

Global Change Research Needs and Opportunities for 2022-2031

Committee to Advise the U.S. Global Change Research Program

March 16, 2021

2:00 – 3:00 PM EDT

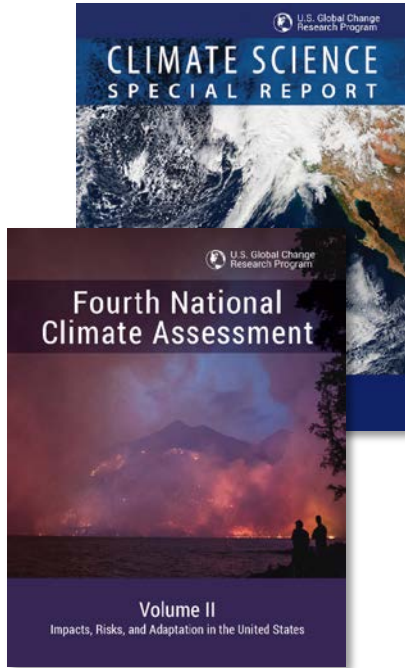
Public Release Briefing Webinar



Briefing Overview

- Background – USGCRP, the committee, its members, its charge, context and approach for this report
- Evolution of Global Change Research
- Exploring the Recommendations –
 - integrated systems-based risk management,
 - coupled human-natural systems,
 - mitigation and adaptation,
 - crosscutting themes,
 - organizational and operational changes, and early actions
- Final thoughts

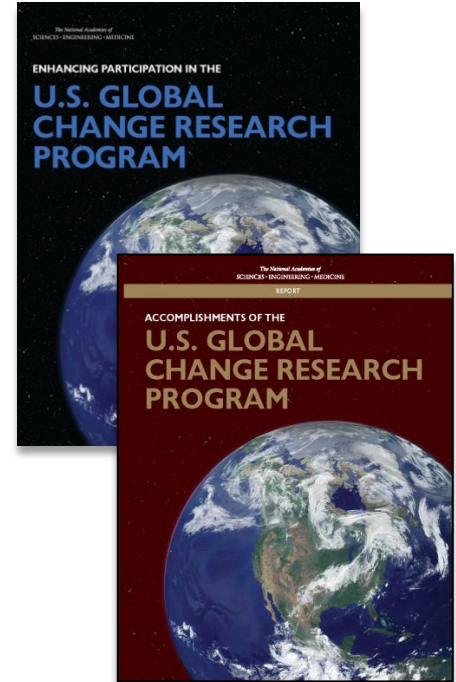
The U.S. Global Change Research Program



- Interagency program (13 agencies and departments) established by Congress (Global Change Research Act of 1990; PL101-606)
- **Coordinates federal research and investments** in understanding the forces shaping the global environment, both human and natural, and their impacts on society
- Coordinates U.S. research activities with **other nations and international organizations**
- **Conducts a synthesis of climate impacts** and trends across U.S. regions and sectors every four years in the National Climate Assessments (NCAs)

Committee to Advise the USGCRP

- Established in 2011; charged to provide ongoing and focused advice to the USGCRP
- Broadly constituted to bring expertise in all the areas addressed by the multi-agency, multi-dimensional USGCRP, and supported by expertise housed in many units across the National Academies
- Convenes meetings with and for the USGCRP; provides venue for ongoing discussions
- Takes on specific *ad hoc* tasks as needed, and issues consensus reports, e.g.:
 - ***Enhancing Participation in the USGCRP* (2015)**
 - ***Review of Draft Update to the Strategic Plan* (2016)**
 - ***Accomplishments of the USGCRP* (2017)**



Current Committee Membership

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Charge for this Report

As input to the next USGCRP decadal strategic plan:

