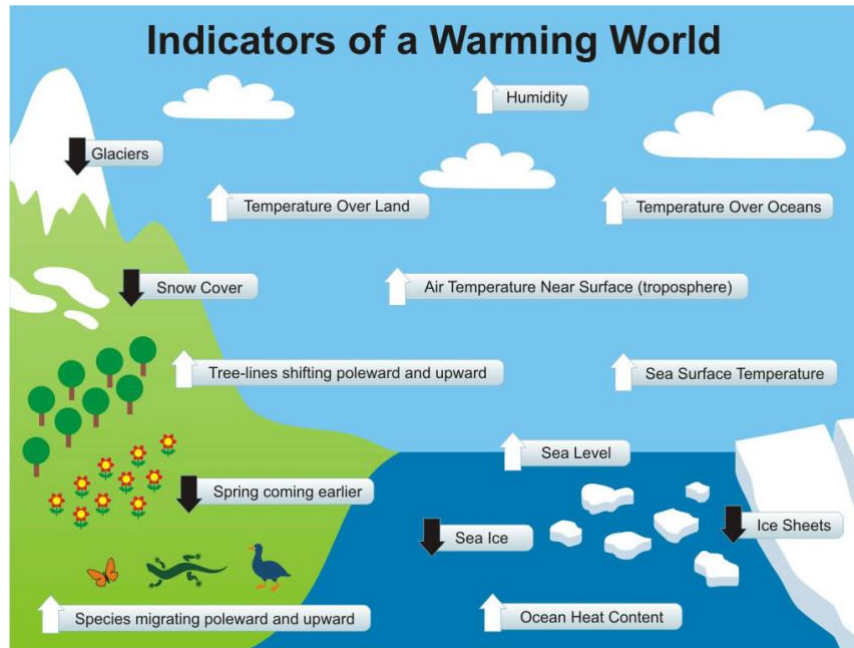
<sup>1</sup>US EPA. 2012. The Greenhouse Effect. Accessed Sept 2018 from [https://commons.wikimedia.org/wiki/File:Earth%27s\\_greenhouse\\_effect\\_\(US\\_EPA,\\_2012\).png](https://commons.wikimedia.org/wiki/File:Earth%27s_greenhouse_effect_(US_EPA,_2012).png)

<sup>2</sup>U.S. Global Change Research Program. 2009. Climate Literacy: The Essential Principles of Climate Science. Retrieved 31 July 2017.

<https://www.climate.gov/teaching/essential-principles-climate-literacy/essential-principles-climate-literacy>

# What Happens in New York State When the Climate Changes?

The videos found at Climate Learning Network will offer climate change basics in a very clear and concise manner: <http://www.climatelearning.net/e-learning-modules/>



Course Book Figure 9. Indicators of a Warming World. Image credit: [www.skepticalscience.com](http://www.skepticalscience.com)<sup>1</sup>

## Observing Climate Change Impacts in New York<sup>2</sup>

New York's ClimAID report (2011, 2014), the National Climate Assessment (2014), and other research show that a variety of climate change impacts have already been observed.

### Temperature

- The annual average temperature statewide has risen about 2.4°F since 1970, with winter warming exceeding 4.4°F. This equals about 0.25°F per decade since 1900.
- Annual average temperatures have increased across the state.

### Precipitation

- Overall, average annual precipitation has increased across New York State since 1900, with year-to-year (and multiyear) variability becoming more pronounced.
- New York is getting more precipitation in the winter and less precipitation in the summer.
- Between 1958 and 2010, the amount of precipitation falling in very heavy events (downpours) increased more than 70% across the northeastern United States.

### Sea-level rise

- Sea levels along New York's coast have already risen more than a foot since 1900.
- New York's rate of rise (about 1.2 inches per decade) is almost twice the observed global rate (0.7 inches per decade) over the same period.

### Natural resources

- Spring begins a week earlier than it did a few decades ago; the first leaf date is more than 8 days earlier & the first bloom date is more than 4 days earlier than in the 1950s.
- Winter snow cover is decreasing.
- Pollinating bees in the northeastern US arrive about 10 days earlier than in the 1880s.
- NY breeding bird & ocean fish population ranges have shifted northward over the last decades.

