Innovation and Co-Benefits of Greenhouse Gas Offset Projects

Climate Solutions Living Lab
Harvard University

Intro to Project

Our Climate Solutions Living Lab team has been tasked with supporting Harvard University and its affiliates in their efforts to lower their carbon footprint through the large-scale purchasing of greenhouse gas (GHG) emission credits.

Our **primary** support for the Consortium involves creating a tool to assess the co-benefits of various offset projects.

Key Takeaways

- **Innovation** project criteria to meet Consortium priorities
- Overview of selected **co-benefits**
  - Innovation
  - Scalability
  - Environmental Impact
  - Public Health
  - Diversity, Equity, Inclusion
- Introduction of **model as tool** for quantifying and comparing co-benefits of projects
- **Recommendations** for moving forward with tool and offset evaluation process

Innovation + Risk

Innovation + Risk Intertwined

- Driven by Deep Uncertainties
- “Innovating” Often Carries Higher Risk

Harvard Plays Dual Role

- Assumes Risk as Buyer and Investor
- Reconcile Innovation with Risk Profiles

Robust Evaluation Frameworks are Critical

- Need Data to Assess Portfolio
- Balance Project and Portfolio Risk

Proposed Framework Can Help Address Challenges & Opportunities

- Holistic Evaluation of Co-Benefits
- Position Harvard + Consortium as Innovators

Credibility

- 5 Carbon Offset Requirements:
  1. Real
  2. Additional
  3. Permanence
  4. Quantifiable/Verifiable
  5. Enforceable

Examples of Standards/Verifiers

Verified Carbon Standard

A VERRA STANDARD

CLIMATE ACTION RESERVE

The Co-Benefits Valuation Model assumes credibility requirements have already been assessed and satisfied.

Preliminary Recommendations on Credibility, Innovation, & Risk

Define projects with high risk of “failure” in terms of credibility and potential for innovation + impact.

→

Form an Independent Assessment Committee to evaluate high-risk/high-reward projects.

Co-Benefits

Mitigate GHG emission
Maximize co-benefits

Optimize strategy
Identify gaps

Structured yet flexible
Examine over time

Innovation

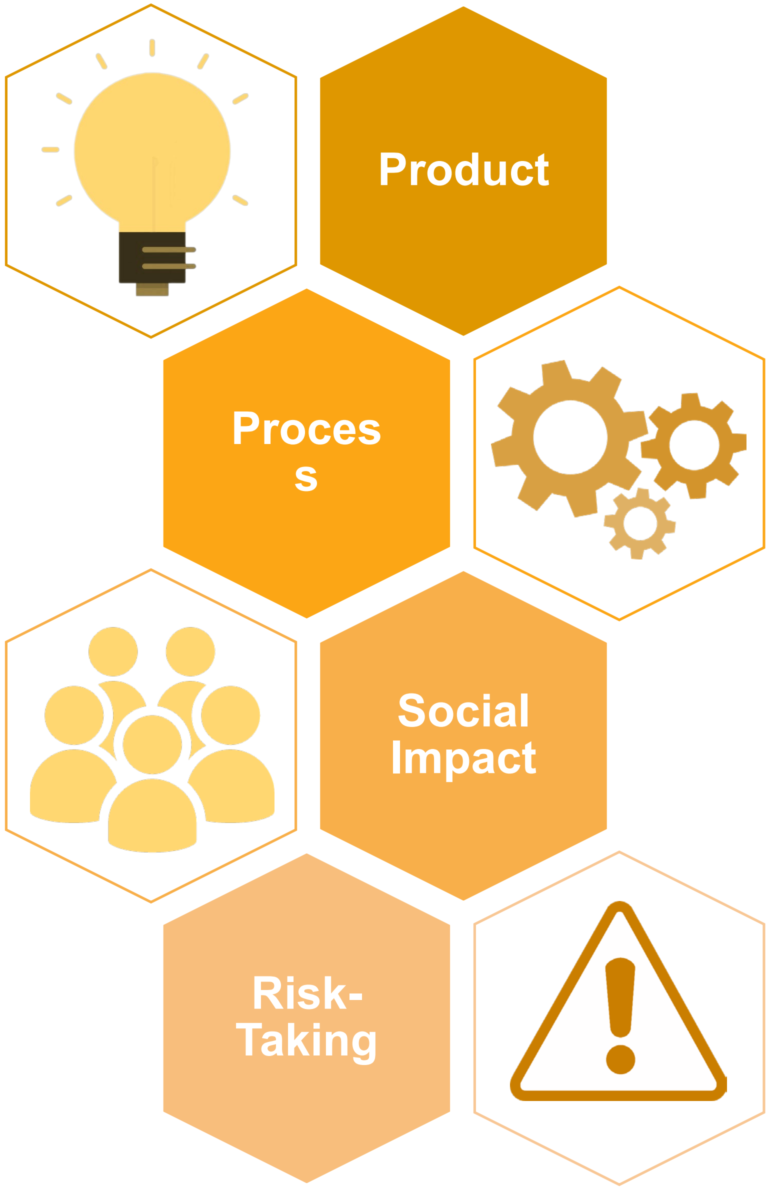
Why?

