Assessing Tall-Grass Prairie Quality for Restoration Management Planning at Lake Elmo Park Reserve

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Resilient Communities Project
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Swim Pond Parking Median at Lake Elmo Park Reserve, October 2022

1. Introduction

The objective of this project was to find the relative advantages and disadvantages of active and passive management approaches in the context of restoring tallgrass prairie communities. A partnership between the Resilient Communities Project of the University of Minnesota and the Lake Elmo Park Reserve (LEPR) in Washington County Parks has made this possible. Understanding the costs and benefits of active vs. passive involvement in restoration management helps land managers determine their resource priorities, especially within large land segments like Lake Elmo Park Preserve because actively managing the entire park would be both financially and logistically infeasible. Active management is advised when there is little to no native seed bank present and it's necessary to accelerate the process of recovery. Passive management recovery is also advised when there is a seed bank of native species. Passive management can also become a phase of management after a site has successfully undergone restoration for several years and is ready to transition into maintenance level management. Active management is advised when there is desire to accelerate the process of recovery or if the land use history makes passive recovery unlikely (Holl & Aide, 2011). One method of determining whether passive recovery is possible is conducting a seed bank assay which identifies if there are native seeds present in a seed

bank and what their abundance is relative to invasive seeds. Site assessments like vegetation meander surveys can determine whether sites nearby are appropriate for seed dispersal to occur. When restorations are in areas of intensive land use like row-crop agriculture, active management is often required to accelerate desired restoration outcomes.

The land comprising LEPR was historically used for crop and cattle production (Fig. 1) before its designation as a Park Reserve within the Twin Cities Metropolitan Regional Park System in 1986. Many sites within the Reserve have undergone restoration in keeping with the requirement of 80% parkland being managed towards pre-agricultural conditions and 20% of the land being dedicated to recreational use (MacSwain, 2021).

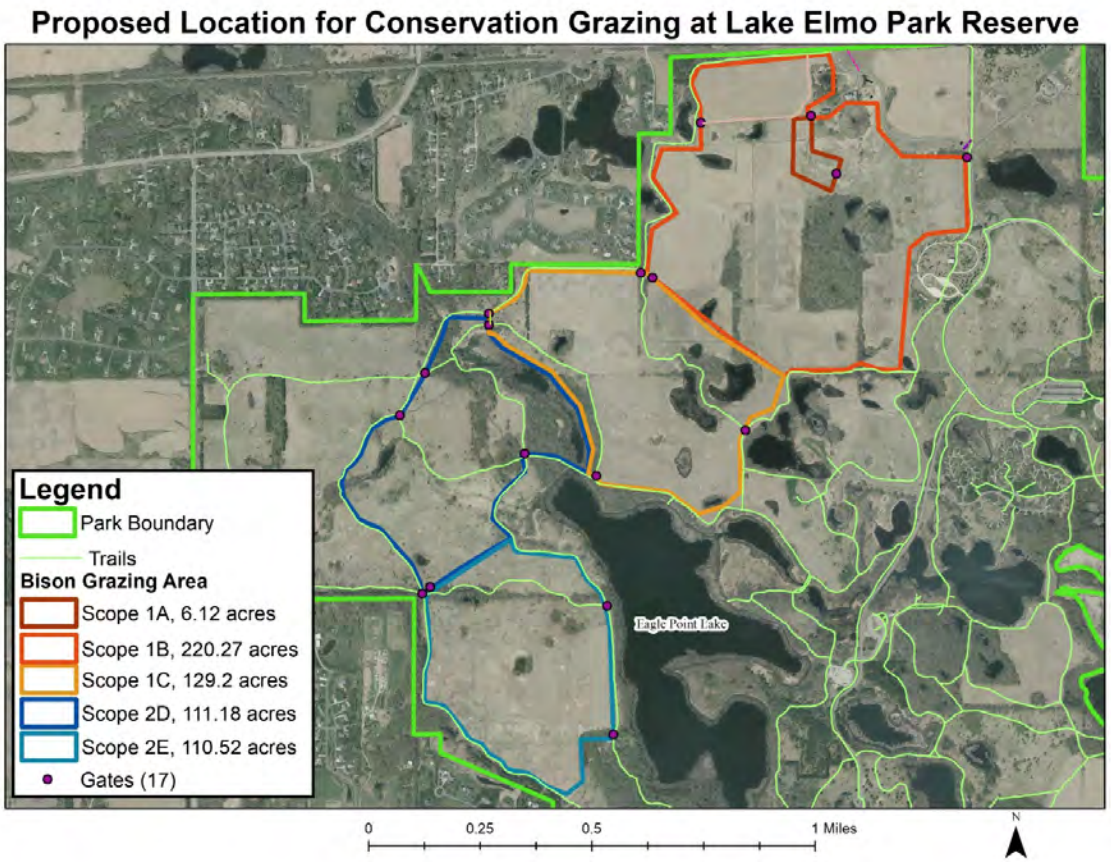
Figure 1.