<sup>1</sup>US EPA. 2012. The Greenhouse Effect. Accessed Sept 2018 from [https://commons.wikimedia.org/wiki/File:Earth%27s\\_greenhouse\\_effect\\_\(US\\_EPA,\\_2012\).png](https://commons.wikimedia.org/wiki/File:Earth%27s_greenhouse_effect_(US_EPA,_2012).png)






<sup>2</sup>NYSDEC Impacts of Climate Change in New York World. Accessed September 17, 2018 from <https://www.dec.ny.gov/energy/94702.html>



### Reliable Resources Matrix – Example

| ➤ <b>Title of Resource:</b> <i>The Climate Conscious Gardener</i> by Janet Marinelli, Editor  |   |   |  |  |  |               |
|---|---|---|--|--|--|---------------|
|   | <b>1</b>                                  | <b>2</b>  | <b>3</b>   | <b>4</b>   | <b>5</b>   | <b>Rating</b> |
| <b>Who?</b> – The author's experience with this area.   | Author background is unknown.             | Little evidence – a few or minor publications in this area. | Some evidence – more than a few/minor publications in this area. | More evidence – several publications in this area.   | Author is known authority in this area.<br><i>Former Director of the Brooklyn Botanical Garden</i> | 5             |
| <b>What?</b> – Are the points relevant to our needs or tasks?   | No, little, or marginal relevant points.  | Some relevant points.                                       | Several relevant points.   | Numerous relevant points.<br><i>Book offers many strategies for sustainable climate change gardening</i> | Content and points closely match our needs or tasks.   | 4             |
| <b>Where?</b> – Context/situation of content is similar to ours?  | Situation is different.                   | Minimal similarities.                                       | Some similarities.   | Number of similarities.<br><i>Book offers examples I can use for my vegetable gardening</i>              | Context/situation matches ours.  | 4             |
| <b>When?</b> – Publication date.*   | Date is not clear or older than 20 years. | 10 to 20 years old.   | 5 to 10 years old.<br><i>Written in 2010</i>                     | 2 to 5 years old.  | Published or updated in the last 2 years.  | 3             |
| <b>Why?</b> – Reasons or purpose of article?  | No apparent motive.                       | Opinion based publication.                                  | Trade magazine or commercial publication.                        | News or information publication lacking specific research based references.                              | Peer reviewed publication with research based references cited.                                    | 5             |
| <b>Total Score</b>  | ➡   | ➡   | ➡  | ➡  | ➡  | 21            |
| Provide a few sentences to summarize the content of this resource:  |   |   |  |  |  |               |
| <p><i>This book offers gardeners specific techniques for mitigating climate change and adapting to climate impacts in their back-yard gardens. It is very reader friendly and has numerous helpful graphs and photos. I found the chapter on reducing your garden's carbon emissions very useful and interesting.</i></p> |   |   |  |  |  |               |
| In which of the following <b>category</b> would you put this resource? (Choose the ONE BEST fit).   |   |   |  |  |  |               |
| Climate Science   |   | Adaptation Measures   |  | <input checked="" type="checkbox"/> Sustainable/Gardening  |  |               |
| Climate Status Report   |   | Mitigation Methods  |  | Other (specify)  |  |               |

**Reliable Resources Matrix - Worksheet**

| <b>Title of Resource:</b>   |   |   |   |  |   |               |
|---|---|---|---|--|---|---------------|
|   | <b>1</b>  | <b>2</b>  | <b>3</b>  | <b>4</b>   | <b>5</b>  | <b>Rating</b> |
| <b>Who?</b> – The author's experience with this area.   | Author background is unknown.   | Little evidence – a few or minor publications in this area.                         | Some evidence – more than a few/minor publications in this area.                    | More evidence – several publications in this area.                                   | Author is known authority in this area.   |               |
| <b>What?</b> – Are the points relevant to our needs or tasks?                                     | No, little, or marginal relevant points.  | Some relevant points.   | Several relevant points.  | Numerous relevant points.  | Content and points closely match our needs or tasks.                                  |               |
| <b>Where?</b> – Context/situation of content is similar to ours?                                  | Situation is different.   | Minimal similarities.   | Some similarities.  | Number of similarities.  | Context/situation matches ours.   |               |
| <b>When?</b> – Publication date.*   | Date is not clear or older than 20 years.   | 10 to 20 years old.   | 5 to 10 years old.  | 2 to 5 years old.  | Published or updated in the last 2 years.   |               |
| <b>Why?</b> – Reasons or purpose of article?  | No apparent motive.   | Opinion based publication.  | Trade magazine or commercial publication.   | News or information publication lacking specific research based references.          | Peer reviewed publication with research based references cited.                       |               |
| <b>Total Score</b>  |  |  |  |  |  |               |
| Provide a few sentences to summarize the content of this resource:                                |   |   |   |  |   |               |
| In which of the following <b>category</b> would you put this resource? (Choose the ONE BEST fit). |   |   |   |  |   |               |
| <b>Climate Science</b>  |   | <b>Adaptation Measures</b>  |   | <b>× Sustainable Gardening</b>   |   |               |
| <b>Climate Status Report</b>  |   | <b>Mitigation Methods</b>   |   | <b>Other (specify)</b>   |   |               |