Innovation is rarely evaluated as a co-benefit for offset projects in existing registries & rating schemes.

Integration into Selection Process

Evaluation of project proposals based on four dimensions of innovation:

1) product
2) process
3) social impact
4) risk-taking



Scalability

Why?

Selection of projects should prioritize project *growth* and *resilience* – scalability is central to both.

Integration into Selection Process

Evaluation of project proposals based on three dimensions of scalability:

1) project design
2) returns to scale
3) market integration

Environmental Impacts

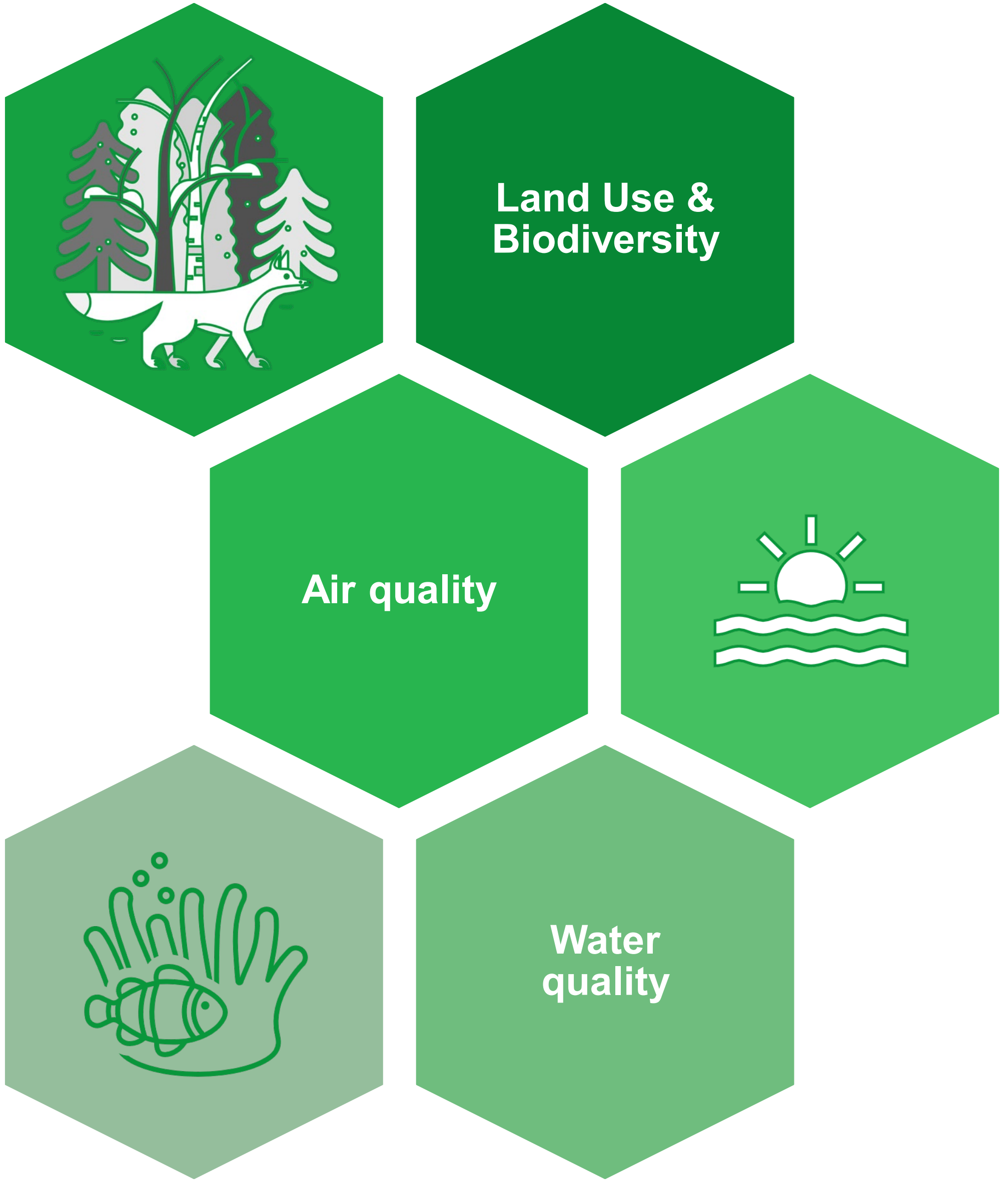
Why?