Areal image of Eagle Point Lake showing agricultural fields, courtesy of Borchert Library (UMN), 1936

In his comprehensive text on prairie management and ecology, Chris Helzer of the Nature Conservancy discusses 'adaptive management' as a productive approach to prairie restoration. Adaptive management is described as follows, "4 basic steps: setting objectives, taking action, measuring progress, and adjusting your objectives, and strategies based on what you learn" (Helzer, 2010). This report focuses on the management of tallgrass prairie plant communities within LEPR as a model system for utilizing the vegetation meander survey tool for site assessment. Site assessment fits the aim of 'measuring progress' within the four-step adaptive management model. The survey tool used for evaluation of existing sites (referred to as 'Scopes') assists in deciding whether active or passive management makes sense for specific parcels of land within the park and what type of active management strategies can be employed there. A 2021 conservation grazing proposal guided site selection for the survey Scopes (MacSwain, 2021). The term 'Scope' refers to specific parcels of land within LEPR, each parcel is

designated as 'Scope' combined with a letter and number to differentiate them from each other. Three Scopes; Scope 2E (S2E) Scope 2D (S2D) and Scope 1C (S1C) show distinct phases of tallgrass prairie establishment and therefore management requirements. The parcels of land are connected to one another and have an average size of 116.97 acres. They border the western, northwestern, and northeastern sides of Eagle Point Lake (Fig. 2). The majority of the meanders conducted for this report were done within the three Scopes mentioned above. The remaining surveys provide baseline vegetative data for other areas in the park.

Figure 2



Map of Proposed Conservation Grazing Scopes at LEPR, MacSwain, 2021

Land-use history on the three land parcels of focus correlates with the observable differences in their level of establishment. The southern portion of S2E is a well-established mature prairie which was seeded with MN BWSR seed mix U-5 (Appendix I) in 2013-2014. S1C is also an established prairie which was planted in 2014 (in partnership with the Outdoor Heritage Fund). The specific seed-mix planted is unknown. The prairie of S1C is well-established with a notably high percentage of *Solidago canadensis* (25-50%). S2D is a much newer project (in partnership with the Conservation Legacy) having been planted fall of 2021 and August 2022, the prairie is the least well-established of the three sites with a high abundance of invasive species coverage.

The vegetative meander surveys generate critical documentation of plant species present on each site and the level of coverage of each plant species for land-managers to reference. The comprehensive body of data can be used to understand what is and is not present within existing plant communities and allows for data to be compared as management occurs year over year. Conducting annual surveys will provide the necessary vegetation

information to answer the question of whether or not specific management goals are being met. The objectives of the project can be described as follows:

2. Objectives

1) Establish a baseline for monitoring responses to tallgrass prairie management actions.

2) Develop guidance for management based on assessment of vegetation quality.

3. Methods

I conducted 11 vegetative meander surveys through October-November 2022 following a monitoring tool (Galatowitsch and Bohnen, 2016). The original goal of the survey tool was to provide qualitative assessment of plant community conditions for restoration projects funded by Environment and Natural Resources Trust Fund (ENRTF). The survey protocol and companion plant community reference lists can be found in Appendix II and III respectively. The bulk of the surveys were conducted across the 3 Scopes (described above). Each plot has a distinct composition of tall-grass prairie plants which reflect their long-term land use history as well as more recent restoration history. For quick and accurate plant ID, I used the app iNaturalist. I recorded each meander using the app Runkeeper for tracking time and location. I conducted my surveys during October and November 2022, however, the tool instructs for sampling to be done during the height of the growing season in July or August when most plants are well established and identifiable. It is worth noting the challenge of IDing some forbs during autumn as leaves and flowers are senesced and harder to recognize during the season. On the other hand, grasses were easier to ID because they had grown to their full height and developed seed heads. Future surveys will yield better data if conducted during the spring (June) as well as within the window of peak growing season (August) to compile a more comprehensive list of species (Galatowitsch & Bohnen, 2016, Appendix II).

