SUPPLEMENTARY INFORMATION:

1. Detailed description of methods

We analyze protected land, characteristics of marginalization, and conservation scores for communities in the New England region. Our unit of analysis is the census tract. We collect and analyze four pieces of information for each tract: demographics from the U.S. Census, percent of land area protected, average "score" for several conservation prioritization layers, and the number of brownfields (remediation sites). All data sources are summarized in Table S1.

1.1 Protected open space data and measures of access

Data on protected open space in New England comes from Version 1.1.0 of the Harvard Forest/ Highstead POS Dataset (2021; Fig. S1). The POS dataset includes public land as well as conservation easements and private acquisitions of land by conservation NGOs and small local land trusts. It records a year of protection for a majority of sites (which allows us to investigate historical vs. recent protection). The data was compiled from over a dozen sources including direct data from local land trusts and other institutions supporting conservation in the region. In addition to regional, state, and local sources, this version of the POS layer contains data from the Protected Areas Database of the United States (PAD-US) 2.1, which substantially improved the representation of urban open space due to PAD-US 2.1's inclusion of the Trust for Public Land's ParkServe data (U.S. Geological Survey Gap Analysis Project 2020).

Data on specific entry points to protected lands or allowable public uses of each parcel is not comprehensively available at a regional scale. Although this information is collected by some of the underlying data sources that are included in the POS data, it is not comprehensively collected by all sources.

Our primary measure of access to open space is the percent of land protected inside or within a 1 km buffer of each census tract (Fig. S1). This is intended to represent protected open space within a community or within a feasible walking distance of that census tract. We use the percent of land protected rather than an absolute amount because census tracts (and buffers) vary considerably in size. Buffers are important to capture access for people near the boundaries of the census tracts, particularly for communities immediately adjacent to park areas. Some parks receive their own census tracts (code range 9800's; Boston's Emerald Necklace area is an example) and would not be counted as part of any community if we did not use the buffering approach.

We also analyze the data with no buffer and apply a series of additional buffers (2km, 10km, 25km) to census tracts to understand the distribution of protected open spaces at varying scales, which may proxy for access to open space on foot versus by car or public transportation. Further analysis of specific travel times is not possible due to a lack of availability of data on entry points to protected open spaces. While such data exists for many urban areas, it is not available comprehensively at a regional scale.

Nearby protected open space is assessed overall as well as by different categories according to ownership (public or private) and year of protection (before or after 1990) (Fig. S1). Public open spaces in the dataset (~13% of the region's land area) include state parks, national parks and national forests, as well as municipal parks and conservation land. Nearly all public open spaces in our region allow public access (limited exceptions include military lands / restricted drinking water supply areas). For this reason, we also analyze publicly protected lands separately as they are particularly important for recreation access. Private open spaces (~12% of the region's land area) are conservation lands owned by individuals, mission-oriented organizations, and more than 300 local and regional land trusts. This includes land with permanent legal restrictions on development ("conservation easements"). Given traditions in the region of allowing public access to protected open space, the majority of private lands in our region also allow public access (Daigle et al. 2012). Protected lands that do not allow public access still provide many locally important ecosystem services including flood protection, pollination services, biodiversity protection, cooling during extreme weather events, and amenity value (Foster et al. 2017, Sims et al. 2019, Mandle et al. 2020). This motivates our use of proximity to all types of protected lands in the main analysis.

Our focus on permanently protected open space may underestimate current access to nature in rural communities. However, we feel that the focus on permanently protected land is appropriate because of ongoing and increasing loss of rural open space which threatens future access. A recent report highlights that the loss of natural land cover due to development has also been borne disproportionately by low income and high minority communities (Rowland-Shea et al.

2020). Indeed, the COVID-19 pandemic has led to dramatic pressures on home prices and development in many exurban and rural areas that highlight these threats (Kolko et al. 2021).

The POS layers were rasterized at 10m resolution prior to analysis, a resolution that is small enough to represent smaller or more narrow protected open spaces (e.g., riparian corridors or pedestrian walkways) and large enough to feasibly run analyses at a regional scale. Although census tract boundary data comes with land and water area estimates for each tract, when calculating percent of land protected, we define land area using the 2016 NLCD for consistency with land area estimates for buffered census tracts.

1.1.1 Characteristics of social marginalization

We use the five-year 2014-2018 American Community Survey (ACS) estimates for census tracts including total housing units, total population, median household income, race, educational attainment, and English proficiency (Manson et al. 2020b, 2020c). These data are the basis for the four demographic variables critical to our analysis: median household income, percent people of color, percent of people 25 or older without at least a 4-year degree, and percent of people 5 or older who do not speak English at home and speak English less than 'very well'. They are also used to categorize communities as urban, exurban, or rural, according to housing density. In our analysis, the percent people of color variable is measured by including all people who identify with categories other than White, non-Hispanic. This includes people who self-identify as Black, Asian, Native American, Native Hawaiian or Pacific Islander, multiracial, and White Hispanic or Latino.

Figure S2 shows the distribution of demographics relevant to social justice within the region. These variables are joined to the 2018 TIGER/Line census tract boundaries (Manson et al. 2020a).

Access to land is a particularly important issue for Native and Indigenous people, who lived throughout this region prior to the arrival of colonial settlers and subsequent dispossession of nearly all land in the area. According to the ACS data, 0.15% of the population of New England currently identifies as Native American. We also calculated that 0.28% of New England's land area is currently controlled by federally recognized tribes, which are sovereign nations with powers of self-government (U.S. Bureau of Indian Affairs 2018). Additional land is owned by communities that lack federal or any official recognition, but we are not aware of systematic data on this beyond population estimates derived from the self-identified data in the census.

Publicly and privately owned protected open spaces may have a role to play in supporting land access or land back for Native and Indigenous communities, if deemed appropriate by those communities. Native and Indigenous people may have distinct motivations for pursuing land protections, including but not limited to the protection of sacred sites or ensuring access to traditional foods and medicines (Krakoff 2018, Deur and James 2020). While full analysis of the ways protected open spaces may be accessible or inaccessible to Native and Indigenous people in the region is beyond the scope of the paper, the analysis and maps do identify some census tracts with a high proportion of people who self-identified as Native American as potential environmental justice focus areas. This includes three federally recognized tribes with sovereign governments (Aroostook Band of Micmacs, Houlton Band of Maliseet Indians, and Penobscot Nation). Ensuring processes that maximize local autonomy regarding land protection may be additionally important for these communities given the specific histories of dispossession.

1.1.2 Definitions of urban, exurban and rural

Total housing units are divided by the census-provided land-area estimate to determine each tract's housing density. Tracts are classified as urban, exurban, or rural according to housing density following the cutoffs in Radeloff et al. 2005 (Urban: >128 housing units/km^2, exurban: 16–128 housing units/km^2; rural: <16 units/km^2). We visually inspected these classifications and reclassified one tract from rural to exurban because it was surrounded by neighboring tracts that were majority urban and was far away from any other rural tracts. We excluded tracts from statistical analysis if they had no housing units, fewer than 100 people, or were missing income data (n = 26). The final dataset comprises N= 3344 tracts*:* Urban N=2131, exurban N=918 and rural tracts N=295. The distribution of urban, exurban and rural tracts, as well as the excluded tracts, are shown in Figure S3. Housing density variables are tied to overall cutoffs that were derived from national data and could be used at a national scale. These values therefore are not adjusted within state.

1.1.3 Ecosystem-based prioritization layers

To analyze conventional conservation priorities, we calculated average scores from three datasets used to aid in conservation prioritization (Table S1) for land that is still available for conservation. We define available land as land that is undeveloped according to the land cover data and unprotected according to the POS data. Tracts receive a score if they have at least 10 acres of available land according to each layer.

Resilience: The Nature Conservancy's terrestrial resilience layer is a national dataset that ranks the long-term resilience of the land with a relativized, unitless index at 30m resolution (Anderson et al. 2016). We use the median index score within 1km buffered census tracts. Since the layer does not include scores for areas that are classified as developed, we exclude those areas from the median score calculation. The total number of tracts scored is 2,987 out of the 3,344 total.