## Climate-smart gardening put into action

The list below provides steps that may improve the climate IQ of your garden; this includes actions to reduce your carbon footprint. Consider each and check the box if the action is adaptation, mitigation or both. As you consider each use the additional space to record comments, questions, or caveats.

| Action  | Is this adaptation?      | Is this mitigation?      |
|---|--------------------------|--------------------------|
| <p><b>Experiment with new species</b><br/>New climate conditions are already shifting plant hardiness zones creating an opportunity to successfully grow species and varieties that previously would not thrive. Projected longer periods of high heat accompanied by low precipitation may also require a shift to more drought-tolerant plant varieties.</p>  | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Move up planting</b><br/>Take advantage of a longer growing season by setting an earlier start date for planting cold sensitive annual vegetables and flowers.</p>  | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Manage water</b><br/>Rain is predicted to fall in more intense events, which can cause plants to have “wet feet” and root disease. Identify where water pools in low spots and reconfigure your garden for better drainage. Use soil amendments to improve drainage during wet periods or to improve water-holding capacity during dry periods. Also consider rain barrels and drip irrigation to collect water and redistribute water to specific locations.</p> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Protect plants against frost</b><br/>When spring temperatures come sooner than usual, trees and shrubs can leaf out earlier, making them vulnerable to spring frost. Avoid planting on north-facing slopes and low-lying shaded areas that are more subject to frosts. Consider strategies such as reusable fabrics to cover plants when frost is likely.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Be aware of invasive threats</b><br/>Higher temperatures are predicted to bring increased weed, insect, and disease pressure. Contact your Cooperative Extension experts to stay informed about new pest.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |

## Climate-smart gardening put into action

The list below provides steps that may improve the climate IQ of your garden; this includes actions to reduce your carbon footprint. Consider each and check the box if the action is adaptation, mitigation or both. As you consider each use the additional space to record comments, questions, or caveats.

| Action  | Is this adaptation?      | Is this mitigation?      |
|---|--------------------------|--------------------------|
| <p><b>Attract native pollinators</b><br/>           Insects are essential to the reproduction of most flowering plants. Climate change impacts may cause some plants to shift when they produce flowers, and other plants to grow poorly. Aim to support a variety of pollinating insects by providing nectar throughout the growing season. Choose a palette that blooms from spring to summer to fall with multiple species of flowering plants that bloom at the same time. If one fail to thrive others will be available for pollinators. This is called <i>functional redundancy</i>.</p> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Stay flexible</b><br/>           While there are projections for climate change in the future, there are many unknowns including the variability of plant responses to environmental changes. One way to be prepared for unpredictability is to include a diverse mix of plants. Pay attention to what plants are doing well and consider what qualities are allowing them to thrive.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Green roofs</b><br/>           Growing turf and plantings on a (flat) roof top, or creating a roof-top patio garden is a way to increase the green space in your dwelling. Trees and shrubs serve as carbon sinks, that is, they absorb carbon dioxide. A green roof can also absorb heat and lower the summertime temperatures of a building. Added green space means urban apartment dwellers can grow veggies on the roof top of their apartment building, or garage.</p>  | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Container gardening</b><br/>           Growing plants, trees and vegetables in containers can increase the amount of green surrounding your dwelling; especially apartments or condos. Using repurposed or containers made of recycling material might be another way of lowering your garden's carbon footprint.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |

## Climate-smart gardening put into action

The list below provides steps that may improve the climate IQ of your garden; this includes actions to reduce your carbon footprint. Consider each and check the box if the action is adaptation, mitigation or both. As you consider each use the additional space to record comments, questions, or caveats.