Following the fieldwork of conducting surveys, I used the vegetative meander survey process to plot each site on a scatter plot graph to show each sites' vegetation quality and compare them with one another. I used the companion plant lists (Species List Data Sheet–Appendix III) to identify which plant community designation each survey area fell into. Plant community designations for the State of Minnesota have been compiled into field guides and given shorthand labels for ease of use. The plant community designations include lists of plant species that can be expected in specific regions. I used the field guides to determine the specific plant community I was observing. I observed two distinct plant communities: Southern Upland Mesic Prairies (Ups23) and a small Southern Wet Meadow (WMs92). I referred to each plant communities' DNR reference sheet to corroborate my specific survey areas (Appendix V). These lists helped me classify all identified plant species into categories of native, introduced, or invasive. Identifying and labeling each plant as native or invasive is necessary for calculating the scores by which each site is measured for quality. I organized my lists into a set of spreadsheets, listing the scientific name, common name, invasive/native/introduced status and coverage class for each observed species. Formulas are provided in the assessment tool to calculate the percent of total Potential Native Vegetation (%PNV) and the Composite Invasive Species Abundance (CISA) score of each site.

The %PNV and CISA values provide a useful approach for assessing management strategies on the LEPR prairies that were surveyed. %PNV was plotted along the x-axis, whereas the CISA score was plotted on the y-axis (Fig. 3). The transecting orange and brown lines represent the median value of state-wide restorations within forest, prairie, and wetland habitat types in Minnesota (Galatowitsch and Bohnen, 2016). They divide the chart into four distinct quadrants. The bottom right quadrant represents a high-quality restoration based on vegetative characteristics. Within the quadrant, the percent of native vegetation (PNV) is much higher than the abundance of invasive species (CISA). Additionally, the plot represents a site that has a higher %PNV than average MN restorations and a CISA score lower than the average.

4. Results & Data Analysis

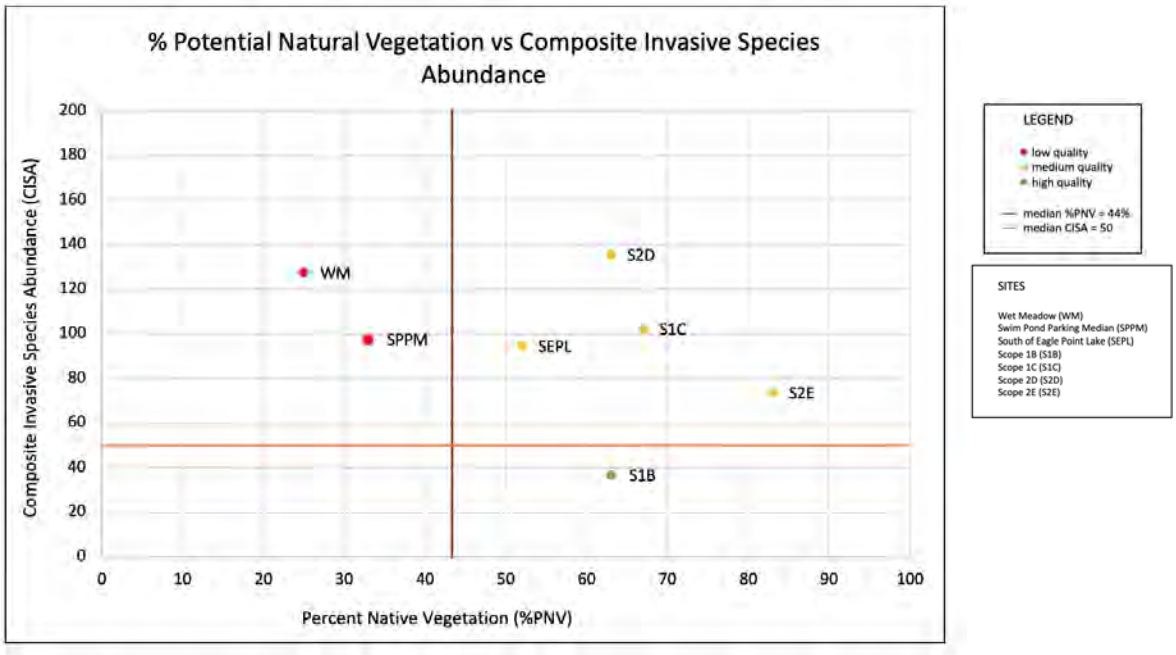
One of my survey sites is situated in the high-quality quadrant, S1B with a PNV of 63 and CISA of 36.5. The native vegetation is almost double that of the invasive species abundance. The survey of this site showed 19 total species observed with one species, *Spartina pectinata,* notably ranking within the highest cover class (50-75%).