Many offset projects evaluate GHG emissions reduction in isolation – important to consider:

- Benefits of reducing GHG emissions on other environmental media
- Other offset benefits beyond emission reduction

Integration into selection process

It is important to consider other outcomes unrelated to emissions including 1) land use and biodiversity, 2) air quality, and 3) water quality



Public Health

- Ensure healthy lives
  and Promote well-being
- Potential benefits
  vs. Negative impacts
- Harmful
  → Prevent Disease
  → Promote Health

Diversity, Equity & Inclusion (DEI)

What is DEI? The commitment to valuing and structuring institutions to ensure:

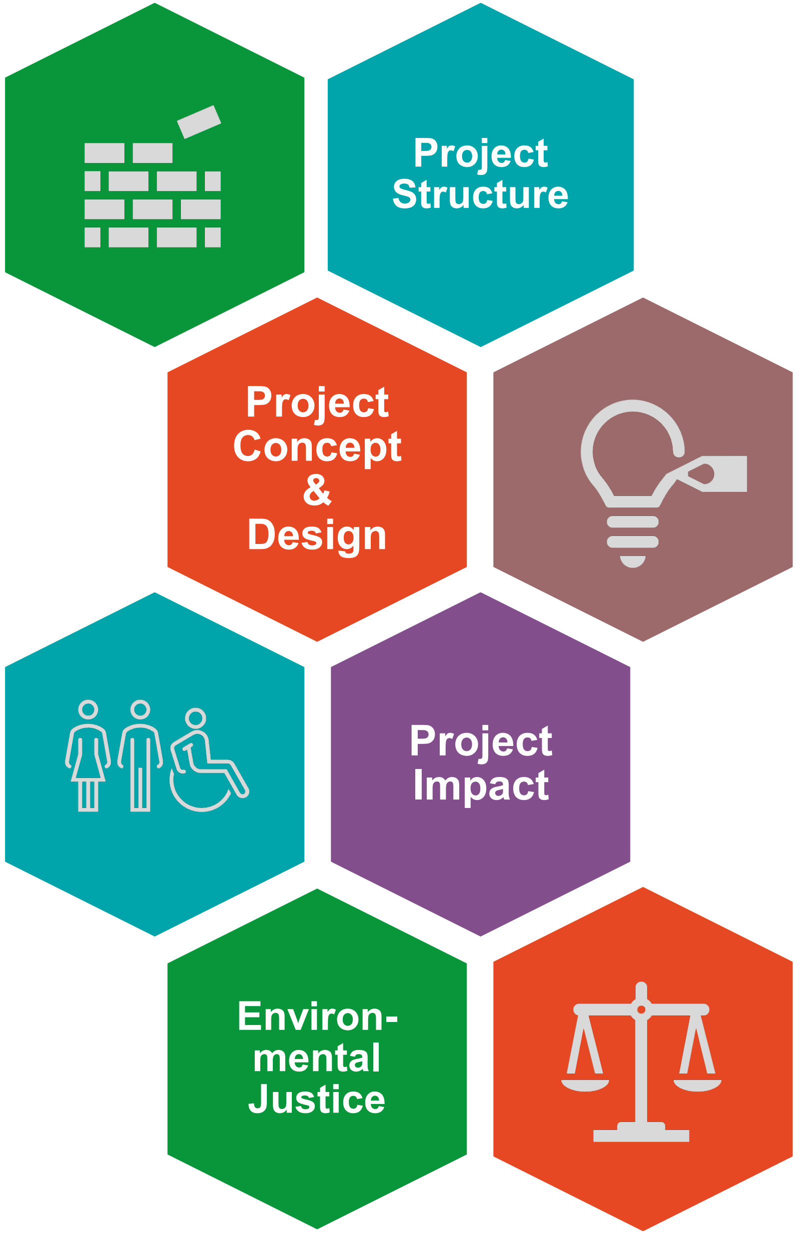
Diversity of age, gender, race, religion, thought, and ++!	**Equity** of access to opportunities for all people	**Inclusion**, respect and fairness for all people involved