| Action  | Is this adaptation?      | Is this mitigation?      |
|---|--------------------------|--------------------------|
| <p><b>Xeriscaping</b><br/>Conserving water is a key principle of xeriscaping, which is accomplished by a garden design that includes a wide range of drought resistant plants, and landscapes materials that require no irrigation. For example, gravel or mulch create the spacing between planting beds, rather than grass.</p> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Permaculture</b><br/>Applying this garden and social design process involves simulating or directly utilizing the patterns and features observed in natural ecosystems in your specific region.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Rain garden</b><br/>This garden maintains the integrity of the soil by preventing erosion and protects water ways by slowing down, or eliminating run-off.</p>  | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Meadow lawn</b><br/>Replacing a lawn with native grasses and wildflowers reduces the need for use of fossil-fuel burning power equipment to maintain the lawn. It will also be attractive to insects and wildlife that support a healthy ecosystem.</p>   | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Raised bed gardening</b><br/>Raising the level of the soil above the surface can improve the health of your plants and thereby increase their ability to store carbon dioxide. It also can decrease the chance of water logging in low areas that may be prone to flooding or ponding.</p>                                  | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Composting</b><br/>Composting organic matter from mowing, pruning, weeding, and food waste would reduce fossil fuel consumption used to transport your waste off-site and would prevent the production of methane that occurs when organic matter is buried in a landfill.</p>  | <input type="checkbox"/> | <input type="checkbox"/> |

## Climate-smart gardening put into action

The list below provides steps that may improve the climate IQ of your garden; this includes actions to reduce your carbon footprint. Consider each and check the box if the action is adaptation, mitigation or both. As you consider each use the additional space to record comments, questions, or caveats.

| Action  | Is this adaptation?      | Is this mitigation?      |
|---|--------------------------|--------------------------|
| <p><b>Use your finished compost</b><br/>Using your finished compost as mulch or mixing it into the garden or potting mix contributes nutrients and beneficial organisms to soil life. The additional organic matter can also enhance soil's water holding capacity and carbon sequestering.</p>                           | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Mulch in place grass clippings &amp; leaves</b><br/>Leaving cut grass blades in place lowers fertilizer needs as they are mostly water and nutrients. Lawn health is not compromised when tree leaves that drop on the lawn in the fall are chopped finely enough to slip between grass blades to soil surface.</p> | <input type="checkbox"/> | <input type="checkbox"/> |
| <p><b>Add your action ideas...</b></p>  |                          |                          |
|   | <input type="checkbox"/> | <input type="checkbox"/> |
|   | <input type="checkbox"/> | <input type="checkbox"/> |
|   | <input type="checkbox"/> | <input type="checkbox"/> |

## APPENDIX B: ACTIVITIES

### Benefits of Systems Thinking for Sustainable Gardening Activities

#### Use *Being a Systems Thinker* Handout #1

##### Inspire Understanding with Discussion

Consider these questions yourself and how you might incorporate them in your educational outreach with individuals and groups. With groups, consider breaking up into small discussion teams of about 4-5 people. When it comes to dire problems like climate change, cultivating a dialogue among gardeners can be a critical aspect of understanding the challenge, and ultimately can lead to changes in behavior grounded in sustainable practices and environmental stewardship.

Q. Reflect on how you make a decision and /or resolve a problem in your own life. How have you or might you use *systems thinking*? Refer to the bullet points under Systems Thinker. (*Explore a full range of scenarios to uncover the application of systems thinking in our daily lives.*)

Q. Reflect on examples in everyday life that illustrate a lack of systems thinking that may not be obvious at first. Advertisements can be a rich source of these examples; for instance, an ad pictures a large 4x4 SUV driving down a flooded street to promote the vehicle as a solution to living in adverse weather conditions. The inappropriateness of the message might emerge when one considers that the adverse weather conditions may have been the result of climate change and that CO<sub>2</sub> emissions from gas powered vehicles contributes to climate change. (*If other examples do not immediately leap to mind, keep this as food for thought as you will likely uncover examples as your habit of systems thinking expands.*)

Q. What are ways in our everyday lives that we contribute to an unsustainable community? (*Explore the full range of behaviors in our modern lives including those motivated by convenience and in contradiction to our environmental stewardships goals.*)

Q. What are some practical ways we might strive to create sustainable communities? (*Identify barriers to sustainable communities as well as avenues and supports that will minimize barriers.*)

Q. Focusing on cultivating a garden, how might *systems thinking* enhance short- and long-term gardening goals and success in a warming world? Provide specific examples. (*Explore a full range of scenarios to uncover the application of systems thinking in gardening success in a changing world.*)

Q. What specific ways might gardens and gardening contribute to sustainable communities? (*Take time to practice systems thinking and connect the dots within and among the three key systems - environmental, economic and social.*)