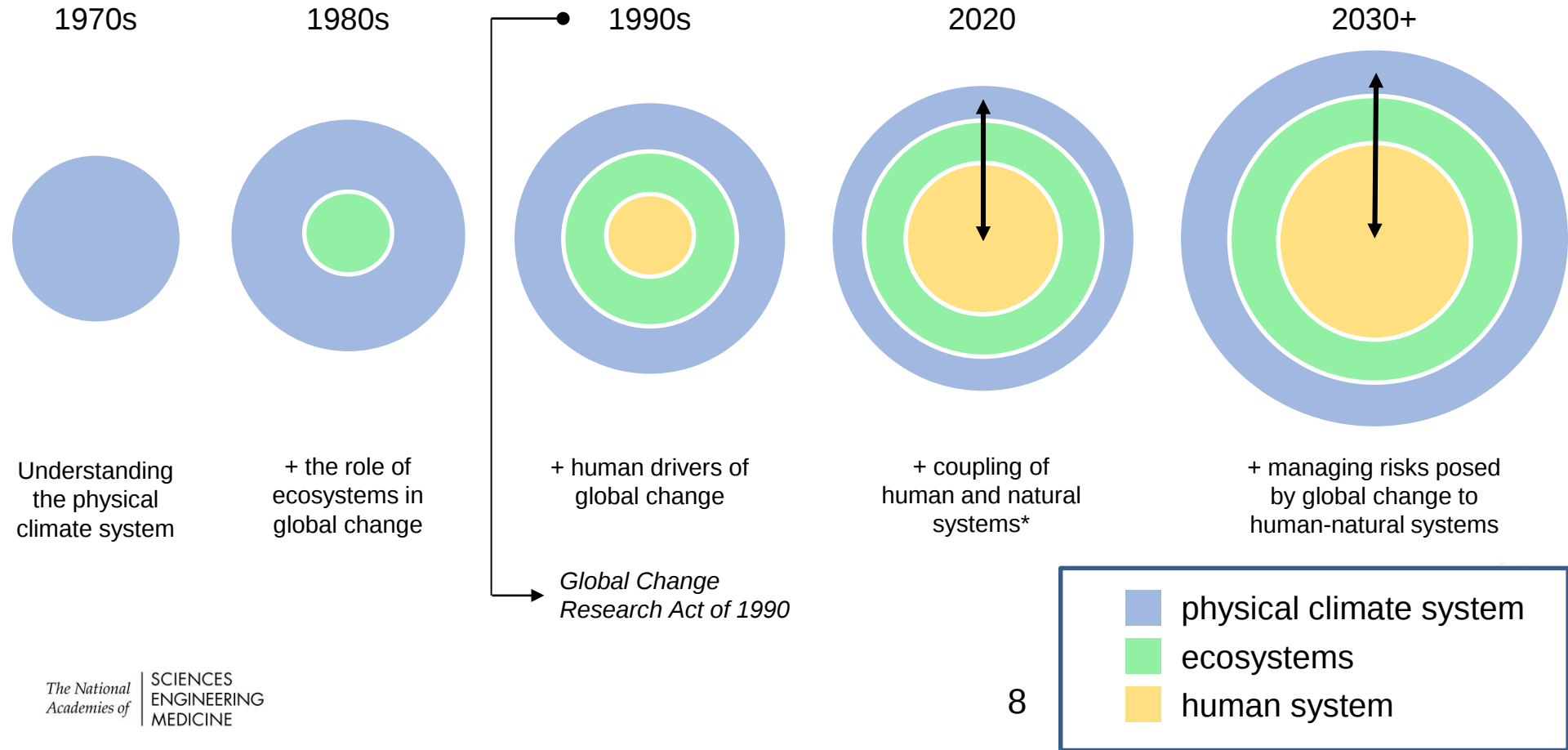
- Identify the most critical global change risks and uncertainties likely to face the nation and the world in the next decade
- Recommend priorities for natural and social science research needed to advance understanding of these risks and uncertainties, and to support decision making at local to national scales
- Discuss opportunities for USGCRP participating agencies and other partners to advance the identified research priorities and applications to decision contexts, including new approaches for better linking the process of scientific deliberations with people who use information

Global Change Research Needs and Opportunities for 2022-2031

- Approach
 - Systems based
 - Forward looking – 2030+
 - User focused
- Committee Expertise and Experience
 - Global change research
 - Climate science-to-policy outreach
 - Familiarity with USGCRP
- History of Productive NAS-USGCRP Partnership
 - Strategic Planning
 - Quadrennial Assessments
 - Ongoing dialogue



Evolution of the Focus of Global Change Research



A New Approach is Needed

- **Traditional climate research is not fully meeting decision-maker needs.** There is an urgent demand for effective, science-based policies to limit climate change and to manage its consequences.
- To produce the scientific understanding needed to inform its climate change policies, the nation requires **a USGCRP commensurate with the scope, scale, and urgency of climate change and other global change challenges.**
- GCRA mandates the Program to “provide usable information on which to base policy decisions relating to global change” (PL101-606). **This information needs to be more than usable, it should be useful and easily used.**

Focus First on Urgent Risks to Americans' Well-being

- Most urgent risks to address are those to the sustained security of critical human systems: **health, food, water, energy, transportation, economy, and national security.**
- Risks to these systems arise from **complex, multidirectional interconnections and interdependencies** between physical manifestations of climate change and human systems.
- Understanding risks will require an **integrated, systems-based risk framing** to identify research priorities.

