Context and Future Directions for Integrating Forest Carbon into Sub-National Climate Mitigation Planning in the RGGI+ Region of the U.S.

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Abstract

International frameworks for climate mitigation that build from national actions have been developed under the United National Framework Convention on Climate Change and advanced most recently through the Paris Climate Agreement. In parallel, sub-national actors have set greenhouse gas (GHG) reduction goals and developed corresponding climate mitigation plans. Within the U.S., multi-state coalitions have formed to facilitate coordination of related science and policy. Here, utilizing the forum of the NASA Carbon Monitoring System's Multi-State Working Group (MSWG), we collected and reviewed climate mitigation plans for 11 states in the Regional Greenhouse Gas Initiative (RGGI) region of the Eastern U.S. For each state we reviewed the 1) policy framework for climate mitigation, 2) GHG reduction goals, 3) inclusion of forest carbon in the state's climate action plan, 4) existing science used to estimate forest carbon, and 5) stated needs for carbon monitoring science. Across the region, we found important differences across all categories. While all states have GHG reduction goals and framework documents, nearly three-quarters of all states do not account for forest carbon when planning GHG reductions; those that do account for forest carbon use a variety of scientific methods with various levels of planning detail and guidance. We suggest that a common, efficient, standardized forest carbon monitoring system would provide important benefits to states and the geographic region

as a whole. In addition, such a system would allow for more effective transparency and progress tracking to support state, national, and international efforts to increase ambition and implementation of climate goals.

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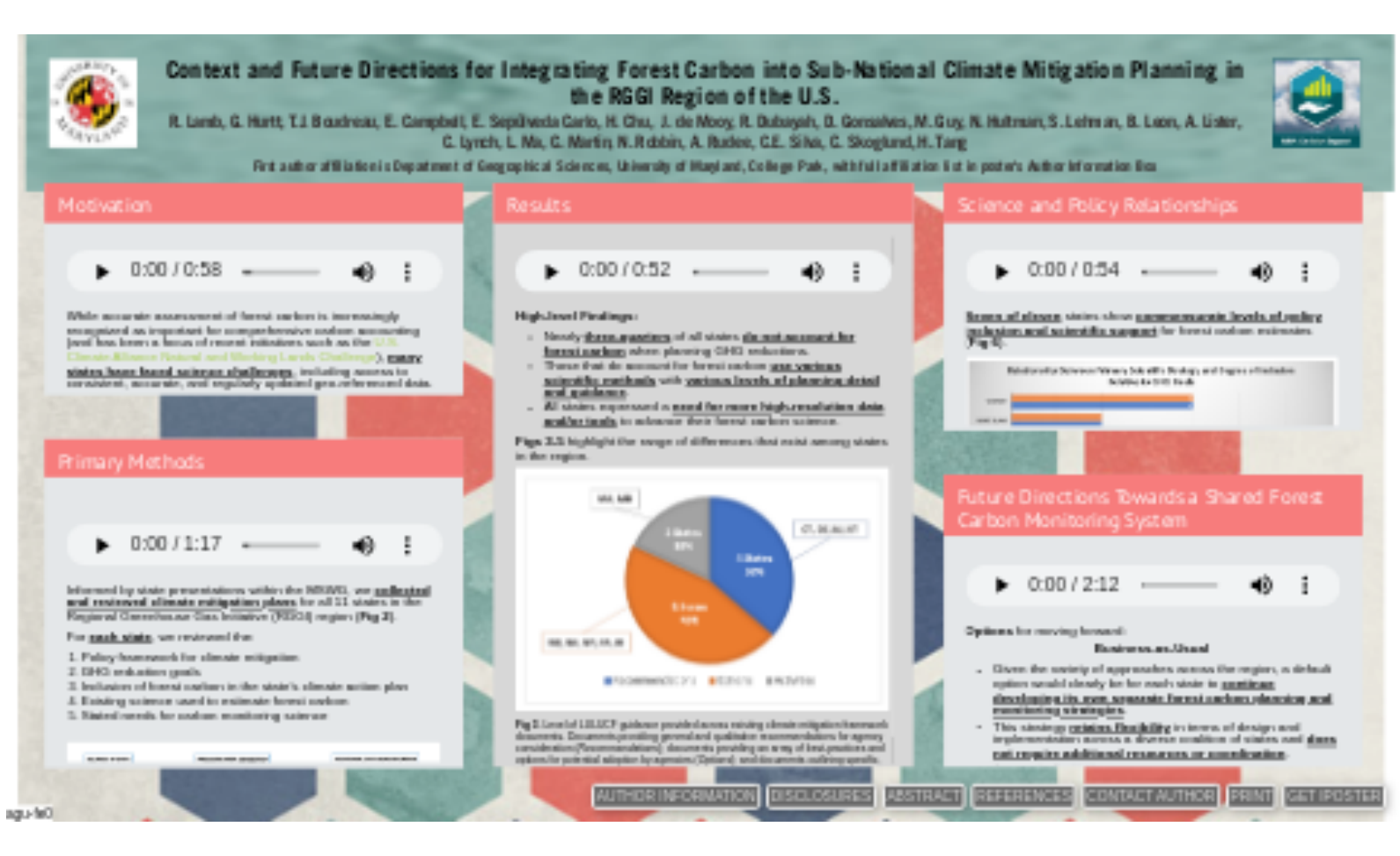