Clean drinking water: USDA's Forests to Faucets 2.0 Assessment is a national layer that ranks sub-watershed importance for cleaning drinking water using a unitless index (U.S. Department of Agriculture Forest Service 2018). We use the relative importance which reflects the percentile rank of each watershed at the national level and allows for comparison across watersheds. We rasterize this layer at 30m resolution for analysis with ArcGIS and use the mean relative importance score within 1km buffered census tracts. The total number of tracts scored is 3,212 out of the 3,344 total.

Carbon: The National Biomass and Carbon Dataset for the Year 2000 is a collection of national maps including aboveground biomass estimates circa 2000 at 30m resolution (Kellndorfer et al. 2013). We mosaic the maps for zones 65 and 66, which together cover all of New England, and use the mean of each map's pixels in areas of overlap. We estimate metric tons of carbon per hectare (C Mg/ha) using the map's original units of kg/m^2 x 10. To do so, we first estimate biomass within each 1km buffered census tract by multiplying the sum of pixels within each tract by 0.09 (which accounts for the proportion of a hectare in each 30m pixel) as described in the dataset user guide (Kellndorfer et al. 2013). We divide this estimate by each tract's available land area to determine biomass Mg/ha. Finally, we divide by two to convert biomass Mg/ha to C Mg/ha (Schlesinger 1991). The total number of tracts scored is 3,211 out of the 3,344 total.

Undeveloped land: To estimate undeveloped land in 1990 and 2016, we use Landsat-derived land cover classifications. For 1990, land cover information is derived from two sources: the Continuous Change Detection and Classification (CCDC) algorithm (Olofsson et al. 2016) and the National Land Cover Database (NLCD) (Homer et al 2015). CCDC is an annual product covering the majority of New England but excluding northwest Vermont and northeast Maine. Because it was developed specifically for New England, we considered it to be the more accurate data source for 1990 and used it first where available. Where CCDC data was not available, we filled the remainder of the study area with the 1992 NLCD. For 2016, we used the 2016 NLCD, which has more detail on developed land uses compared to CCDC.

1.1.4 Brownfields data

To assess redevelopment potential, we analyzed overlap between the EPA's data on the locations of brownfields and the census tracts (U.S. Environmental Protection Agency 2020). We provide a count because the EPA data is in points.

1.2 Analysis methods: additional details

1.2.1 Assessing disparities in access

To assess disparities in access to protected open space by demographic characteristics, we group census tracts into within-state quartiles based on their demographics. We use relative ranking within each state to identify marginalized communities and potential focus areas, with the goal of developing a method that is easily scalable across regions. Specifically, we use the percentile rankings for each of these characteristics within each state. This adjusts for the fact that some states have overall higher or lower incomes or higher or overall levels of racial and ethnic diversity, education, or language isolation.

We compare the distributions of percent of land protected across each of these quartile groups as shown in the boxplots (Fig. 1). Specifically, for each quartile group, Figure 1 shows the median percent protected (horizontal line), the 25th and 75th percentiles (ends of each box), and the 5th and 95th percentiles of this variable. The stars on each boxplot indicate the statistical significance of the pairwise correlation coefficient between the percent of land protected and the percentile rank of household income or percentile rank of % people of color (* $p<.05$, ** $p<.01$). These correlation coefficients characterize the continuous relationships between protected open space and characteristics of marginalization. In addition, we report in the text the median percent protected in low and high quartiles for some quartiles. For those, we calculate the standard errors of the median using bootstrapping with 1000 replications.

In addition to Figure 1 as described in the main text, we provide analysis of disparities across time and by alternate characteristics. Figure S4 indicates the percent of land protected before and after 1990, by quartiles of income and percent people of color based on current demographics. Figure S5 analyzes patterns of disparities using educational attainment and language isolation rather than income and race as characteristics of marginalization.

1.2.2 Identifying EJ focus areas

To identify potential EJ focus areas within New England, we calculate the within-state percentile rank of each census tract for median household income, percent people of color, percent people English-language isolated, and percent of land protected within 1km of the tract. We use a state-based approach because of the role that states play in allocating funding for conservation and to adjust for overall differences between states in terms of income, availability of open space, and racial or ethnic diversity. We identify the tracts that are in the lowest quartile (percentile rank less than or equal to 0.25) of income and protection, and the highest quartile (percentile rank greater than 0.75) of percent people of color and percent language isolated within each state. While each of these groups can be considered social justice communities, we consider tracts that fall within *all* of these groups as our core environmental justice focus areas. This narrows the environmental justice focus to the most marginalized communities. Statistics by state and examples of more detailed map areas are given in Table S2 and Figs. S6 and S7.

1.2.3 Multivariate analysis of disparities and land protection patterns

The main focus of our analysis is on current patterns of disparity in nearby open space. These are potentially driven by a complex set of intersecting historical factors, including development pressure, land availability, patterns of settlement across the region, and discrimination in siting of conservation. Fully disentangling the potential causal influence of these multiple factors is outside of the scope of our analysis. However, we report the results of a limited set of multiple regression models to analyze how current access to nearby protected land is jointly related to demographic characteristics, urbanicity and land availability (Tables S3-S8, Fig. S8).

2. Supplementary results and discussion

2.1 Assessing disparities in access: additional figures and multiple regression analysis

2.1.1 Educational attainment and language isolation

Figure S5 analyzes patterns of disparities using educational attainment and language isolation. This confirms that very similar patterns of disparities to Figure 1 result when we consider educational attainment or language isolation as markers of marginalization. Communities where fewer people have a four-year degree or where there is more language isolation also have substantially less nearby protected land.

In Table S3, part a, we relate the percentage of land protected inside or within a 1 km buffer of each census tract to race, income, settlement density (urban/rural/exurban) and educational attainment (percent with a college degree). We find a strong and statistically significant negative relationship between the percent of people of color in a tract and the percent of land protected (Column 1; coefficient = -0.123, SE = 0.007). We also find a strong and statistically significant positive relationship between income and the percent of land protected nearby (Column 2; coefficient = 0.729, SE = 0.059). These coefficients remain statistically significant when both are in the model together (Column 3) and when we control for whether a census tract is urban, exurban or rural (Column 4). The coefficient on percent people of color becomes smaller in magnitude as we add median household income, whether or not a tract is urban or exurban, and the percent of individuals 25 years or older who do not have a college education (Column 5; coefficient = -0.018, SE = 0.008). This change indicates that income, location in more densely settled areas, and educational opportunity are correlated with both the percent of people of color and the percent of available protected land. This is consistent with the idea that historical structural inequality—differential access to educational opportunities, jobs, and residential areas on the basis of race—likely plays a crucial role in present day access to protected land. Results are similar when we include state fixed effects (indicator variables for each state), which uses variation in relationships from within each state (Table S3, part b). As before, the percent people of color is significantly negatively correlated with nearby protected land and income is significantly positively correlated (Columns 1-4). With state fixed effects and the percent of people without a college education included, the relationship between income and percent protected becomes negative, likely because of the high correlation between income and educational attainment (Column 5).

2.1.2 Public vs. private

We also examine these partial relationships by estimating the same models for public and private protected land separately (Table S4). At a regional level, we find that the percent of people of color has a less negative relationship with public versus private protected land (Part a, Columns 4-6 vs. 1-3). Indeed, when we include structural factors of income, urban/exurban/rural and educational attainment in the model, race does not significantly predict access to public land and the coefficient is zero or slightly positive (Part a, Columns 2 and 3). For privately protected land, however, the relationship remains negative and statistically significant (Part a, Column 6). When we include state fixed effects (Table S4, part b), we find that the relationship between public land protected and percent people of color is consistently significantly negative despite adding additional controls (Table S4, part b), and the same holds for private protected land.

2.1.3 Varying buffer sizes

In Table S5, we show the relationship between land protected, percent people of color and income for different size buffer areas around each tract and the tract with no buffer. Prior literature of specific cases has used a wide variety of catchment areas in defining access (Flores et al 2018, Castaneda 2017, Kim and Nicholls 2016, Nicholls 2001). Here we include state fixed effects so that estimates are derived from within-state variation, following our main approach in the paper. For percent people of color, we find that the gradient of disparity is generally reduced as the buffer size increases. For income, we find that up to the 10 km buffer there is a significant and positive relationship between income and nearby protected land. This relationship reverses for the largest buffer (25 km), reflecting the overall greater availability of protected land in more rural and lower income communities in the region.