Key Terms:

Systems

Natural Systems: physical climate system and ecosystems; dynamics governed by biophysical and/or physical processes

Human Systems: systems managed by people to meet specific needs of society; dynamics governed by human actions

Coupled Human-Natural Systems: systems with interconnected, interdependent, and complex interactions among human systems, the physical climate system, and ecosystems

Risks

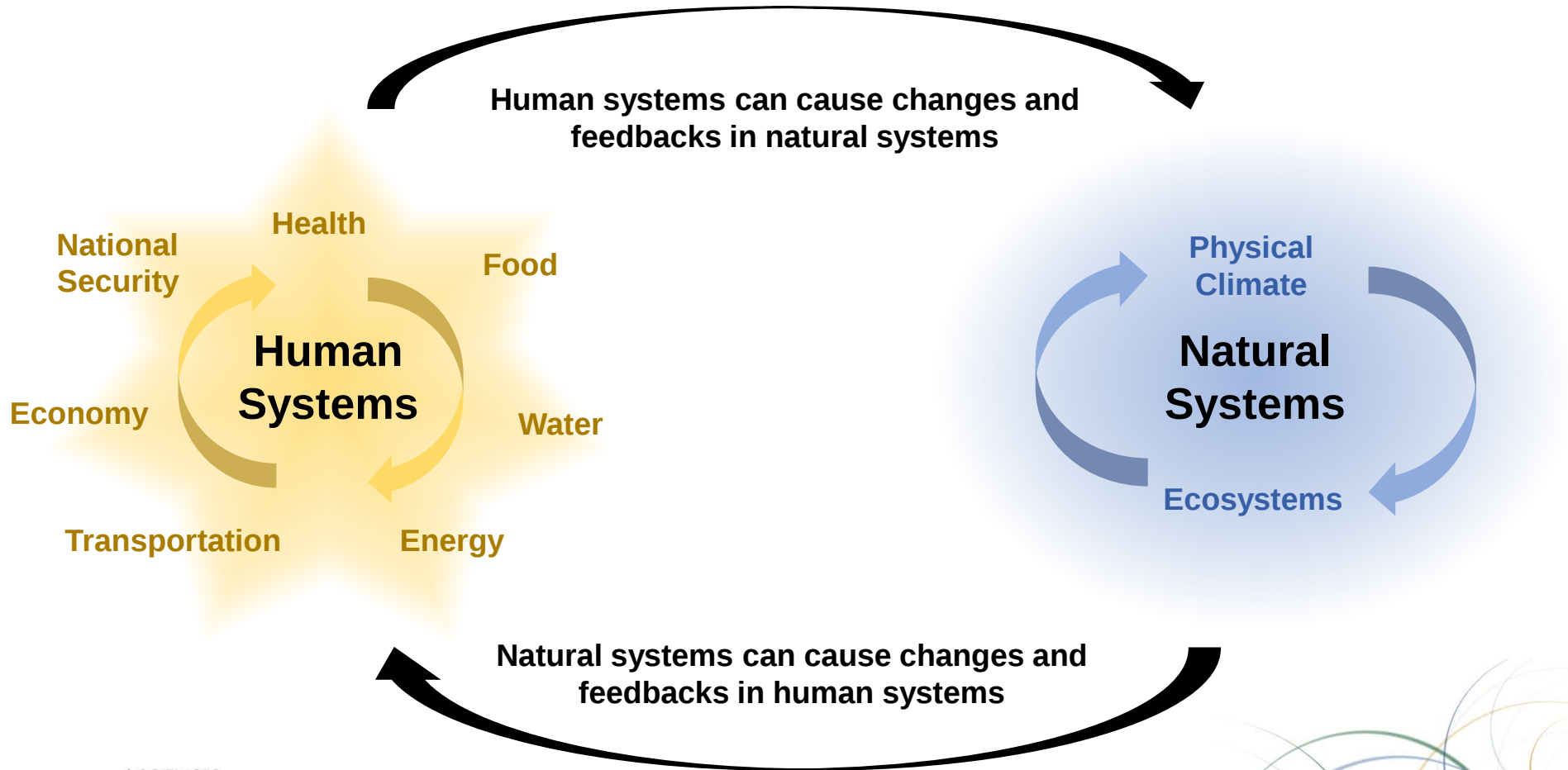
Risks: the potential for adverse consequences for human or natural systems from exposure to hazards