Most of the data points fell into the upper right quadrant of the scatter plot, meaning these surveyed sites are of medium restoration quality. They have a high abundance of %PNV but also a high CISA score. Sites in this category include all three of the sites of focus: S2D, S1C, S2E. S2D also had a PNV of 63 but a CISA of 135.5. Significant presence of invasive species like *Bromus inermis, Cirsium arvense,* and *Centaurea stoebe* contribute to the CISA abundance of 2D. S1C showed slightly higher abundance of native vegetation with a PNV of 67 and slightly lower invasive species cover with a CISA of 102. The species with the highest abundance overall in S2C was *Solidago canadensis.* S2E had a PNV of 83 and CISA of 73.5 with high *Solidago canadensis* coverage as well as notably high coverage of the big four tall-grass prairie grasses *Andropogon gerardii, Schizachyrium scoparium, Panicum virgatum,* and *Sorghastrum nutans.* One other survey fell into the mid-range category which was south of Eagle Point Lake (SEPL), it had a PNV of 54 and CISA of 94.5 with notable presence of woody species on a south-facing slope including *Cornus racemosa,* and *Juniperus virginiana* as well as *Rhamnus cathartica.*

The upper left quadrant is indicative of a low-quality site due to high abundance of invasive species and low percentage of native vegetation. My pilot survey in the parking median (SPPM) fell into this category. It was largely dominated by *Bromus inermis* with a lack of many native grasses and forbs to increase the percent of potential native vegetation. The PNV was 33 and CISA of 97.5. Lastly, the wet meadow site south of S1C fell into the low-quality quadrant with a PNV of 25 and CISA nearly five times that at 127.5.

The three land parcels of focus show the most comprehensive data as the PNV and CISA scores were calculated from 2-3 meanders rather than just one like the rest of the surveys. Notably, S2D shows the highest CISA score of all surveys with 135.5%, and a native vegetation cover of 63%. It is worth noting the native vegetation in this area is not well established with sparse groupings of immature plants. The prairie was recently seeded (July 2022). S2E the mature prairie shows the highest abundance of native plant coverage out of all surveys (83%) and lowest invasive species score (73.5%) of all mid-range surveys. S1C is found on the opposite (Western) side of Eagle Point Lake and survey results fall between the two prior scopes in both native species abundance (67%) and invasive species abundance (102%).

October-November 2022 Vegetative Meander Surveys at Lake Elmo Park Preserve (Figure 3.)



5. Discussion

Within the framework of adaptive management, recommendations in this section will aim at increasing the biodiversity of the overall existing plant community. Each of the following recommendations utilizes the results of vegetation monitoring surveys to manage competition between plants, the surveys revealed what plants are present on the landscape and what their level of abundance is giving land managers the ability to "understand the competition and manipulate it so that each species [can] win often enough to stay in the community…through a variety of methods of defoliating plants." (Helzer, 2010)

Using results from the autumn 2022 LEPR surveys to inform further active and passive management decisions reflects the 'measuring progress' element of the adaptive management approach to tall-grass prairie maintenance (Helzer, 2010) For example the lowest quality mid-range survey (S2D) showed high coverage of invasives like Canada thistle (*Cirsium arvense*) which may occur in patches. A specific goal for S2D could be reducing the size and/or number of *Cirsium arvense* patches over a set period of time (Helzer, 2010)