Other qualities to consider:

Accessibility for people with different physical and mental capacities	Cultivate a feeling of **Belonging** for all people involved

Keep in mind!

- Diversity and Inclusion are relative concepts
- DEI is most effective when embedded in the project concept
- The most DEI-rich projects may be most in need of assistance



Co-Benefits Valuation Model

"All models are wrong, but some are useful". George E.P. Box.

- **Goal:** to provide a useful framework to quantitatively assess offset co-benefits, aggregating those assessments, and optimizing The Consortium's offset portfolio based on user-defined preferences.

- **Deliverable:** Excel Optimization Tool

Co-Benefits Valuation Model
Process

Input Co-Benefits Preferences → Input Desired Investment → Score Projects → Input Project Risk Factors → Optimize Portfolio → Check Results Against Intuition

Model Demonstration

- **Input Co-Benefits Preferences**
- **Input Desired Investment**

Climate Lab Portfolio Optimization		
	Desired Attributes (Inputs)	
	Innovation	0.3
	Scalability	0.1
	Environmental	0.1
	Public Health	0.3
	DEI	0.2
	Total (Constraint, Must = 1)	1
	Desired Investment	$2,000,000

Subjective Consortium Preferences (weights)

Initial Investment

Model Demonstration

- **Score Projects**

	Projects	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I	Project J
Innovation	Product Innovation	0	0	1	2	1	1	3	3	3	5
	Social Impact	0	0	2	3	1	1	4	1	2	5
	Risk Taking	0	0	2	2	1	1	5	1	4	5
	Innovation Total (Max 15)	**0**	**0**	**5**	**7**	**3**	**3**	**12**	**5**	**9**	**15**
Scalability	Project Design	0	0	3	2	5	1	4	3	3	5
	Returns to Scale	0	0	2	1	5	1	4	4	3	5
	Market Integration	0	0	2	1	1	1	4	3	3	5
	Scalability Total (Max 15)	**0**	**0**	**7**	**4**	**11**	**3**	**12**	**10**	**9**	**15**
Environmental	Biological Diversity	0	0	3	4	1	1	2	5	2	2
	Air Quality	0	0	2	5	1	1	3	4	3	3
	Water Quality	0	0	1	5	2	1	4	1	5	5
	Environmental Total (Max 15)	**0**	**0**	**6**	**14**	**4**	**3**	**9**	**10**	**10**	**10**
Public Health	Extreme Weather Resilience	0	0	3	4	5	3	3	5	3	3
	Illness Mitigation	0	0	5	3	1	3	2	5	4	4
	Food Security	0	0	4	4	0	4	1	5	5	2
	Public Health Total (Max 15)	**0**	**0**	**12**	**11**	**6**	**10**	**6**	**15**	**12**	**9**
DEI	Project Structure	0	0	2	4	4	2	3	4	5	3
	Project Concept & Design	0	0	3	5	3	3	4	4	5	4
	Project Impact	0	0	3	2	3	1	1	2	2	3
	Environmental Justice	0	0	4	3	2	2	1	3	3	4
	DEI Total (Max 20)	**0**	**0**	**12**	**14**	**12**	**8**	**9**	**13**	**15**	**14**