Integrated Risks: risks to coupled human-natural systems

Risk Management Approaches

Management Approaches: strategies to minimize risks to systems; include mitigation, adaptation, and strategies that combine them

Integrated Risk Management Approaches: address risks to human and natural systems, as well as synergies and tradeoffs, to increase security of the integrated system



RECOMMENDATION: Apply an *integrated risk-framing approach* to identify research priorities for the next 10 years that provide insights to avoid the worst potential consequences of urgent risks to human and natural systems from current and future climate change



E.g., food availability and food security. *Photo: CDC*



Design and Implement Integrated Systems-based Research

- Meeting the **urgent decision needs of the next decade** will require greater commitment to research focusing on the interactions among human systems, ecosystems, and physical climate system
- Accelerating the **exchange of technical knowledge** between USGCRP agencies and decision makers
- **Ensure research promotes diversity, equity, and inclusion**
- **Investment in social science research to improve understanding of the:**
 - consequences of climate change, including for migration, global security, supply chains, governance, human health, the insurance industry, etc.
 - behavioral, institutional, and political drivers at different scales

RECOMMENDATION: Accelerate the integration and communication of research on *coupled human and natural systems* to advance understanding of effective options for managing urgent climate change risks at local to international scales.



E.g., coastal systems, communities, and security.
Photo: NOAA Sea Grant

User and Public Participation in Global Change Research

- New approaches to setting research priorities are needed that **put user needs at the forefront**; doing so would attract a broader and more diverse set of stakeholders and incentivize integrated research
- **Ongoing engagement** with users who are involved in setting, implementing, and communicating a research agenda would enhance uptake of findings and information products



Envisioning Cambridge – a NOAA community engagement activity

Decision Support for Mitigation and Adaptation Strategies

- As climate consequences continue to increase across the globe, there is an urgent need to refine strategies that will **manage climate risks** to protect human and natural systems.
- The primary management strategies are: (1) **mitigation**, reducing global emissions and removing CO₂ from the atmosphere; and (2) **adaptation**, preparing for and managing the harmful effects of global change
- Mitigation and adaptation can work together to help society **create a more resilient future**.



Enlarging culvert in Vermont after Hurricane Irene in August of 2011

Mitigation: Reducing Global Greenhouse Gas Emissions and Atmospheric Concentrations

- Achieving net-zero CO₂ emissions is critical to **lowering future risks**.
- Pursuing and informing mitigation-related policies will require better understanding of:
 - 1) emissions targets and associated impacts;
 - 2) thresholds and tipping points in both human and natural systems;
 - 3) approaches for CO₂ removal, reliable sequestration, and utilization; and
 - 4) improved ability to accurately quantify and verify emissions at national and global scales.
- Limiting climate risk also **requires greater understanding of the technical potential** for reducing emissions and requires equity and ethical considerations (i.e., what is feasible given existing or developing technologies, and at what potential cost to whom).

Adaptation: Increasing Resilience to Climate Change Risks

- Has been on USGCRP's research agenda for the past two decades
- **New research, enhanced coordination, and expanded communication** efforts are needed to advance society's ability to adapt to risks that are often arising sooner and more intensely than projected in the context of increasingly complex interactions among these risks.
- **Longer-term evaluation** is needed to monitor the effectiveness of adaptation practices over time and across spatial scales, to identify adjustments needed to enhance resilience.