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MOTIVATION

While accurate assessment of forest carbon is increasingly recognized as important for comprehensive carbon accounting (and has been a focus of recent initiatives such as the U.S. Climate Alliance Natural and Working Lands Challenge), **many states have faced science challenges**, including access to consistent, accurate, and regularly updated geo-referenced data.

To identify opportunities for **enhancing action through more systematic development and application of new carbon monitoring strategies,** governmental representatives from 11 states in the Northeastern and Mid-Atlantic United States participated in quarterly calls of the NASA Carbon Monitoring System's Multi-State Working Group (MSWG) between 2018-2020 (**Fig 1**).

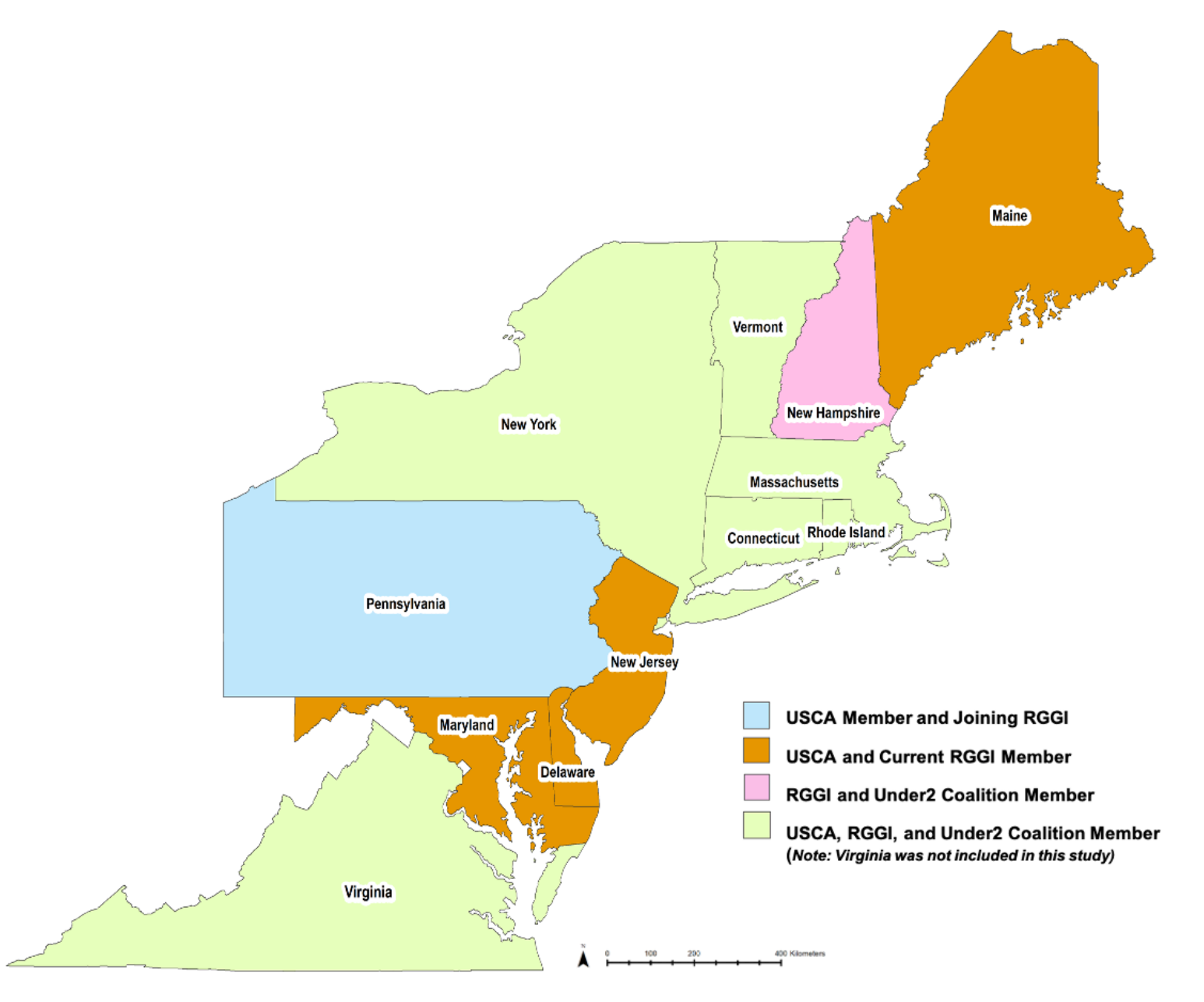

Fig 1. All states in the region belong to one or more multi-state coalitions, including the United States Climate Alliance (USCA), Regional Greenhouse Gas Initiative (RGGI), and the Under 2 Coalition of state and regional governments. Note that while Virginia has recently become a member of RGGI, it was not included in this study as the formation of the MSWG pre-dated its participation in RGGI.

These 11 states represent all current and participating members of the Regional Greenhouse Gas Initiative (RGGI) (except Virginia, plus Pennsylvania). The RGGI region has long engaged in carbon trading and is poised to expand the scope of their efforts if the science allows.

The work described here is a collaboration among participating members of the MSWG to **capture the current context for integrating forest carbon into climate mitigation planning.**

PRIMARY METHODS

Informed by state presentations within the MSWG, we **collected and reviewed climate mitigation plans** for all 11 states in the Regional Greenhouse Gas Initiative (RGGI) region (**Fig 2**).

For **each state**, we reviewed the:

1. Policy framework for climate mitigation
2. GHG reduction goals
3. Inclusion of forest carbon in the state's climate action plan
4. Existing science used to estimate forest carbon
5. Stated needs for carbon monitoring science