In Figure S9, we provide an alternative version of Figure 1 using unbuffered census tracts. We find that the trends and relationships between the percent of land protected and income or percent people of color do not meaningfully change with or without a 1km buffer. The only difference in significance between versions is that with no buffer there is a statistically significant correlation between income and percent of total land protected in exurban tracts, which was not significant in the main figure.

2.1.4 Pre 1990 and post 1990

Since 1990, more than 5 million acres of open space were protected in the region (approximately half of all protected land). Dates of protection in our dataset allow us to examine how current (ACS 2018) characteristics of marginalization relate to land protected before versus after 1990 (Figure S4, Table S6). If more recent land protection was positively correlated with percent people of color or negatively correlated with income, it could indicate that newer protection had contributed to reductions in current disparities even if historical protection did not. Since we do not observe how the composition of communities may also have changed over time, the conclusions we can draw are limited. For example, new protection could have been targeted to help underserved communities and then resulted in the displacement of marginalized communities to areas with less protection.

Keeping these limitations in mind, we do not see evidence that more recent protection has reversed trends of disparities in access to protected land. As shown in Fig. S4, there are disparities in the patterns of land protected both pre-1990 and post-1990. Considering the relationship between current (ACS 2018) tract characteristics and protection since 1990, we find strong negative correlations between new land protected and the percent people of color and positive correlations with median household income (Table S6, Columns 1 and 2). One reason for this is that the amount of land that was actually available for protection by 1990 is a significant predictor of what was protected. As shown in column 3 of Table S6, the percent of land available in 1990 is a strong predictor of the percent protected between 1990 and the present, with an R^2 of 32.6% of the variation in new land protected. Adding other variables measuring race, income, urban/exurban/rural status, and educational attainment explains relatively little additional variation in new land protected (column 5, R^2 = 35.9%). This indicates strong co-occurrence of marginalized communities and areas with little land left to be protected by 1990. The same holds true in the current data, with strong correlation between the percent people of color in the 2018 ACS estimates and the percent of land currently available (rho=-0.605, $p < 0.0001$). This suggests that future land protection that proceeds along similar lines to protection since 1990 will very likely result in further increasing disparities in access to protected land.

Table S7 indicates that these patterns hold for new protection of both public and private land since 1990. New land protected inside or within 1 km of census tracts is negatively correlated with the percent people of color and positively correlated with income for both public and private land. All coefficients are statistically significantly different from zero.

2.1.5 State by state analysis

Table S8 investigates disparities for each state in the region using bivariate regressions. Part A shows regressions with the variables in standard values (percent and dollars). Part b shows regressions of the percentile rank of variables within each state. In part A, the coefficients indicate a strong positive gradient between median household income and land protection in all states except New Hampshire. The coefficients also indicate that all states had a negative relationship between the percent protected and percent people of color. This relationship is weakest in Maine, which also has the least racial diversity within the dataset. Vermont's coefficients are consistent with our overall findings but have limited precision due to the smaller number of census tracts. In part B, we see confirmation of positive relationships between the state-based percentile rank of land protected and income and of negative relationships with percent people of color. All relationships are statistically significant except for percent people of color in Maine and income in Vermont. Overall, these results indicate that there is substantial disparity either by income or race within each state in the region.

2.1.6 Geographically weighted regression

Nevertheless, local variation is important and should be a crucial part of ultimate decisions about funding allocation or focus areas. In Figure S8 we show the results from geographically weighted regressions of the main bivariate relationships described in Figure 1 and Table S3, part A between the percent protected and income or race. These figures are helpful in indicating some areas of the region where relationships may be different, for example close to the federally protected White Mountains area in New Hampshire. This further highlights the importance of robust community-centered processes that consider the actual amount of land currently protected and local information on access to that land in decisions about focus areas for new protection or restoration. It also reinforces the utility of a state-based approach to identifying environmental justice focus areas.

2.2 Additional figures and results on environmental justice focus areas

Table S2 provides summary statistics on the environmental justice focus areas by state. While states differ in their relative abundance and characteristics of each EJ group, due to different state sizes and demographics, using a state-based approach ensures that all states have environmental justice focus areas. The focus area tracts with high conservation value from an environmental justice perspective collectively include 6.3% of the population and 0.38% of the land area in New England.

We further identify focus areas with and without the inclusion of language isolation as a criterion (shown in the web map) and find that 87% of focus areas identified using our three core criteria (income, race, protection) are also in the highest quartile of English-language isolation. This highlights the ways in which many communities are cumulatively marginalized and demonstrates the importance of translation and interpretive services for community engagement.

Figure S6 shows EJ focus areas in four different parts of New England using three criteria. The figure shows in more detail how the tracts presented in Figure 2 overlay in different parts of the region. Figure S6 also highlights that we identify EJ focus areas in a range of communities, from a large, heavily urbanized city like Boston to smaller cities with more exurban environments like Concord and Manchester, New Hampshire.

Figure S7 shows a screenshot of the web map, which includes census tracts in the highest quartile of language isolation and the focus areas identified with four criteria, in addition to those shown in Figure 2 and Figure S6. Protected open space and brownfields data add conservation context to the map. The user can click on protected areas or census tracts to see the underlying data. For census tracts, we provide the unique tract ID, tract type, demographic information, and land protection information. For protected open space, we provide the owner type (public or private), year protected, and area name.

SUPPLEMENTARY FIGURES

Figure S1: Study area and nearby protected open space by census tracts. *Left panel provides a map of all protected lands in New England, broken down by public and private ownership. Right panel shows a map of the census tracts in the region. Tracts are color coded according to the percent of land area that is in protected open space inside or within 1 km of each census tract.*