Solar Geoengineering Research

- Interventions that modify the amount of solar heating of the Earth; not enough is known to deploy today – could reduce some near-term risks but could also introduce new risks.
- Potential for USGCRP to advance this research, particularly if the Program takes steps to improve both its disciplinary representation and its efforts to engage stakeholders in defining research priorities
- Forthcoming consensus report (NASEM, 2021) on the topic for more in depth discussion

RECOMMENDATION: Prioritize research related to *managing climate risks*, including:

- 1) reducing global greenhouse gas emissions and lowering their atmospheric concentrations;**
- 2) increasing resilience to current and anticipated climate-related security risks; and**
- 3) expanding research on incentives for and the synergies and trade-offs between these risk-management approaches**

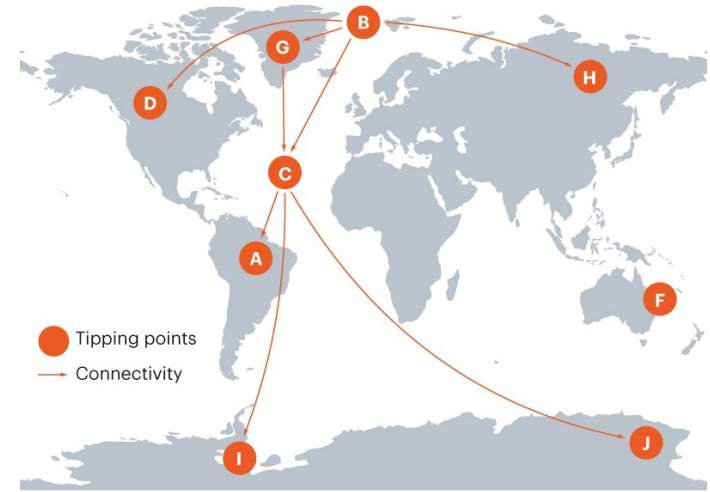
Crosscutting Research Needed to Support Management of Climate Risks

USGCRP is especially well-suited to make progress on crosscutting research efforts that would:

- facilitate cross-comparison and consideration of the intersections of impacts (and responses) across multiple systems, and
- eliminate redundancy in underlying analyses.

RECOMMENDATION: Expand research in five *crosscutting areas*:

- 1) extremes, thresholds, and tipping points;
- 2) regional- and local-scale climate projections;
- 3) scenario-based approaches;
- 4) equity and social justice; and
- 5) advanced data and analysis frameworks.



A. Amazon rainforest
Frequent droughts

B. Arctic sea ice
Reduction in area

C. Atlantic circulation
In slowdown since 1950s

D. Boreal forest
Fires and pests changing

F. Coral reefs
Large-scale die-offs

G. Greenland ice sheet
Ice loss accelerating

H. Permafrost
Thawing

I. West Antarctic ice sheet
Ice loss accelerating

J. Wilkes Basin, East Antarctica
Ice loss accelerating

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Source: Lenton et al., 2019

Enabling USGCRP to Support a Risk Management Paradigm

- Committee's vision will require a significant expansion in scope and funding.
- USGCRP agencies need to maintain critical Earth system research and provide more resources for essential research gaps

RECOMMENDATION: To accompany the shift in the USGCRP paradigm, the Program should explore organizational and operational changes to enhance the relevance and effectiveness of its work

RECOMMENDATION: To enhance successful implementation:

- 1) *Prioritize diversity* in both the Program and USGCRP activities by greatly expanding efforts to be inclusive and representative, and prioritize justice with research that highlights consequences and opportunities for underserved communities;
- 2) Increase the *usability and relevance of research* by adopting a co-production approach to research, recommitting to the sustained assessment process, and establishing a standing user working group or advisory mechanism as a forum for input on user needs;
- 3) Advance *program integration and accountability* by increasing transparency of the management structure and criteria for setting priorities, sequencing investments, and guiding development of an integrated program across the individual agencies; and
- 4) Develop an evidence-based strategy for *monitoring, evaluation, and learning* for the Program's activities, including the next strategic plan, with flexibility for setting priorities and activities to adapt to and incorporate learning on an ongoing basis

FINAL THOUGHTS

The COVID-19 pandemic demonstrates the need to envision and plan for multiple and multilevel disruptions to human, physical, and ecological systems. The pandemic also provides a vivid reminder that **science-based challenges should be managed using science-based policies.**

The **GCRA provides the flexibility** for USGCRP to include the agency participation necessary to meet the nation's needs for useful information.

The **committee urges USGCRP to be bold in crafting its new strategic plan.** USGCRP has an opportunity to put forward a strategic plan that explains how global change research contributes to the knowledge set needed to address multiple interrelated challenges, and ultimately **prepare society to create a more resilient future.**

Acknowledgements

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Thank You!