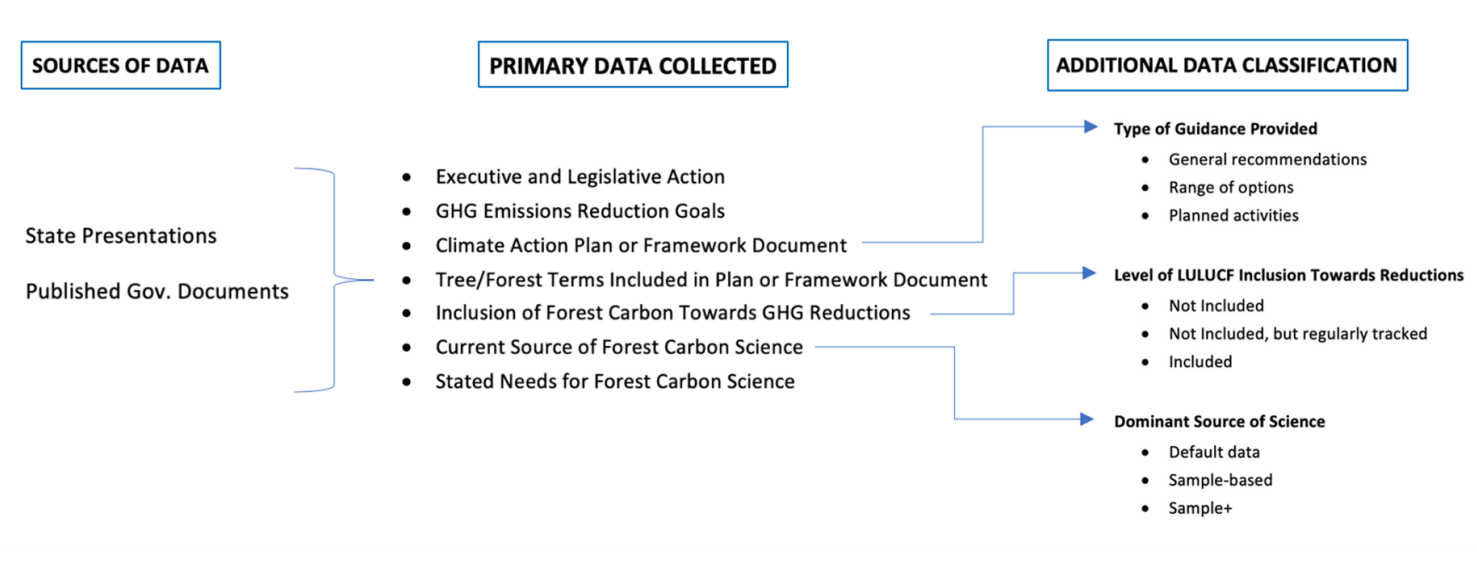

Fig 2. Flow chart of methodological steps for data collection, review, and additional classification of three data categories.

Given the range of data collected, we **further classified states with three additional variables**. Specifically, we evaluated the:

1. Type of LULUCF guidance in the climate mitigation framework document,
2. Degree of inclusion of forest carbon towards state GHG reduction goals, and
3. Dominant forest carbon science strategy used to estimate net LULUCF emissions.

Finally, we **evaluated whether a state's primary scientific strategy was related to higher LULUCF inclusion levels within climate policy**. We compared the type of guidance provided in the plans (in ascending order of detail provided) to the dominant science used to estimate LULUCF emissions (in ascending order of methodological sophistication).

RESULTS

High-level Findings:

- Nearly **three-quarters** of all states **do not account for forest carbon** when planning GHG reductions.
- Those that do account for forest carbon **use various scientific methods** with **various levels of planning detail and guidance**.
- All states expressed a **need for more high-resolution data and/or tools** to advance their forest carbon science.

Figs 3-5 highlight the range of differences that exist among states in the region.