The goal of continued active management on S2E should be focused on maintaining and enhancing existing native species. The big four native warm-season grasses: *Andropogon gerardii, Schizachyrium scoparium, Panicum virgatum,* and *Sorghastrum nutans* are primary examples. Additionally, land managers should focus on increasing forb diversity and coverage for species like *Dalea candida,* which was present but with low abundance. *Liatrus aspera and Liatrus pycnostachya* are further forb examples which both comprised 0.03% of the original BWSR seed mix planted there but did not appear on the landscape during my surveys. Haying is recommended in S2E to reduce the thatch layer in the mature part of the prairie allowing for native forbs to emerge and increase their population density. As mentioned, this prairie contained some forbs but was dominated with warm-season grasses. A secondary benefit of haying this scope would be seed collection for bulk overseeding other areas of the park, for example the northern portion of the S2E scope which is in an early establishment phase or S1B which is a high-quality site with low species diversity. Timing is crucial to collect viable seed. The ideal time for haying is when the primary native species have mature and viable seed. Adding another layer to this technique would be the incorporation of ruminant grazers (Appendix VI) that could utilize the forage from the hay in the winter months to overseed scopes with lesser establishment and diversity (like S1B).

The tree line in the northern 20% of S2E separates mature prairie from a segment of first-year restoration, presenting a possible opportunity for Park staff to test passive management as the two plots are adjacent to one-another and seed transfer between the segments will be highly likely to occur without human intervention.

S2D is close in proximity to the northern portion of 2E and appears similarly prepared and seeded within the last year and appears to be at the same level of establishment. Based on the high percentage of invasive coverage, prioritizing active management is recommended until the invasive population is reduced and the overall quality is improved. Examples of active management techniques include seed collection and bulk overseeding, spot treatments like selective mechanical removal of weedy species, spot-mowing, or selective herbicide application (back-pack spraying- of invasives). Non-selective mechanical removal (flail mowing) or non-selective chemical treatment (broadcast herbicide spraying) are active management strategies commonly applied to early-stage tall grass restoration sites like S2D.

For mid-range sites where more native vegetation is desired in combination with mitigating invasive plant species, actions such as prescribed burning, conservation haying, and conservation grazing can be employed. Additionally, to bolster species diversity, mid-range sites can benefit from enhancement pockets forb plantings (plugs rather than seeds).

Passive management follows active management within sites like LEPR based on prairie establishment levels of the parcels in question and surrounding landscape. For example, a fully mature prairie to the west (leeward side) of a less mature restored prairie provides seed input through the action of wind (abiotic dispersal). The site most in need of high intensity, early-stage active management is S2D. In this case non-selective mechanical and chemical

activities like flail mowing and broadcast herbicide application are recommended, especially for year one of active management. Progressively more selective mechanical and chemical activities can be employed during following years. Generally, three years of aggressive active management allows for the quality of the restoration site to improve and transition to less intensive long-term management. Surveys should be used to monitor when transitions in management can occur and whether or not future interventions are necessary.

S1C shows evidence of being actively managed due to the level of native species establishment. Continued selective techniques are recommended. This site would likely benefit from a prescribed burn to increase native warm season grass cover and reduce non-native or aggressive native forb species like Canada goldenrod (*Solidago canadensis*). Burn timing is critical for preventing stress on native species while targeting invasives. Though varying burn timing is key, an example of optimal timing would be an early spring burn, post-invasive vegetation emergence when cool season grasses are beginning to grow but before sensitive ephemeral forbs have broken ground (Helzer, 2010).

6. Implications for Management

a. Conducting twice annual surveys (mid-June and late August) throughout key sites at LEPR would provide clarity for land-managers working in the tall-grass community there. Comparing the meander survey data results year over year fits into adaptive management by providing clear monitoring data.

b. Selecting optimal management strategies can be supported by survey results, scores of given sites will point towards specific active or passive management techniques (as illustrated in the discussion) to target removal of invasive plant species and promote growth and diversity of native vegetation.

c. Transitioning to more passive approaches will become more feasible as plant diversity improves over time. Varying the management strategies applied to each site, altering the time of year and sections of prairie under management will maximize species diversity and mimic the variety and randomness of “natural” disturbance events.