## **Benefits of Systems Thinking for Sustainable Gardening Activities**

### **Use *Being a Systems Thinker* Handout #1**

#### **Garden Clinic**

Recruit one or more volunteers to briefly describe to the whole group a specific challenge or problem in their garden. Break up into teams to practice systems thinking in examining the challenge(s) or problem(s) and identifying potential strategies to address the challenge(s) or problem(s). Encourage teams to review the systems thinker bullet points in their efforts to identify the connections and impacts that solutions might have – including potential effects that might not be obvious at first. For example, using an herbicide may successfully kill a noxious invasive species but also the beneficial insects including pollinators that converge on it and nearby plants. Systems thinking requires being a detective who asks good questions to ascertain connections. Some groups may find drawing a simple diagram or map helps explore links between components, actions and potential impacts.

#### **Ball of Yarn Interconnections**

Try this as an icebreaker and/or an introduction to a discussion around interconnectedness. Form a circle with your group and have on hand a ball of yarn. Give the ball of yarn to one person who is willing to begin by stating a personal garden challenge or problem. The first person keeps hold of the end of the yarn ball and tosses the ball to another group member, who then shares a personal garden challenge or problem that relates to the previous one described. Continue this pattern until everyone in the circle has shared. Note the interconnected web that has been formed as the relationships among challenges or problems emerge.

#### **Mind map**

Mind mapping is a method of brainstorming. It relates to the way our brains work, and that is, by linking thoughts and making connections, with one idea leading into another. This activity is an effective way to reflect on the key elements of sustainability. For this exercise, create small discussion groups of 4 to 5 people. Pass out news-print/ flip-chart size paper (or typing-paper if larger sheets are not available) and marking pens. Have each group select someone to do the writing for the group. Each group draws a circle in the middle of the page and writes the word "sustainability" in the circle. Identify main ideas group members think of which relate to sustainability and write those ideas on lines emanating from the circle. Draw lines branching out from the main ideas and write any connecting thoughts on those lines. Each group can then share their mind maps in a whole group discussion.



## Knowing Our Garden Systems Activities

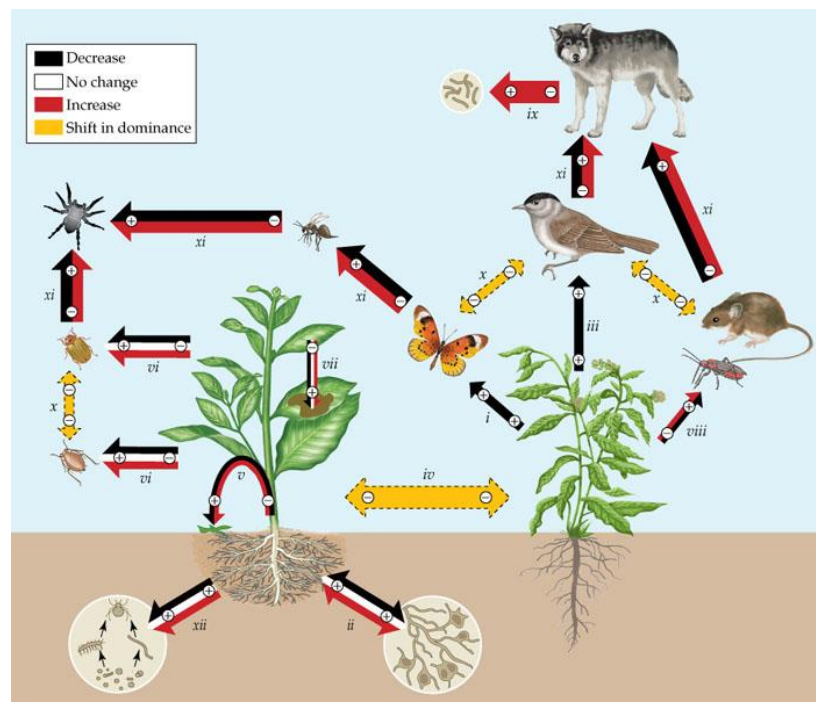
The art of learning how to notice is invaluable to our understanding of biological impacts of climate change on our garden landscapes. The following activities will enhance your, or your group's observational skills in the garden.