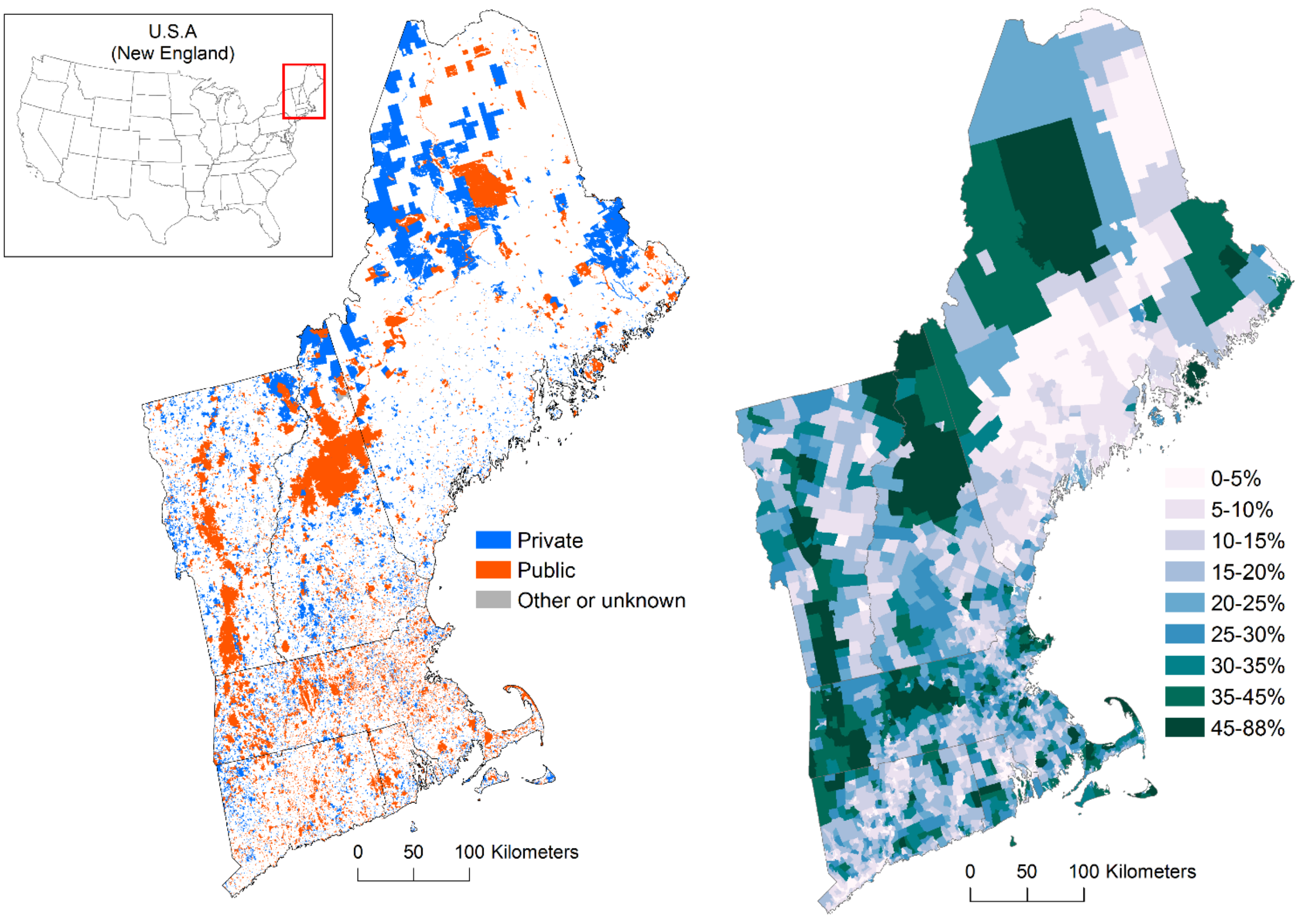


Figure S2: Distribution of income, race, education, and language isolation by within-state quartiles

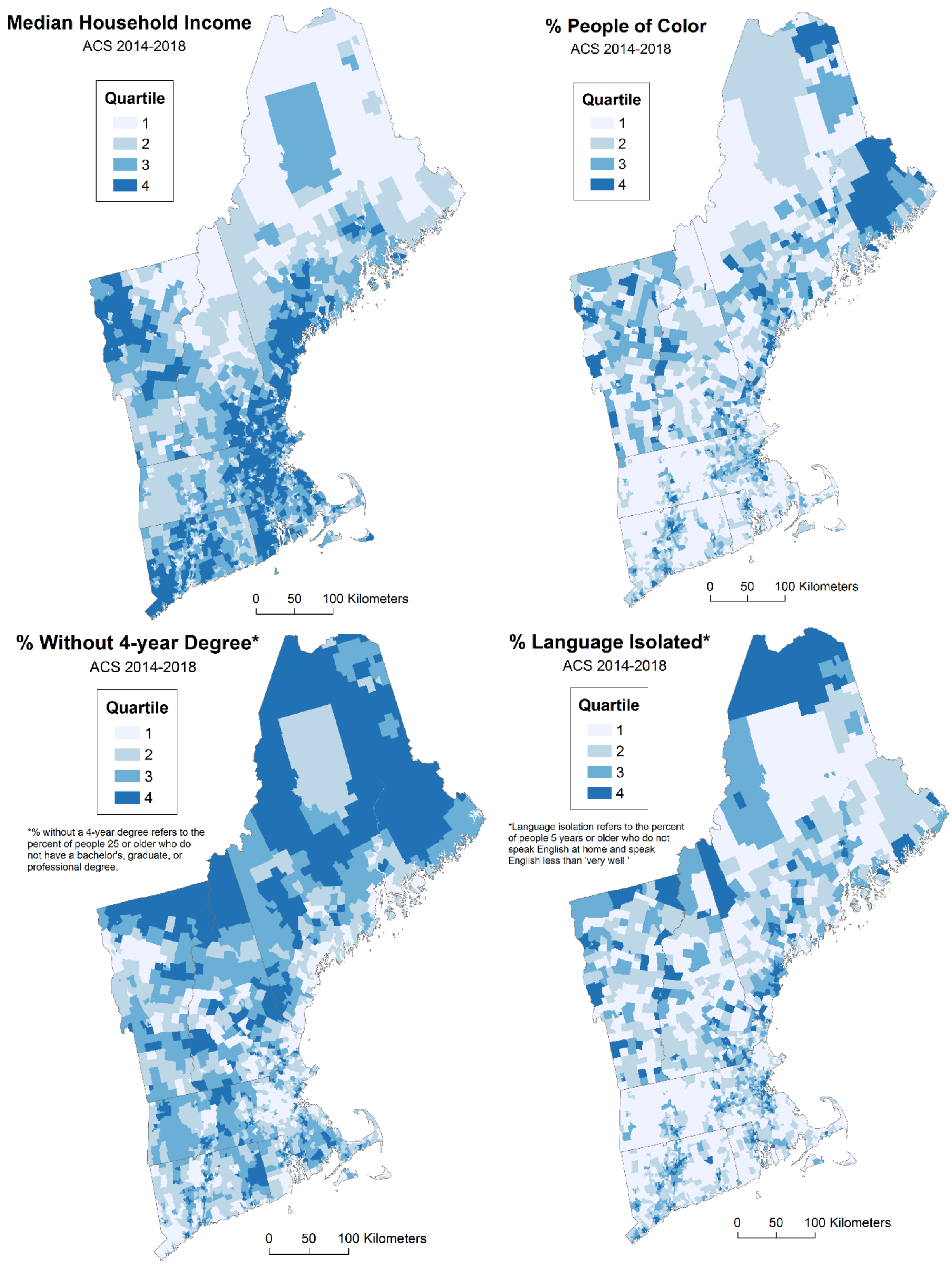


Figure S3: Distribution of tract types and tracts not used in statistical analysis. *Map shows the census tracts classified as rural, exurban and urban according to housing density. (Urban: >128 housing units/km^2, exurban: 16–128 housing units/km^2; rural: <16 units/km^2).*

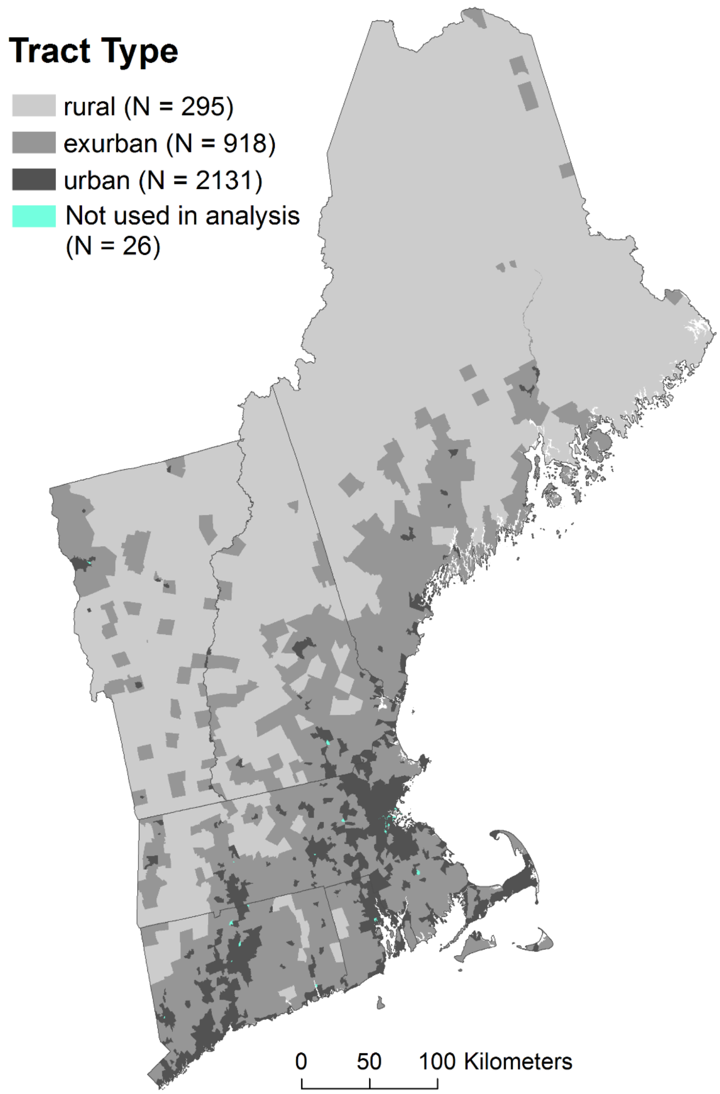


Figure S4: Disparities in land protected since 1990. *Percent protected before and after 1990 within a 1 km buffer of current census tracts by within-state quartiles of income and percent people of color. For each quartile group, boxplots show the median (line), 25th and 75th percentiles (box), and 5th and 95th percentiles (whiskers). Stars indicate a statistically significant (* p<.05, ** p<.01) correlation between percent protected and the percentile rank of income or percent people of color. For each set of quartiles, access to protected open space is analyzed before 1990 and 1990 or later. A) All tracts (N=3344). B) Subsets of each quartile that are: urban (N=2131), exurban (N=918) and rural tracts (N=295).*