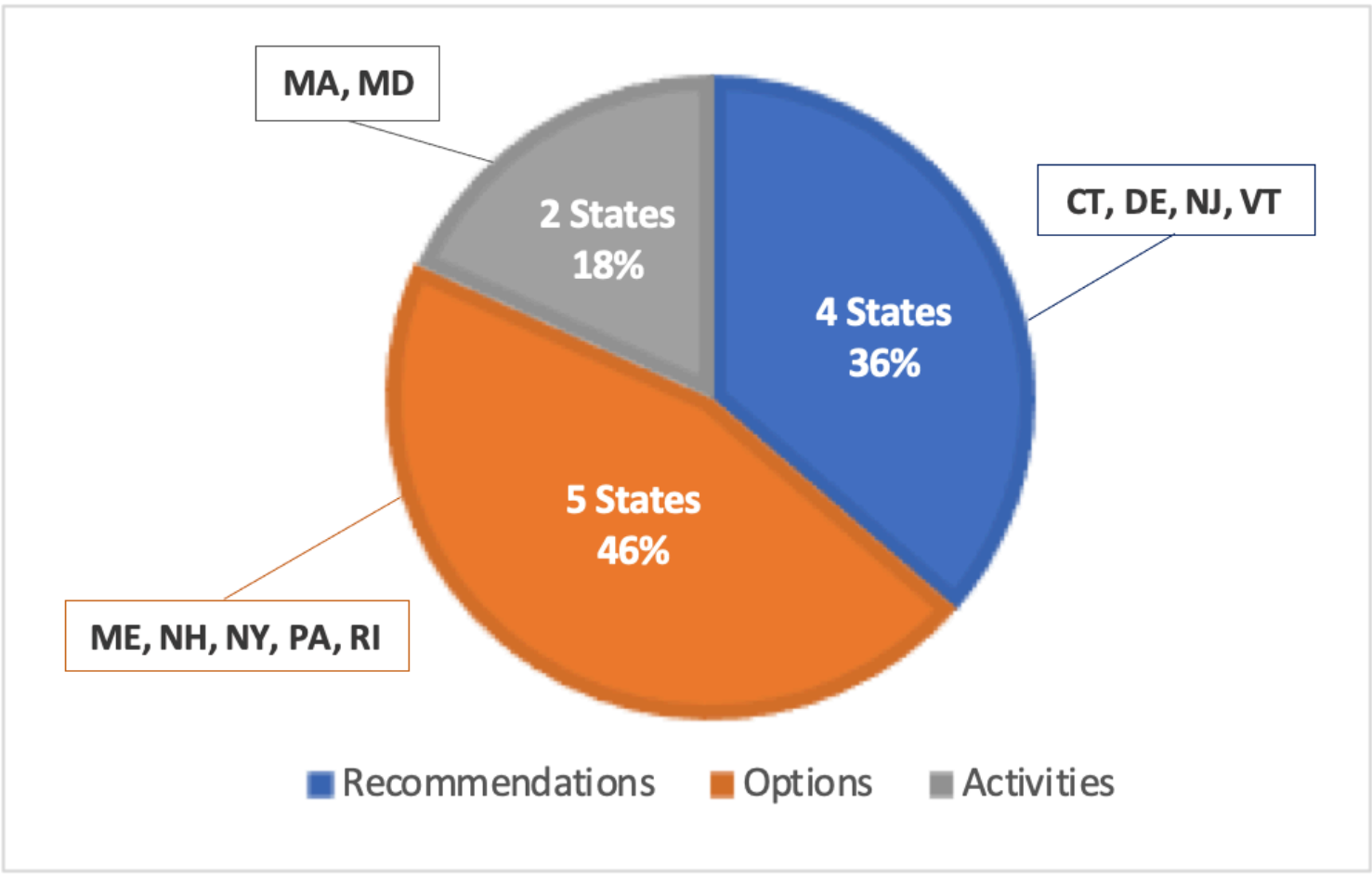

Fig 3. Level of LULUCF guidance provided across existing climate mitigation framework documents. Documents providing general and qualitative recommendations for agency consideration (*Recommendations*); documents providing an array of best-practices and options for potential adoption by agencies (*Options*); and documents outlining specific, quantitative activities, for planned implementation by agencies (*Activities*).