Case Study

- **Project A** = high tech, innovation, and risk…potential for scale and high yields

- **Project B** = lower tech, less innovation, but also little risk…potential for secure gains, but not much more

Model Demonstration

- **Score Projects**

	Projects	Project A	Project B
Innovation	Product Innovation	5	1
	Social Impact	5	2
	Risk Taking	4	1
	Innovation Total (Max 15)	**14**	**4**
Scalability	Project Design	3	2
	Returns to Scale	4	1
	Market Integration	5	2
	Scalability Total (Max 15)	**12**	**5**

Innovation
Scalability
↑ ↓

Model Demonstration

- **Score Projects**

	Projects	Project A	Project B
Environmental	Biological Diversity	3	4
	Air Quality	3	3
	Water Quality	4	2
	Environmental Total (Max 15)	**10**	**9**
Public Health	Extreme Weather Resilience	1	3
	Illness Mitigation	2	3
	Food Security	2	3
	Public Health Total (Max 15)	**5**	**9**
DEI	Project Structure	2	3
	Project Concept & Design	1	4
	Project Impact	2	3
	Environmental Justice	3	4
	DEI Total (Max 20)	**8**	**14**

Environmental ~

Public Health
DEI

↓ ↑

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

Projects	Project A	Project B
Probability of Failure (Risk)	40%	5%
Total Score (Max 80)	49	41
Adjusted Score (For Preferences)	9.5	8.1
Adjusted Score Comparison	102.48%	87.38%
Price Comparison	0.79	0.53
Cost/Offset ($)	$300	$200
Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Risk, from framework

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

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Probability of Failure (Risk)	40%	5%
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Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Aggregate project score

Model Demonstration

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- **Outputs**

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Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Adjusted score =

Preference Weights * Co-Benefit Scores

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

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Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Adjusted score comparison =

$$\frac{\text{Adjusted Score}}{\text{Average of Portfolio Adjusted Scores}}$$

Intuition: how Project ___ compares to the rest of the portfolio…100% is average portfolio desirability

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

Projects	Project A	Project B
Probability of Failure (Risk)	40%	5%
Total Score (Max 80)	49	41
Adjusted Score (For Preferences)	9.5	8.1
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Price Comparison	0.79	0.53
Cost/Offset ($)	$300	$200
Project Return (Adjusted Score/Adjusted Price)	130%	166%

$$\text{Price comparison} = \frac{\text{Cost Per Offset}}{\text{Average of Portfolio Costs Per Offset}}$$

Intuition: how Project ___ compares to the rest of the portfolio…1 is average portfolio cost per offset

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

Projects	Project A	Project B
Probability of Failure (Risk)	40%	5%
Total Score (Max 80)	49	41
Adjusted Score (For Preferences)	9.5	8.1
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Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Cost Per Offset, defined in RFP submission

Model Demonstration

- **Input Project Risk Factors**
- **Outputs**

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Adjusted Score (For Preferences)	9.5	8.1
Adjusted Score Comparison	102.48%	87.38%
Price Comparison	0.79	0.53
Cost/Offset ($)	$300	$200
Project Return (Adjusted Score/Adjusted Price)	130%	166%

→ Project Return =

$$\frac{\text{Adjusted Score Comparison}}{\text{Price Comparison}}$$

Intuition: how Project ___'s comparative co-benefit desirability relates to comparative cost. Greater than 100% = more 'bang for buck" **within** portfolio

Portfolio Optimization

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I	Project J
Return	130%	166%	80%	117%	108%	42%	85%	145%	92%	128%
Risk	40%	5%	30%	50%	20%	10%	40%	5%	5%	10%