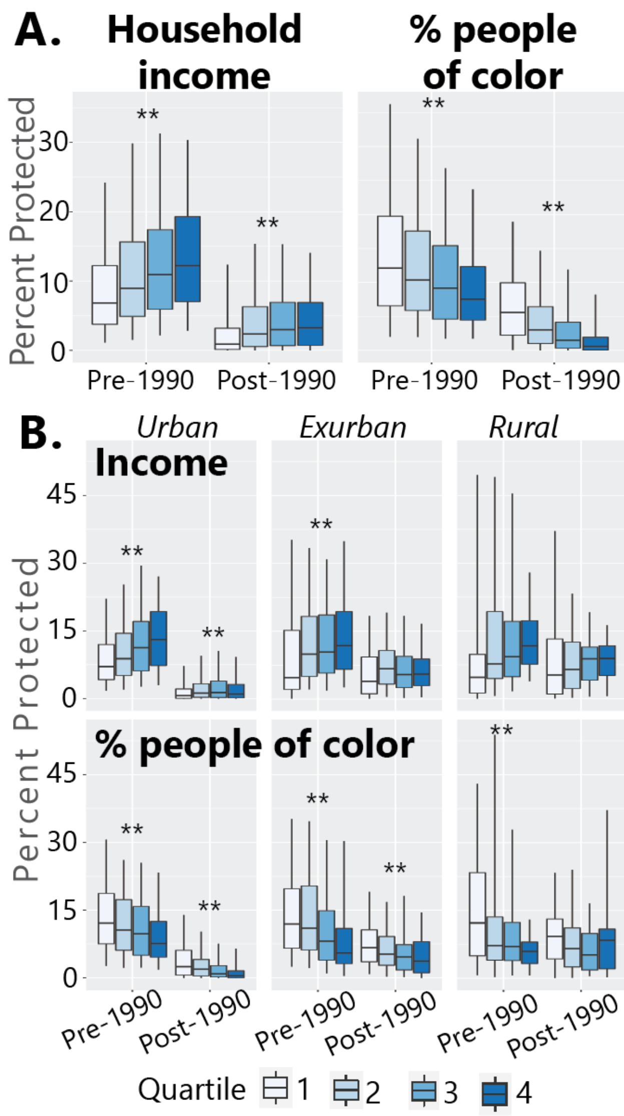


Figure S5: Disparities in land protected by degree of language isolation and educational attainment. *Distribution of the percent of land protected within a 1 km buffer of census tracts by within-state quartiles of percent without a four-year degree and percent language isolated households. For each quartile group, boxplots show the median (line), 25th and 75th percentiles (box), and 5th and 95th percentiles (whiskers). Stars indicate a statistically significant (* p<.05, ** p<.01) correlation between percent protected and the percentile rank of educational attainment or English-language isolation. For each set of quartiles, access to protected open space is analyzed for all protected lands, then by public and private ownership. A) All tracts (N=3344). B) Subsets of each quartile that are: urban (N=2131), exurban (N=918) and rural tracts (N=295).*

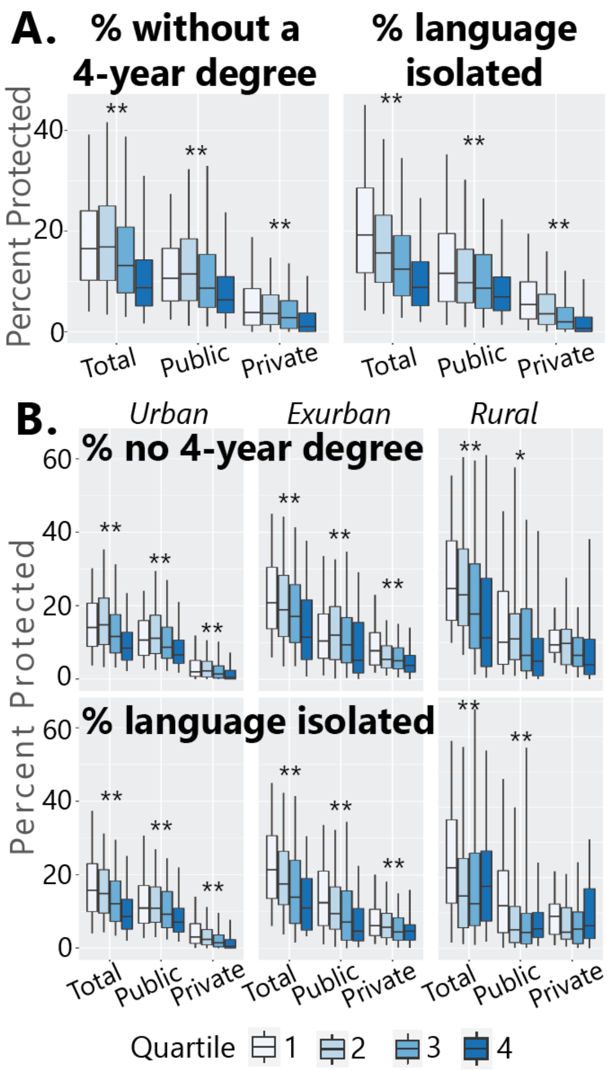


Figure S6: Areas of potential focus for new land protection according to environmental justice criteria: examples of detail for four metro-areas.