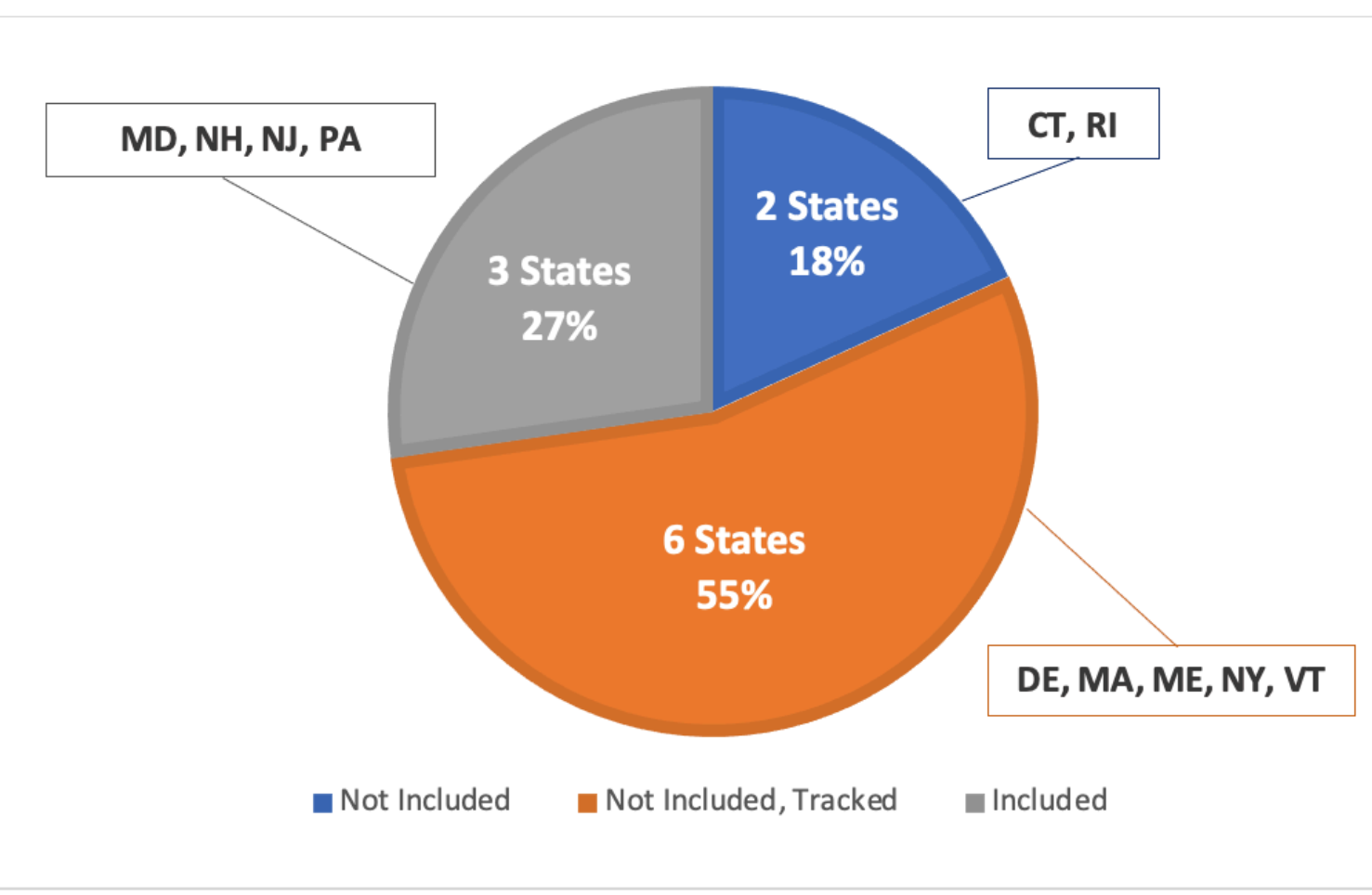

Fig 4. Degree of forest carbon inclusion relative to achieving GHG reduction goals. States may not include LULUCF activities relative to goal completion (*not included*), states may not include LULUCF activities, but track changes independently of the GHG inventory (*not include, tracked*), or they may include them directly within their inventories as a component of overall GHG reductions (*included*).

