



## 20 Abstract

21

22 The abundance and diversity of insect pollinators around the world is declining and habitat loss is a  
23 leading cause. Turfgrass lawns cover a vast area in North America and provide a great opportunity for  
24 habitat restoration to native wildflowers by the general public. Efforts to encourage the public to replace  
25 lawns with wildflowers could be improved by a better understanding of the thoughts and opinions of the  
26 public about lawns. We conducted a nationwide online survey to understand what barriers are most  
27 important in preventing people from converting a 6 x 6 ft portion of turfgrass lawn to native wildflowers.  
28 We also collected data on a variety of demographic factors to see if those influence survey responses.  
29 Over 3200 people took survey across the US. We found that ‘Maintenance time’ and ‘Not knowing what  
30 to do’ were the most important barriers to creating wildflower habitat. Age was the most important  
31 demographic factor impacting results with young people significantly more likely to select multiple  
32 barriers in the survey. For example, people aged 18-34 were 4.3 times more likely to indicate  
33 ‘Maintenance cost’ would prevent them from creating a wildflower plot than those age 65 or older. Those  
34 who had already created a wildflower plot, or those who were members in a native plant or pollinator  
35 organization were less likely to select barriers across the board, except for external barriers related to  
36 homeowners associations, neighbors, and local governments. This shows that these are persistent  
37 concerns even for those that are otherwise keen to create wildflower habitat. Our results suggest that  
38 outreach promoting pollinator-friendly native plant gardens should focus on clear and simple methods,  
39 small plots that will not take too much time and less likely to provoke neighbors or authority figures.

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41

42 **Keywords:** lawn care, pollinators, native wildflowers, urban planning, horticulture, habitat restoration,  
43 public opinion, ecological design, urban ecosystems, residential lawns, environmental perceptions,  
44 landscape preferences

45

## 46 Introduction

47 Human activities on earth have resulted in a loss of biodiversity worldwide [1, 2]. For example,  
48 there has been a steady decline in the abundance of birds in North America over the last 50 years with  
49 habitat loss thought to be the single most important cause [3]. The abundance and diversity of native  
50 insect pollinators, such as bees, flies, and butterflies are also falling [4-7]. This is particularly troubling  
51 because these pollinators provide significant ecological and economic services, and their decline would  
52 result in serious negative impacts worldwide [8-10]. The leading cause for pollinator declines is also  
53 habitat loss, notably the loss of native wildflowers [4, 9] and the overuse of pesticides and fertilizers [6,  
54 7]. Turfgrass lawns contribute to this problem as they provide little to no resources for pollinators [11]  
55 and cover a total surface area of 163,812 km<sup>2</sup> in the US, roughly the size of Georgia [12]. This is three

56 times larger than the area of irrigated corn, the largest irrigated crop in the US [13, 14]. Turfgrass is  
57 typically grown as a monoculture and has several negative environmental impacts associated with  
58 maintenance and upkeep. A ‘pretty’ lawn often requires large chemical inputs such as fertilizers,  
59 insecticides, and herbicides, and extreme water use which accounts for up to 75% of a household’s total  
60 water consumption in semiarid regions [12].

61 While turfgrass lawns have become the standard for home landscapes, they have great potential to  
62 be transformed into landscapes rich with native wildflowers that are beautiful, sustainable, and better for  
63 pollinators [15, 16]. However, the widespread adoption of this type of habitat restoration by private  
64 landowners pose several cultural challenges. As there are strong cultural norms associated with mowed  
65 turfgrass lawns in residential areas [17-19], turfgrass is well-liked by many homeowners and for some  
66 represent neatness [20], wealth, and security [21, 22]. That said, yards with mixtures of turfgrass and  
67 gardens of native plants have been found to be equally as attractive as traditional turfgrass lawns [23].  
68 Therefore, outreach efforts could be successful at convincing the average homeowner to transform a  
69 portion of their turfgrass lawn into a garden of native wildflowers, but these efforts need to be guided by  
70 an understanding of the factors that influence people’s decisions.

71 Larson et al (2016) surveyed homeowners about what they valued in their lawns and found that  
72 low maintenance and aesthetically pleasing designs were preferred [18]. Dahmus and Nelson (2014)  
73 conducted a similar survey asking homeowners how they conceived their yard to be part of the local  
74 ecosystem [24]. They found that the surveyed individuals do have a complex understanding of their yard  
75 as part of the local ecosystem, but that they usually had some prominent gaps in their understanding, most  
76 notably knowledge of biodiversity and ecosystem services. Here we build upon this body of research by  
77 conducting a nationwide survey to better understand the general public’s thoughts regarding converting  
78 portions of their turfgrass lawns to wildflowers. More specifically, we sought to answer two questions:

- 79 1. What barriers are most important in preventing people from converting patches of lawns to  
80 wildflowers?
- 81 2. How do barriers that prevent lawn to wildflower conversions vary by demographic factors and  
82 personal characteristics?

83 We chose to target this survey towards an audience that is already interested in plants and pollinators  
84 and likely concerned about pollinator declines. We focused on this audience for three reasons. First, they  
85 ended up being the people that were most likely to take the survey. Second, they represent the people that  
86 are most likely to act and create wildflower habitat. Third, we wanted the results of the survey to help  
87 guide our outreach efforts for our public science project Lawn to Wildflowers  
88 (<https://lawntowildflowers.org>) and people that are already interested in wildflowers and pollinators are

89 who we will reach out to first. This project provides resources to help the general public convert lawns to  
90 pollinator-friendly wildflower habitats, to learn to identify pollinators, and to collect data on pollinators.