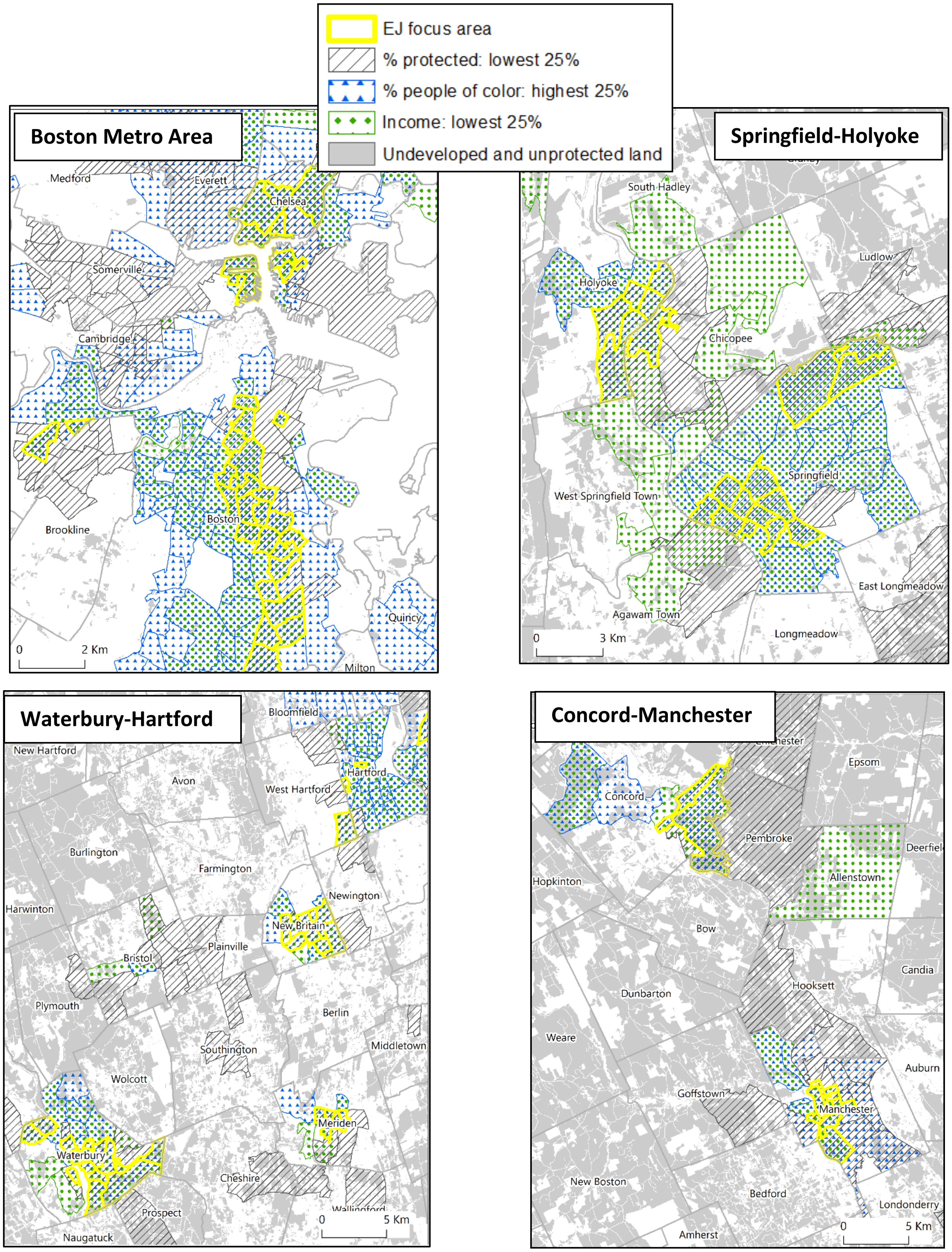


Figure S7: Example of web-based map showing focus areas for environmental justice *in Boston, Massachusetts, the largest city in New England. The web map shows the same data as shown in Figure 2, plus data on language-isolated census tracts. Additional layers including protected open space (shown below), brownfields (not shown), and tract scores for the three conservation prioritization layers in Figure 2 (not shown) add conservation context. The user can click on map features to see data in pop-up windows. View map online:* *http://bit.ly/EJ-OS-NE.*

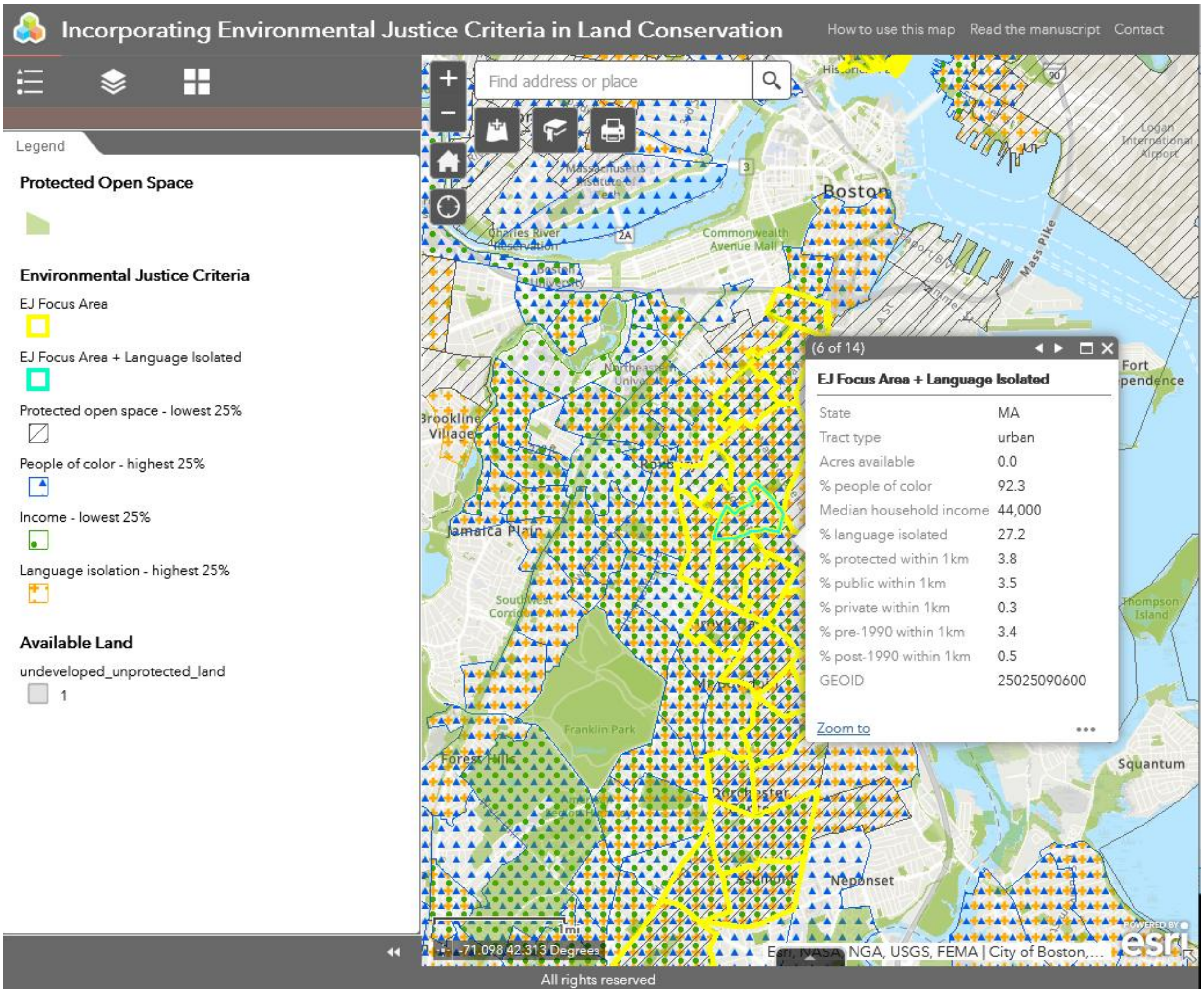


Figure S8: Coefficients for income and percent people of color in bivariate geographically weighted regression. *The maps show an overall positive relationship between income and percent protected and an overall negative relationship between percent people of color and percent protected across the region. Histograms show that the OLS coefficients (columns 1 and 2 of Table S3, part a) are approximately in the center of the distribution of GWR coefficients and represent the regional average. Local regressions in GWR are calculated using an adaptive kernel of 100 neighbors, which results in a smaller kernel in more densely populated areas and larger kernel in more sparsely populated areas.*