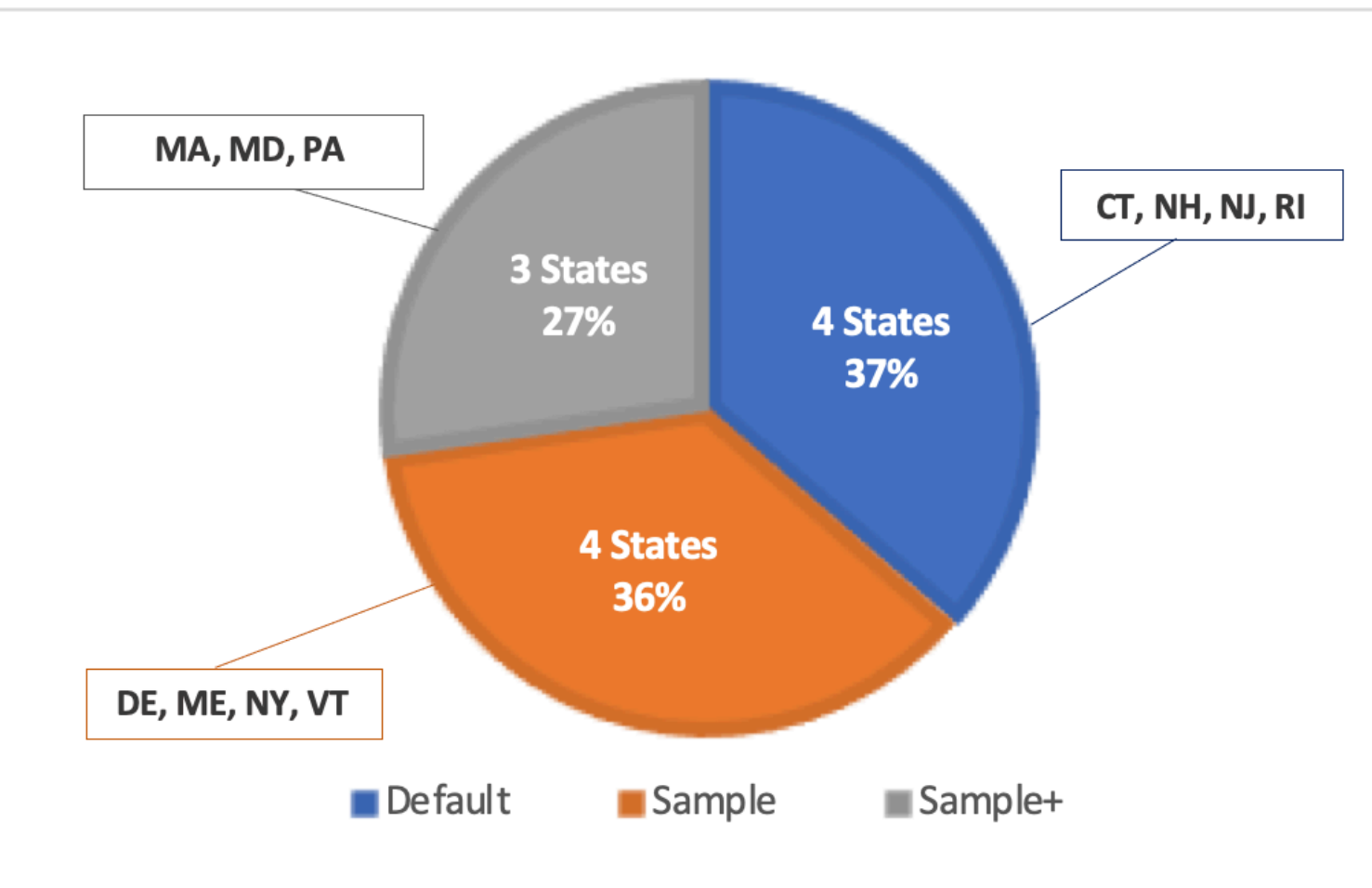

Fig 5. Primary scientific strategy employed by the states to estimate forest carbon stocks and fluxes within their climate mitigation plans or GHG inventories. Four states use default data directly from the EPA State Information Tool (SIT), static literature values, or sample-based estimates from their region rather than their state (*default*). Four states utilize USFS FIA field data directly or via USFS technical reports as updated and made available to the states (*sample*). The final three states use USFS FIA data in addition to either high-resolution modeling or field data from the state's own continuous forest field inventory (*sample+*).

SCIENCE AND POLICY RELATIONSHIPS

Seven of eleven states show **commensurate levels of policy inclusion and scientific support** for forest carbon estimates (**Fig 6**).