Desired Portfolio Return (Maximized)	**0.00%**		
Portfolio Risk	**0.00%**		
Portfolio Allocation		**Invesment**	
Project A	0.00%	$0	0
Project B	0.00%	$0	0
Project C	0.00%	$0	0
Project D	0.00%	$0	0
Project E	0.00%	$0	0
Project F	0.00%	$0	0
Project G	0.00%	$0	0
Project H	0.00%	$0	0
Project I	0.00%	$0	0
Project J	0.00%	$0	0
Total (Constraint)	0.00	**Total Offsets**	**0**

Portfolio Return =

(Project __ Return * Project __ Allocation) + …

Portfolio Risk =

(Project __ Risk * Project __ Allocation) + …

Optimization Example #1

- **Maximizing Portfolio Return**

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I	Project J
Return	130%	166%	80%	117%	108%	42%	85%	145%	92%	128%
Risk	40%	5%	30%	50%	20%	10%	40%	5%	5%	10%

Desired Portfolio Return (Maximized)	166.02%		
Portfolio Risk	5.00%		
Portfolio Allocation		**Invesment**	
Project A	0.00%	$0	0
Project B	100.00%	$2,000,000	10,000
Project C	0.00%	$0	0
Project D	0.00%	$0	0
Project E	0.00%	$0	0
Project F	0.00%	$0	0
Project G	0.00%	$0	0
Project H	0.00%	$0	0
Project I	0.00%	$0	0
Project J	0.00%	$0	0
Total (Constraint)	1.00	**Total Offsets**	**10,000**

Optimization Example #2

- **Maximizing Portfolio Return, Risk = 20%**

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I	Project J
Return	130%	166%	80%	117%	108%	42%	85%	145%	92%	128%
Risk	40%	5%	30%	50%	20%	10%	40%	5%	5%	10%

Desired Portfolio Return (Maximized)	**150.50%**		
Portfolio Risk	**20.00%**		
Portfolio Allocation		**Invesment**	
Project A	42.86%	$857,143	2,857
Project B	57.14%	$1,142,857	5,714
Project C	0.00%	$0	0
Project D	0.00%	$0	0
Project E	0.00%	$0	0
Project F	0.00%	$0	0
Project G	0.00%	$0	0
Project H	0.00%	$0	0
Project I	0.00%	$0	0
Project J	0.00%	$0	0
Total (Constraint)	1.00	**Total Offsets**	**8,571**

Optimization Example #3

- **Maximizing Portfolio Return, Risk = 20%, Total Offsets = 7,000**

	Project A	Project B	Project C	Project D	Project E	Project F	Project G	Project H	Project I	Project J
Return	130%	166%	80%	117%	108%	42%	85%	145%	92%	128%
Risk	40%	5%	30%	50%	20%	10%	40%	5%	5%	10%

Desired Portfolio Return (Maximized)	**140.52%**		
Portfolio Risk	**20.00%**		
Portfolio Allocation		**Invesment**	
Project A	42.86%	$857,143	2,857
Project B	10.00%	$200,000	1,000
Project C	0.00%	$0	0
Project D	0.00%	$0	0
Project E	0.00%	$0	0
Project F	0.00%	$0	0
Project G	0.00%	$0	0
Project H	47.14%	$942,857	3,143
Project I	0.00%	$0	0
Project J	0.00%	$0	0
Total (Constraint)	1.00	**Total Offsets**	**7,000**

Supporting Recommendations

Build Internal Capacity
to support small-scale and/or innovative projects

Issue Project Developer Templates
to help project developers understand priorities and valuation methods

Streamline RFPs
to ensure that proposals include all information needed for the co-benefits valuation

Start a Project Incubator
to help projects get from concept to implementation

Engage in Project Outreach
to increase the number of small-scale and community developed projects

Grow pipeline for Harvard-led projects
to better engage the resources available throughout the University

Thank You!