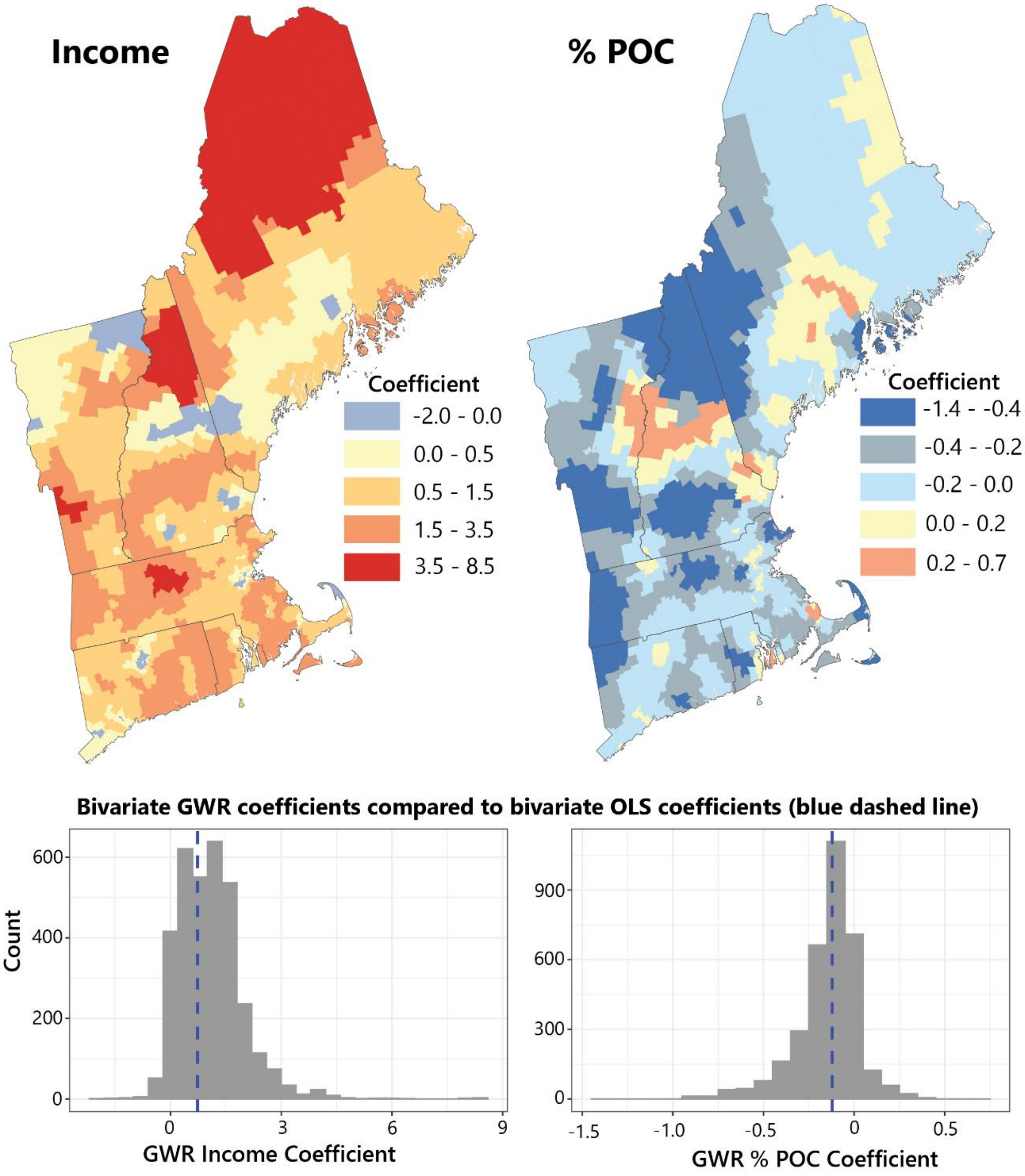
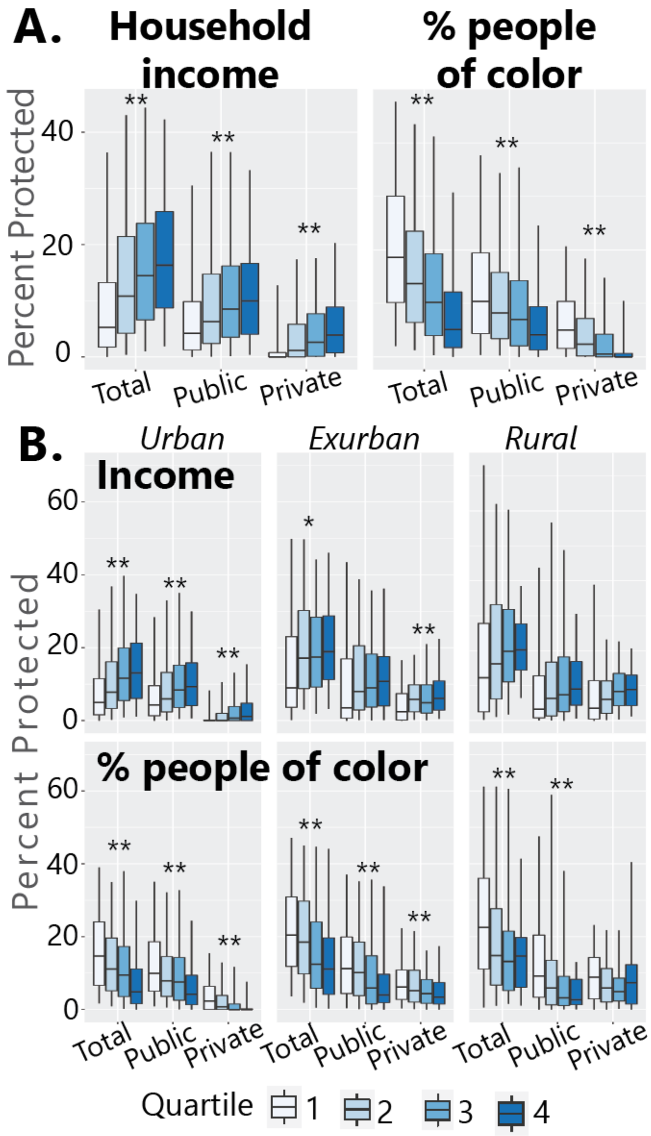


Figure S9: Alternate version of Figure 1 using unbuffered census tracts. *Distribution of percent of land protected within census tracts by state-based quartiles of income and percent people of color. For each quartile group, boxplots show the median (line) 25th and 75th percentiles (box) and 5th and 95th percentiles (whiskers) of the percent protected. Stars indicate a statistically significant (* p<.05, ** p<.01) correlation between percent protected and the percentile rank of income or percent people of color. For each set of quartiles, access to protected open space is analyzed for all protected lands, then by public and private ownership. A) All tracts (N=3344). B) Subsets of each quartile that are: urban (N=2131), exurban (N=918) and rural tracts (N=295).*



SUPPLEMENTARY TABLES

Table S1: Data sources

Layer or variable	Source	Year	Resolution
Census tract boundaries	Manson et al. 2020a	2018	Tract
Total housing units	Manson et al. 2020b	2014-2018	Tract
Median household income	Manson et al. 2020c	2014-2018	Tract
Percent people of color, total population	Manson et al. 2020c	2014-2018	Tract
Percent language isolated	Manson et al. 2020c	2014-2018	Tract
Percent with less than a 4-year degree	Manson et al. 2020c	2014-2018	Tract
Protected open space	Harvard Forest and Highstead Foundation 2021	2021	10m
Land area, undeveloped land area	National Land Cover Database 2016	2016	30m
Undeveloped land area	Olofsson et al. 2016 + National Land Cover Database	1990	30m
Terrestrial resilience	Anderson et al. 2016	2016	30m
Forests to Faucets 2.0	U.S. Department of Agriculture Forest Service 2018	2018	30m
National Biomass and Carbon Dataset 2.0	Kellndorfer et al. 2013	2000	30m
Brownfields	U.S. Environmental Protection Agency	2020	points

Table S2: Area and number of tracts with high environmental justice value characteristics

State (code)	**All** **total area (acres)** **# of tracts**	**Lowest quartile Income** **% area** **# of tracts**	**Highest quartile % people of color** **% area** **# of tracts**	**Lowest quartile nearby PAs** **% area** **# of tracts**	**Lowest income + highest % POC + lowest nearby PAs** **% area** **# of tracts**
CT (9)	3,090,870	3.5%	3.1%	6.7%	0.76%
	823	205	206	205	70
ME (23)	19,730,036	47.3%	12.9%	14.7%	0.26%
	351	87	88	87	7
MA (25)	4,990,524	5.2%	2.5%	6.1%	0.63%
	1455	363	364	363	126
NH (33)	5,735,184	30.6%	4.7%	5.0%	0.25%
	292	73	73	73	19
RI (44)	664,631	3.6%	3.0%	5.8%	0.82%
	240	60	60	60	20
VT (50)	5,912,137	19.8%	10.4%	12.1%	0.46%
	183	45	46	45	4
All states	40,123,382	31.5%	9.1%	11.1%	0.38%
	3344	833	837	833	246

Table S3: Percent protected within census tract and 1 km buffer as a function of tract characteristics

a. Regional model

Dep var: % protected in 1 km buffer	(1)	(2)	(3)_	(4)	(5)
% people of color (2014-2018 ACS)	-0.123***		-0.097***	-0.034***	-0.018**
	(0.007)		(0.008)	(0.008)	(0.008)
Median HH income 2018 ($10,000s)		0.729***	0.476***	0.596***	0.042
		(0.059)	(0.066)	(0.066)	(0.090)
Urban (1/0)				-8.644***	-9.692***
				(1.085)	(1.072)
Exurban (1/0)				-3.943***	-4.118***
				(1.126)	(1.110)
% without college education					-14.088***
					(1.450)
N	3344	3344	3344	3344	3344
R^2	0.070	0.051	0.088	0.135	0.159

Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

b. State fixed effects

Dep var: % protected in 1 km buffer	(1)	(2)	(3)_	(4)	(5)
% people of color (2014-2018 ACS)	-0.155***		-0.143***	-0.083***	-0.071***
	(0.007)		(0.009)	(0.008)	(0.008)
Median HH income 2018 ($10,000s)		0.651***	0.152**	0.121**	-0.424***
		(0.054)	(0.064)	(0.059)	(0.084)
Urban (1/0)				-14.107***	-15.400***
				(1.034)	(1.022)
Exurban (1/0)				-6.683***	-7.118***
				(1.018)	(1.000)
% without college education					-13.291***
					(1.415)
State fixed effects	yes	yes	yes	yes	yes
N	3344	3344	3344	3344	3344
R^2	0.193	0.138	0.195	0.295	0.316

Model includes state fixed effects (a dummy variable for each state). Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

Table S4: Public and private land protected as a function of tract characteristics

a. Regional model

Dependent variable:	**Percent public land protected in 1 km buffer**			**Percent private land protected in 1 km buffer**		
	(1)	(2)	(3)	(4)	(5)	(6)
% people of color	-0.040***	0.000	0.011	-0.080***	-0.033***	-0.028***
(2014-2018 ACS)	(0.006)	(0.007)	(0.007)	(0.003)	(0.003)	(0.003)
Median HH income 2018		0.467***	0.102		0.136***	-0.049
($10,000s)		(0.054)	(0.077)		(0.027)	(0.037)
Urban (1/0)		-2.760***	-3.450***		-5.599***	-5.949***
		(0.970)	(0.970)		(0.529)	(0.523)
Exurban (1/0)		-1.615	-1.730*		-2.200***	-2.258***
		(1.007)	(1.000)		(0.545)	(0.541)
% without college education			-9.271***			-4.700***
			(1.239)			(0.648)
N	3344	3344	3344	3344	3344	3344
R^2	0.011	0.038	0.053	0.128	0.223	0.235

Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

b. State fixed effects

Dependent variable:	**Percent public land protected in 1 km buffer**			**Percent private land protected in 1 km buffer**		
	(1)	(2)	(3)	(4)	(5)	(6)
% people of color	-0.081***	-0.047***	-0.039***	-0.074***	-0.036***	-0.032***
(2014-2018 ACS)	(0.006)	(0.007)	(0.007)	(0.003)	(0.004)	(0.003)
Median HH income 2018		0.039	-0.325***		0.080***	-0.099**
($10,000s)		(0.051)	(0.074)		(0.028)	(0.041)
Urban (1/0)		-7.665***	-8.528***		-6.326***	-6.751***
		(0.961)	(0.967)		(0.558)	(0.556)
Exurban (1/0)		-4.147***	-4.437***		-2.519***	-2.662***
		(0.952)	(0.946)		(0.552)	(0.546)
% without college education			-8.879***			-4.368***
			(1.206)			(0.667)
State fixed effects	yes	yes	yes	yes	yes	Yes
N	3344	3344	3344	3344	3344	3344
R^2	0.152	0.191	0.204	0.155	0.257	0.266

Model includes state fixed effects. Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

Table S5: Percent protected by race and income within buffers of different sizes

Dep var: % protected in tract and buffer	(1)	(2)	(3)	(4)	(5)
	No buffer	1 km buffer	2 km buffer	10 km buffer	25 km buffer
% people of color (2014-2018 ACS)	-0.185***	-0.155***	-0.139***	-0.088***	-0.048***
	(0.009)	(0.007)	(0.006)	(0.004)	(0.003)
State fixed effects	Yes	yes	yes	yes	Yes
N	3344	3344	3344	3344	3344
R^2	0.138	0.193	0.220	0.347	0.464
	(1)	(2)	(3)	(4)	(5)
Median HH income 2018 ($10,000s)	0.794***	0.651***	0.559***	0.085***	-0.122***
	(0.067)	(0.054)	(0.048)	(0.029)	(0.021)
State fixed effects	Yes	yes	yes	yes	Yes
N	3344	3344	3344	3344	3344
R^2	0.087	0.138	0.166	0.297	0.445

Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10. Each model includes a dummy variable for each state (state fixed effects).

Table S6: Protection since 1990 related to present-day tract characteristics and land availability in 1990.

Dep var: % protected in 1 km buffer Since 1990	(1)	(2)	(3)	(4)	(5)
% people of color (2014-2018 ACS)	-0.071***			-0.014***	-0.006*
	(0.00)			(0.00)	(0.00)
Median HH income 2018 ($10,000s)		0.137***		-0.138***	-0.287***
		(0.02)		(0.02)	(0.03)
Percent land available in 1990			11.755***	8.573***	9.623***
			(0.36)	(0.52)	(0.55)
Urban (1/0)				-4.110***	-4.065***
				(0.54)	(0.54)
Exurban (1/0)				-2.310***	-2.363***
				(0.53)	(0.53)
% without college education					-3.777***
					(0.55)
State fixed effects	yes	Yes	yes	yes	yes
N	3344	3344	3344	3344	3344
R^2	0.151	0.070	0.326	0.353	0.359

Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10. Regressions include state-level fixed effects.

Table S7: Public and private protection since 1990 related to present-day race and income

Dependent variable:	Percent public land protected in 1 km buffer		Percent private land protected in 1 km buffer	
	(1)	(2)	(3)	(4)
% people of color (2014-2018 ACS)	-0.031***		-0.040***	
	(0.00)		(0.00)	
Median HH income 2018		0.029**		0.106***
($10,000s)		(0.01)		(0.01)
State fixed effects	yes	yes	yes	yes
N	3344	3344	3344	3344
R^2	0.072	0.027	0.170	0.122

Model includes state fixed effects. Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

Table S8: Percent protected within census tract and 1 km buffer as a function of tract characteristics by individual states

a. Values: regional model

	CT	**MA**	**RI**	**NH**	**ME**	**VT**
Dep var: % protected in 1 km buffer	(1)	(2)	(3)	(4)	(5)	(6)
% people of color (2014-2018 ACS)	-0.117***	-0.178***	-0.143***	-0.484***	-0.047	-0.236
	(0.010)	(0.011)	(0.017)	(0.058)	(0.060)	(0.212)
N	823	1455	240	292	351	183
R^2	0.127	0.147	0.147	0.098	0.001	0.008
Dep var: % protected in 1 km buffer	(1)	(2)	(3)	(4)	(5)	(6)
Median HH income 2018 ($10,000s)	0.336***	0.900***	1.556***	-0.115	0.628***	0.301
	(0.076)	(0.071)	(0.277)	(0.316)	(0.233)	(0.518)
N	823	1455	240	292	351	183
R^2	0.025	0.084	0.176	0.000	0.012	0.001

Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

b. Percentiles: state-based model

	CT	**MA**	**RI**	**NH**	**ME**	**VT**
Dep var: Percentile rank: % protected in 1 km buffer	(1)	(2)	(3)	(4)	(5)	(6)
Percentile rank: % people of color (2014-2018 ACS)	-0.416***	-0.439***	-0.516***	-0.381***	-0.016	-0.157**
	(0.032)	(0.023)	(0.051)	(0.053)	(0.054)	(0.072)
N	823	1455	240	292	351	183
R^2	0.173	0.193	0.266	0.145	0.000	0.025
Dep var: Percentile rank: % protected in 1 km buffer	(1)	(2)	(3)	(4)	(5)	(6)
Percentile rank: median HH income 2018 ($10,000s)	0.294***	0.364***	0.475***	0.166***	0.206***	0.105
	(0.033)	(0.023)	(0.052)	(0.059)	(0.051)	(0.074)
N	823	1455	240	292	351	183
R^2	0.087	0.133	0.226	0.027	0.042	0.011

Variables are the within-state percentile rank of the percent protected within each tract or a 1km buffer, the within-state percentile rank of the percent people of color and the within-state percentile rank of median household income. Ordinary least squares regression with robust standard errors; *** p < .01; ** p < .05; * p < .10

Table S9: Tract counts per boxplot shown in Figure 1, parts (A) and (B)

	All tracts (A)		**Urban tracts (B)**		**Exurban tracts (B)**		**Rural tracts (B)**	
Quartile	**Income**	**% POC**	**Income**	**% POC**	**Income**	**% POC**	**Income**	**% POC**
1	833	833	696	271	76	431	61	131
2	837	837	555	489	166	261	116	87
3	837	837	477	614	277	166	83	57
4	837	837	403	757	399	60	35	20
Total	3,344	3,344	2,131	2,131	918	918	295	295