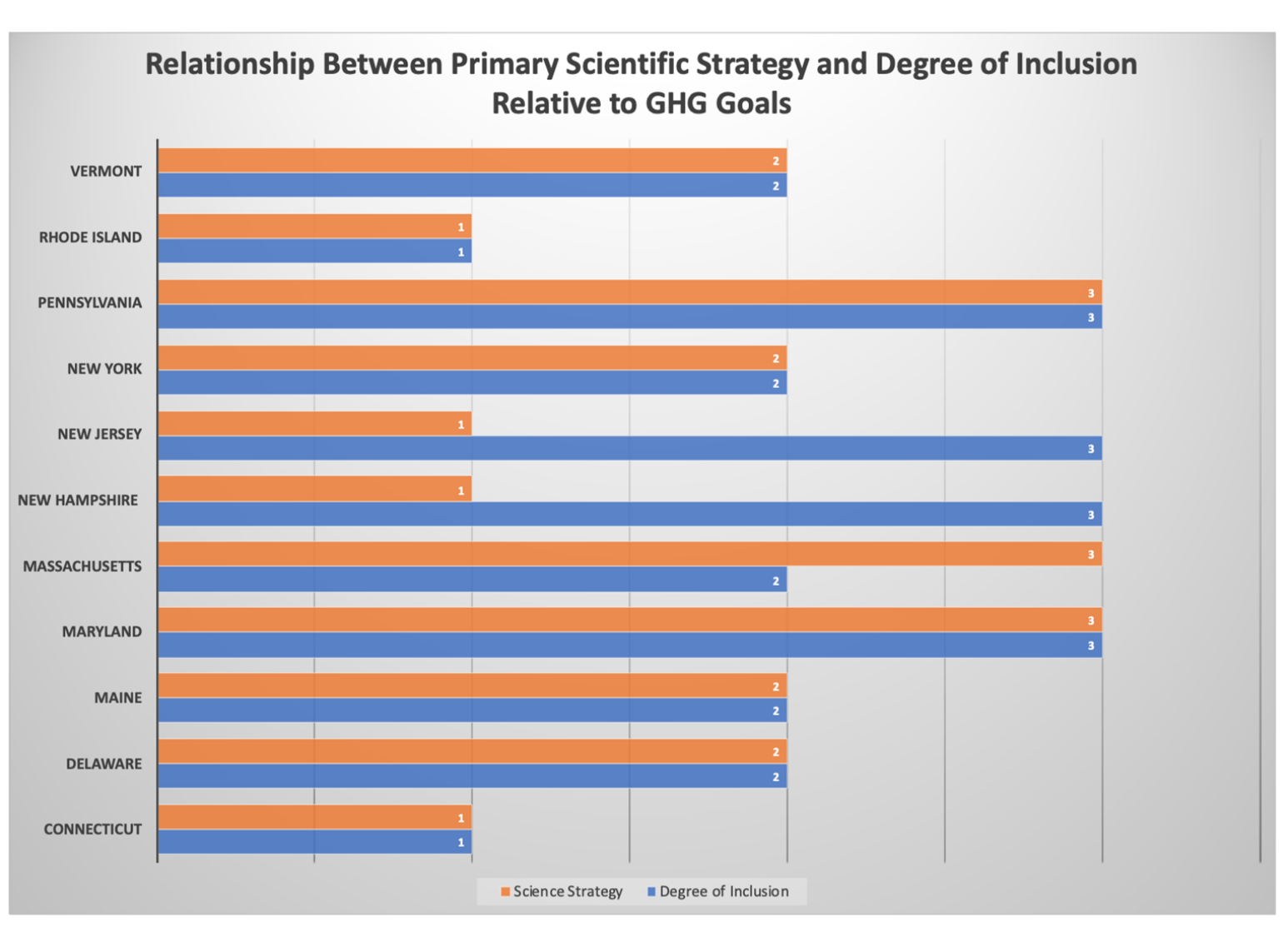

Fig 6. Degree of LULUCF inclusion relative to the primary scientific strategy employed to generate forest carbon estimates. Where science strategies are denoted as *1-Default, 2-Sample, and 3-Sample+,* and the degree of inclusion is represented as *1-Not Included, 2-Not Included, Tracked, and 3-Included*. Where levels are the same, scientific and policy support are considered to be commensurate.

Commensurate levels of science sophistication and policy support within most states in the region **suggest a general awareness of current capabilities and regular coordination** across state government agencies and offices.

Further, **all states in the region have GHG reduction goals and have indicated an interest in improving their forest carbon science** relative to climate mitigation planning, as evidenced by the range of data, tools, and methods requested by states; specifically, higher resolution and spatially explicit forest carbon estimates.

However, the **pace at which new science and technologies are embraced** by individual states is and **likely will remain variable if primarily dependent on state resources**.

FUTURE DIRECTIONS TOWARDS A SHARED FOREST CARBON MONITORING SYSTEM

Options for moving forward:

Business-as-Usual

- Given the variety of approaches across the region, a default option would clearly be for each state to **continue developing its own separate forest carbon planning and monitoring strategies**.
- This strategy **retains flexibility** in terms of design and implementation across a diverse coalition of states and **does not require additional resources or coordination**.
- Among its **limitations**:
  - Splitting of individual state efforts has **resulted in regional scale inefficiencies**, with each state investing time and money into building their own carbon monitoring systems.
  - Results show **varying levels of scientific quality**, institutional robustness, and direct applicability to planning.
  - Such a mix of methods and approaches also **make it difficult to compare or combine carbon estimates** across a region already poised for carbon trading.

Towards a Shared Carbon Monitoring System

- A common system would allow for a **direct comparison of forest carbon strategies across the region**, provide for the scientific needs of all states, and **operate more efficiently** than multiple systems.
- System design **should meet science needs already identified** including high spatial resolution georeferenced capabilities, transparent methods, reliable and consistent data updates, streamlined integration with GHG baseline years, and an ability to capture trees outside of forests.
- Coalitions like **MSWG, RGGI, and USCA have provided a forum for states to share best practices** and pursue joint research in support of finding or supporting the best technology and science available.
- However, **individual projects be must ultimately be leveraged towards a shared system** to maximize the policy-relevance of scientific improvements.
- **Ongoing collaboration is critical** among federal and state agencies, non-governmental organizations, and academic institutions.

DISCLOSURES

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