Team & QAs

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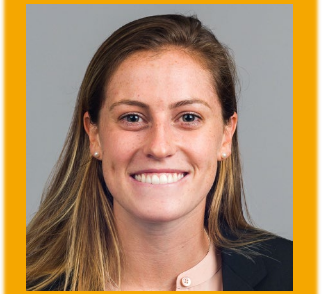

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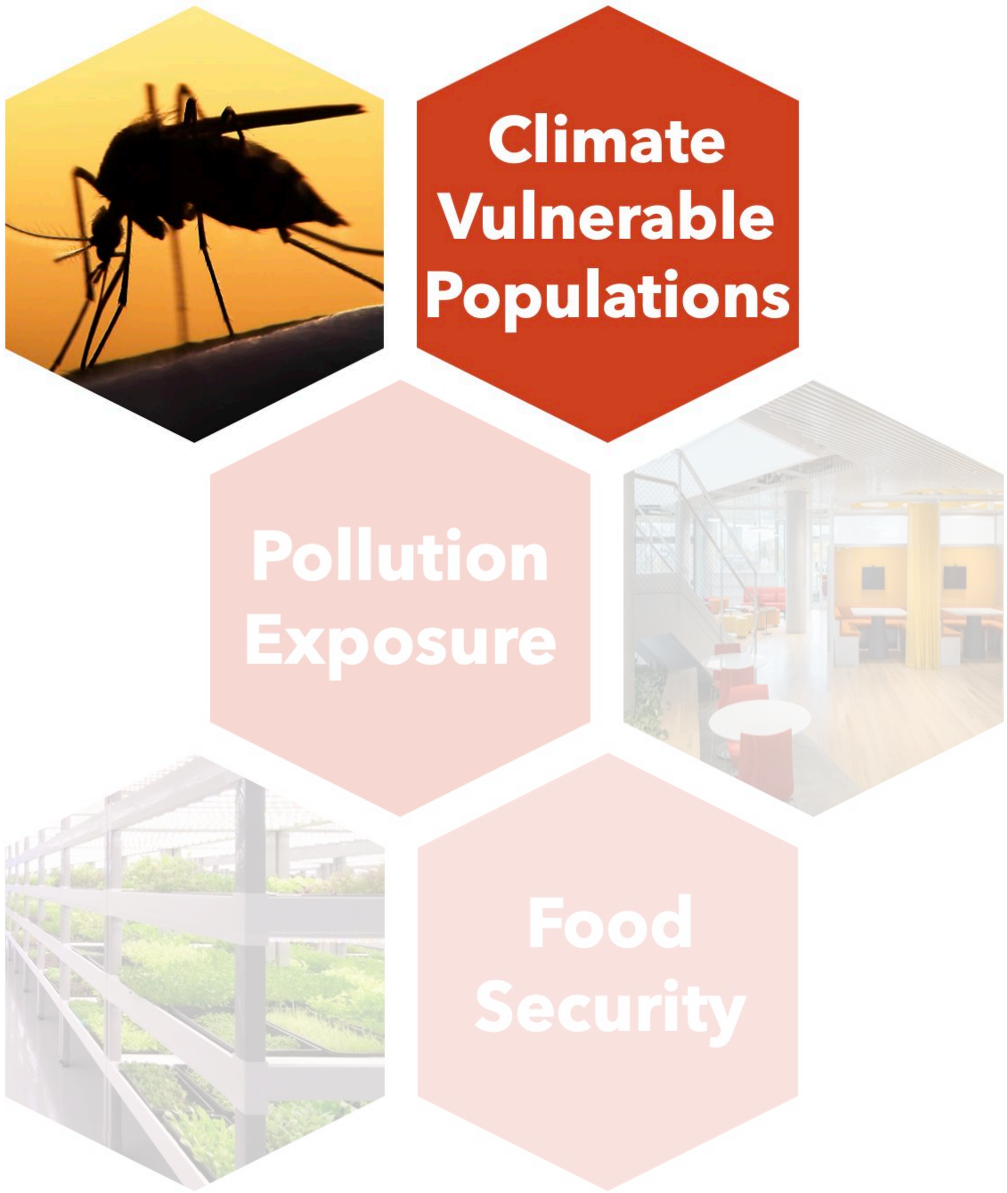
Public Health

- Assess climate vulnerability
- Prevent disease deterioration
- Help adaptation



Public Health

- Aware materials used and follow chemical regulations
- Prevent leakage or clean up contaminated sites
- Toxic-free product by design

Public Health

- Minimize GHG

  during food product life cycle

- Ensure food security

  and prevent climate impacts

- Promote

  Equitable food distribution

  Sustainable agriculture