### Inspire Understanding with Discussion

Consider these questions yourself and how you might incorporate them into your educational outreach with individuals and groups. With groups consider breaking up into small discussion teams of about 4 -5 people. When it comes to dire problems like climate change, cultivating a dialogue among gardeners can be a critical aspect of understanding the challenge, and ultimately can lead to changes in behavior grounded in sustainable practices and environmental stewardship.

Q. What types of changes have you noticed in your garden over the years? Evaluate the links among your observations and the climate change impacts in New York State. (*Share and connect personal observations with insights collected through scientific monitoring, research and modeling. Continue or begin recording and reflecting on observations as well as discussing them with others*)

Q. Practice systems thinking and discover how elements in your garden are linked to other elements and systems by selecting some part of your garden with which you are very familiar (a tree, a group of plants, a compost pile, a sitting area, a pond). Investigate it by asking a series of simple questions like: What is it made of? Where has it come from? Who made it? Then consider more searching questions like: What needs does it fulfill? Is it necessary? What will happen to it in the future? Could it be redesigned to have a smaller environmental footprint? (*Each group member might first consider something familiar, individually recording their answers to the questions and beginning to identify connections between their answers, producing a web-like diagram. Then a volunteer might share her initial exploration with the whole group where additional connections might be uncovered. This activity can extend almost indefinitely depending on the enthusiasm of the groups and can lead groups well outside the garden system to economic, social and ecological systems.*)



## Knowing Our Garden Systems Activities

### Garden Journaling Exercise

This exercise can be done by yourself or in a facilitated setting. If you are leading a group workshop, find out who among your participants has engaged in journaling. Ask them what they have learned and have them share their experiences with the whole group.

Suggest to participants that they begin a garden journal if they have not already started one. Direct them to use a garden journal to continue, or begin, collecting observations and reflecting on patterns they notice. They should start with what information they are already considering in planning and cultivating their garden landscapes. They will want to pay close attention to those changes they might observe that are consistent with what scientists are predicting about climate change. You can direct them to the Climate Change Basics –Unit 3- of the Course Book for such information.

### Cataloging Your Garden Site

This is an excellent individual or group activity. If you are facilitating a group, have your participants collect leaves/plant parts from around their garden site. Ask them to photograph or sketch them and work towards identifying what they have collected. They can develop their own cataloging method they find most useful. It may be by plant family, color of flowers, type of plant, habitat or any of the other many characteristics of plants and landscapes. Likewise, they might photograph or sketch creatures such as spiders, insects, pollinators, wildlife, and even domesticated animals that are connected to the plants.

There are a number of print resources for identifying plants and animals. Additionally, these few online resources might be helpful:

BugGuide <http://bugguide.net/>

Bugwood Image Database System <https://images.bugwood.org/>

Discover Life <http://www.discoverlife.org/>

Finger Lakes Native Plant Society <http://flnps.org/native-plant-profiles>

### Creating a Garden Calendar

This is a very enjoyable and informative activity whether in a group or individual basis. Create your own personalized calendar using images of your gardens, plants, flowers, etc. A quick web search will lead you to numerous online options for creating calendars. Images that you may use can include photographs, drawings, paintings, scanned plants, etc. Let your artistic whim guide you. On your calendar you might include last year's observations as well as space for this year's. Here are a sampling of topics that might be relevant to your garden site:

- weather data (precipitation, temp, wind)
- day length/hours of sunlight
- bloom dates
- Specifics on what you are doing in the garden (e.g. planting, mulching, compost, pruning, fertilizer, watering). What, when, how much and from where?

## Knowing Our Garden Systems Activities

### A Close Look: Cultivating Plant Observation Skills

Familiarity with botany terminology improves our observations and descriptions of plant characteristics. As you may know, the botanical name for plants is written in italics and begins with the genus (with the initial letter capitalized) followed by the species (lower-case initial letter). As long-time gardeners can attest, using the correct name for a plant can save you from a whole garden season of growing the wrong plant!

This plant identity activity and accompanying **Botany Language** fact sheet can be enjoyed by youth and adults is found at:

<http://gardening.cals.cornell.edu/lessons/activities/>

### Are the Bloom Dates Changing and More?

Phenology is the study of life cycle events for plants and animals. The flowering sequence of plants can be used as a biological calendar to predict insect activity, and to time other gardening practices that are dependent on a particular stage of plant development, such as propagation or pest and weed management. Have your participants record the dates and weather conditions on which their favorite plants or dominant vegetation shows first leaf, first bud, first flower, full bloom, and die-off.