References

Holl, K. D., & Aide, T. M. (2011). When and where to actively restore ecosystems? *Forest Ecology and Management*, *261*(10), 1558–1563. https://doi.org/10.1016/j.foreco.2010.07.004

Galatowitsch, S., & Bohnen, J. (2016). RESTORATION EVALUATION PROJECT Vegetation Monitoring Tool University of Minnesota.

MacSwain, D. (2021, May 20). *Bison conservation grazing at Lake Elmo Park Reserve*. ArcGIS StoryMaps. Retrieved December 3, 2022, from https://storymaps.arcgis.com/stories/39ed7acf98dc420899af47392462cf4e

Helzer, C. (2010). *The ecology and management of Prairies in the central United States*. Published for The Nature Conservancy by the University of Iowa Press. U.S. Department of the Interior. (n.d.). *Bison stories*. National Parks Service. Retrieved December 5, 2022, from https://www.nps.gov/subjects/bison/bison-bellows.htm

U.S. Department of the Interior. (n.d.). *Bison stories*. National Parks Service. Retrieved December 5, 2022, from https://www.nps.gov/subjects/bison/bison-bellows.htm

Appendix

I. BWSR U-5 Seed Mix

II. Vegetation Monitoring Protocol

III. Vegetation Monitoring Reference Lists

IV. October-November 2022 Lake Elmo Park Vegetation Monitoring Surveys

V. Field Guides to Plant Communities of Minnesota:
Southern Upland Mesic Prairie (Ups23)*
Southern Basin Wet Meadow (WMs92)*

*These lists are not an indication of everything that should be on the landscape, rather a representation of all the possible species that fit into the plant community category, some species will be on the list that are not present in a given survey area.

VI. The 2021 grazing proposal which guided site selection for the survey scopes of this project incorporates plans for bison as the ruminants of choice for conservation grazing at LEPR. Applying the survey tool to the process of introducing bison to restored prairie creates a baseline for assessing potential grazing site quality and readiness. It can also help answer questions like should the bison be seasonal or full-time residents at the park, how many bison should there be to start, and for how long can they graze a given area without putting the native vegetation at risk of overgrazing?

Bison Grazing in the Sunshine at Minneopa State Park by Jen Merth, 2022

Surveys conducted before and during the introduction of bison will show if the diversity and coverage of native vegetation is degraded over time with grazing or improved. A 2019 grazing plan for LEPR put together by an

independent consulting firm (Stantec) suggests that vegetation monitoring should be conducted at several different times during the growing season to monitor forage and vegetation to ensure a herd of bison would have sufficient food supply and that active grazing is having the desired conservation impacts on the tall-grass prairie community.

The American Bison (*Bison bison*) is an iconic ruminant which was nearly pushed to extinction in the 1800s by Early European settlers. Prior to the mass killing of bison, millions of bison browsed the historic prairies from the arctic lowland taiga forests of Southern Alaska to the western grasslands of Mexico (NPS, 2020). The bison was named the national mammal of the United States in 2016 due in part to the focus on conservation efforts over the last few decades. Tall-grass prairies like those located within the focus area, developed, and evolved through the consistent periodic disturbances of fire and grazing which is why they are restoration management techniques for the plant community. The disturbances caused by bison gives them their reputation for being ecosystem engineers, they have been observed to prioritize grasses when they graze especially when compared with their domestic counterpart, cattle, who tend to be less preferential grazers. This is thought to have created more plant diversity by allowing forbs to flourish as grasses are mowed down, which shapes the complex ecosystems we know prairies to be. Not only does bison grazing create less competition between grasses and forbs allowing for greater plant diversity, but their nomadic grazing habits also mean they create a variety of levels of heterogeneity within grassland ecosystems; short grazed-down patches, tall untouched patches, and patches in between. These levels provide necessary habitat for other prairie inhabitants such as arthropods and birds. It is important to note that if bison do not have enough space to mimic their natural historic land-use over many thousands of acres (Helzer, 2010), they run the risk of overgrazing a given area in the same way cattle will.

Ultimately, grazing provides necessary disturbance and vegetation removal without the need for machinery and intensive human input, however it is a nonselective and continuous approach with a high impact on the landscape. Site selection should be strategic and limited to seasonal grazing prior to necessary vegetative establishment levels for rotational grazing management to be supportive of native vegetation restoration. Vegetation monitoring surveys should be employed to identify when grazing efforts can be initiated and eventually scaled up.

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