Additionally, there are several citizen science projects that offer opportunities to report on the phenological stages of specific plants. They offer information, handbooks, guides, data sheets and organism profiles to support you becoming an observer of your garden landscape and other ecosystems:

- Ohio State University Phenology Garden Network <http://phenology.osu.edu/resources.asp>
- National Wildlife Federation <http://www.nwf.org/wildlife/wildlife-conservation/phenology.aspx>
- Natures Notebook/ National Phenology Network <http://www-dev.usanpn.org/home>
- Vegetable Varieties for Gardeners <http://vegvariety.cce.cornell.edu/>
- The Lost Ladybug Project <http://www.lostladybug.org/>
- CoCoRaHS is a network of weather watchers <http://www.cocorahs.org/>
- Journey North <http://www.learner.org/jnorth/>

You may find even more in **Citizen Science Central** database of projects. Try using search terms like garden, soil or invasive. <http://www.birds.cornell.edu/citscitoolkit>





## Climate Change Basics Activities

### Inspire Understanding with Discussion

Consider these questions yourself and how you might incorporate them in your educational outreach with individuals and groups. With groups, consider breaking up into small discussion teams of about 4 - 5 people. When it comes to dire problems like climate change, cultivating a dialogue among gardeners can be a critical aspect of understanding the challenge, and ultimately can lead to changes in behavior grounded in sustainable practices and environmental stewardship.



Q. Does climate affect your everyday life? Elaborate on specific examples. (*Consider the many ways that climate is a part of our daily lives- eating, working, playing, traveling... Be sure to think about climate – not weather. Clarify the definitions of each.*)

Q. What changes in your life do you foresee as the temperate climate we have been so used to begins to warm? Explore how it might specifically impact your gardening practices. (*Explore the full range of quality of life scenarios that could unfold - from the negative to positive.*)

### Identify Reliable Sources About Climate Change

#### Use *Reliable Resources Matrix Handout #5*

Prior to a workshop or presentation, have people read and bring to the session 2 to 3 articles about climate change. Take some time to briefly discuss the sources they found and the key points they learned. You can ask prompting questions such as: What indicators do you look for to be certain the information you read is research-based? Where else do you find research-based information that will keep you informed about climate change? (For example, the blog [realclimate.org](http://realclimate.org) is written by a consortium of climate scientists who provide background data and scientific interpretation of the latest climate news). This activity can help your participants identify the latest news about climate change, and also, how to identify good sources of news on the topic. It illustrates the scope and breadth of the information available as well as the challenge of identifying credible sources. Consider sharing and using the following matrix for participants to organize and evaluate their climate resources.

If you are pressed for time, consult the reflective questions section at the end of Climate Change Basics Unit in the Course Book for a simpler, checklist version of this activity.)

For each resource the participant brings in, ask them to rate each one on the following "Who," "What," "Where", "When" and "Why" criteria from 1 (low) to 5 (high) based on the descriptive definition provided for each rating. After completing the ratings for each resource, tally the total number, which will help provide the participants with a rough idea as to the overall quality and reliability for that source. You can also ask them to use the small box at the bottom of the chart to summarize the content of that resource as well, and finally, categorize it by type. This exercise helps quantify the value of each resource, how accurate it is, and how reliable.

## Climate Change Basics Activities

### Hot Globe

Try this version of "hot potato" as an icebreaker and/or an introduction to a discussion of climate change. Form a circle with your group and have on hand a ball (the "hot globe" representing planet earth). Toss the "hot globe" to a person in the circle and say "climate change". That person is to immediately say the first word that comes to mind then throw the "hot globe" to another person in the circle who does the same. The process continues until everyone has held the "hot globe".

### How Do You Feel?

Organize small group discussions around how participants feel (not think) about climate change. In guiding the discussion, suggest feeling words such as "uncomfortable", "afraid", "skeptical". It is important for people to discover how this unprecedented **threat** makes them feel so they can begin to deal with their feelings. Fear and apathy in particular can hold people back from taking corrective action. Understanding our feelings as well as our audience's feelings is key to effectively communicating and fostering understanding around a topic like climate change.

### Role-Play

Recruit two volunteers to simulate neighbor 1 and neighbor 2 talking over the backyard fence in the following scenario:

It is the morning after a record-breaking severe rainfall. Neighbor 1 and 2 are evaluating the respective damage to their gardens. Neighbor 2 mentions over the fence to neighbor 1 that this event is what scientists have predicted would be a likely climate change impact for our region in New York State. Neighbor 1 replies that the weather has certainly been whacky but it is just part of a natural cycle, nothing particularly new. Neighbor 2 offers details about the natural heating/cooling cycles of climate over the history of the earth including the overwhelming data showing that human activity is responsible for accelerating a change in climate trends. Neighbor 1 respectfully disagrees and neighbor 2 respectfully continues the dialogue about weird weather and climate change.

Be creative. What other role-play scenarios might help us practice



engaging in respectful and insightful conversations around climate change?

## **Climate-Smart Sustainable Garden Audit Activities**

### **Inspire Understanding with Discussion**

When it comes to dire problems like climate change, cultivating a dialogue among gardeners can be a critical aspect of understanding the challenge, and ultimately can lead to changes in behavior grounded in sustainable practices and environmental stewardship.

Our Sustainable Garden Audit focuses on mitigation and adaptation actions in these major practices. (See details in *Course Book* Unit 4)

1. Organic material waste management
2. Soil health and nutrient management
3. Water management and conservation
4. Pollinator protection
5. Garden design and plant selection
6. Equipment and material selection

Our aim is to inspire deeper learning and discussion not provide a check list of what to do to call yourself a good steward (the one and done attitude will not do). Instead, recall *Habits of a Systems Thinker* and embrace that there are no single solutions, practices are interrelated, one strategy influences the other. As you reflect on the 6 areas above focus on:

1. What are you already doing and what additional actions can you take to reduce (mitigate) GHG emission in our gardening practice?
2. What are you already doing and what additional actions can you take to adapt our gardens to climate change?

If you are short on time and or working with a group, consider breaking up into smaller groups and having each focus on just one area that is assigned to them or chosen by them. After some time in small groups, come back together as a whole group and highlight or list the full range of strategies gardeners are or could be implementing through mitigation and adaptation.

### **Right Plant Right Place**

Knowing your local conditions and choosing a diverse mix of plants suited to your site conditions are essential parts to working with nature to cultivate a sustainable garden ecosystem in the face of climate change. Ask other gardeners what they are growing and explore our growing guides to diversity your plant portfolio. Here are some places to start - and ask others what resources they might use:

- Woody Plant Database: <http://woodyplants.cals.cornell.edu/home>
- Flower & Vegetable Growing Guides: <http://www.gardening.cornell.edu/homegardening/index.html>
- Vegetable Varieties for Gardeners: <http://vegvariety.cce.cornell.edu/main/login.php>
- New York invasive species: <http://nyis.info/>
- Alternatives to Invasive Plants: [http://www.nysipm.cornell.edu/nursery\\_ghouse/invasive\\_plants.asp](http://www.nysipm.cornell.edu/nursery_ghouse/invasive_plants.asp)



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## Cornell Cooperative Extension Monroe County



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<sup>1</sup> NYSDA. 2014. Climate Change in New York State: Refined and Updated Projections Online at <https://www.nyseda.ny.gov/-/media/Files/Publications/.../ClimAid-Brochure.pdf>, accessed June 17, 2017.

<sup>2</sup> Killion, J. and Simmons, L. 1992. Zen of Facilitation. *Journal of Staff Development* 13(3): 2-5. Online at <https://learningforward.org/docs/jsd/killion133.pdf?sfvrsn=0>

<sup>3</sup> Center for Courage and Renewal. (n.d.). Circle of Trust Touchstones. Online at <http://www.couragerenewal.org/touchstones/>, accessed May 1, 2017.

<sup>5</sup>From Gaining trust as well as respect in communicating to motivate audiences about science topics, by Fisk and Dupree in *Proceedings of the National Academy of Sciences* 2014 vol. 111.

<sup>6</sup> Eco-America and Center for Research Environmental Decisions, Earth Institute, Columbia University. 2014. Connecting on Climate: A Guide to Effective Climate Change Communication. Online at <http://ecoamerica.org/wp-content/uploads/2014/12/ecoAmerica-CRED-2014-Connecting-on-Climate.pdf>, accessed May 2, 2017.

<sup>7</sup> Baram-Tsabari, A. and Osborne, J. (2015), Bridging science education and science communication research. *Journal of Research in Science Teaching*, 52: 135–144.

<sup>7</sup> Baram-Tsabari et al., 2015.

<sup>9</sup> Cook, John. 2017. Skeptical Science: Getting Skeptical about Global Warming Skepticism. Online at <http://skepticalscience.com/Welcome-to-Skeptical-Science.html>, accessed June 13, 2017.

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