91

## 92 **Methods**

### 93 **Survey details**

94 We developed an online survey using the Qualtrics<sup>XM</sup>® Software (<https://www.qualtrics.com/>)  
95 that was distributed between 28 August, 2018 and 18 April, 2019. Anyone could take the survey, though  
96 we requested that the individuals only take it if over the age of 18. The survey included a question which  
97 asked people to select all the barriers that might prevent them from converting a 6 x 6 ft patch of turfgrass  
98 in their front yard to a patch of wildflowers. We included 11 potential barriers to lawn-to-wildflowers  
99 restorations which we chose after talking with colleagues promoting native plants and pollinator-friendly  
100 landscaping, and surveying related literature [18]. These barriers can be placed in three categories:  
101 individual barriers based on personal opinions and circumstance (‘Appearance’, ‘Maintenance cost’,  
102 ‘Maintenance time’, ‘Loss of space for recreation’, and ‘Not knowing what to do’), external barriers  
103 relating to plants and animals (‘Undesirable plants’, ‘Undesirable wildlife’, and ‘Bee stings’), and  
104 external barriers relating to other people (‘Fines or infractions from local government’, ‘Opinions of  
105 neighbors’, and ‘Violation of homeowners association policies’). We also included a twelfth choice as  
106 ‘None apply.’

107 The survey also included a series of multiple-choice questions relating to the demographics of the  
108 respondent. This included basic demographic questions related to age, gender, income and education. We  
109 pulled nationwide census data from 2018 to compare the demographics of our respondents to the nation at  
110 large (S1 Table). We included some additional questions related to the topic of lawns, homeowners’  
111 associations, membership in plant and pollinators groups, and if they had already created a wildflower  
112 plot. Finally, we also asked two additional Likert Scale questions to assess their likelihood of creating a  
113 wildflower plot and to identify their concerns about pollinator declines. The full text of the survey is  
114 available in supplementary information (S1 Appendix). The Qualtrics software determined the  
115 approximate Latitude and Longitude for most of the survey responses which we used to create a map of  
116 where responses came from (S1 Fig.). We included a question that asked for Zip Code, using the middle  
117 of the Zip Code area to determine location when other coordinates were not available. Responses that  
118 were incomplete, did not have location data, or were from outside the US and southern Canada (below  
119 54° N) were removed from the dataset (N=483).

120

## 121 **Distribution of survey**

122 We promoted the survey using our Lawn to Wildflowers social media accounts, utilizing paid  
123 advertisements and boosted posts on Facebook and Instagram. A sample of the post we used for most  
124 paid advertisements is included in supporting information (S2 Fig.). One round of advertisements targeted  
125 people in the US by using the topic keywords “pollination, beekeeping, wildflower, and lawn” to reach  
126 individuals already interested in the topics of the survey. To diversify the audience taking the survey we  
127 also targeted a younger audience (below 50) and more conservative audience using the topic keywords  
128 “American football, lawn mower, and lawn”. We also conducted an email campaign where we messaged  
129 Native Plant Society chapters in every US state or region and encouraged them to share the survey with  
130 their members.

131

## 132 **Statistical analyses**

133 To determine the most important barriers that may prevent lawn to wildflower conversions, we  
134 simply compared the differences in counts in responses to each of the 12 possible choices. For  
135 visualization, we converted counts to percentages of total respondents. To test if demographic factors and  
136 personal characteristics influenced those results, we conducted Chi-Squared tests for independence. We  
137 looked at age, gender, income, education level, membership in a homeowner’s association, membership  
138 in a native plant or pollinator group, and if they had already created a wildflower plot. Because we  
139 conducted a large number of tests, which increased the possibility for Type 1 error, we chose to focus on  
140 results with  $P < 0.001$ . We excluded the following demographic categories that had too few respondents (<  
141 40) as we felt the small sample size would not be a reliable representation of the group: when looking at  
142 gender we excluded gender nonconforming, when looking at income we excluded those who made  
143 >\$500,000 per year, and when looking at education level we excluded those who did not complete high  
144 school. The full dataset used in the analyses is available in supporting information (S2 Appendix).

145

## 146 **Results**

147 Our final dataset had 3249 survey responses located across the US and some in Southern Canada.  
148 Most survey responses originated from the eastern US, most notably the coasts of Florida and New  
149 England, although responses were scattered throughout the US (S1 Fig.). Our surveyed population tended  
150 to be older, more educated, and more female than the average person according to US census data. Of our

151 respondents, 56.5% were over the age of 55 (Table 1), compared to only 28.9% of US citizens in the same  
152 age range (S1 Table). Also, 80.8% of our respondents had achieved some degree of formal college  
153 education (defined as an associate degree or higher) as opposed to 41.2% of Americans in census data (S1  
154 Table). Furthermore, 76.7% of respondents identified as women, while 50.8% of Americans overall  
155 identify as women (Table 1, S1 Table). Finally, our audience had a very strong interest in the topic, with  
156 71% of respondents identifying that they were extremely concerned about pollinator declines and 79%  
157 identifying that they would create a 6 x 6 ft wildflower plot (Table 2).

158

159 **Table 1. Basic Demographics.** Demographic summary of survey respondents.

Age	%	Gender	%
18-24	4	Female	76.7
25-34	11.4	Male	22.1
35-44	12.8	Non-conforming	1.2
45-54	15.2		
55-64	26.7		
65-74	24.7		
75 or older	5.1		
Household income in \$	%	Highest level of income	%
< 20K	7.2	No high school diploma	0.5
20K - 35K	11.7	High school diploma	4.2
35K - 50K	14.1	Some college	14.5
50K - 75K	20.1	Associate degree	8.2
75K - 100K	19.1	Bachelor's degree	34.2
100K - 500K	27	Master's degree	28.1
> 500K	0.7	Doctorate	10.3

160

161

162 **Table 2. Further Demographics.** Summary of responses to various questions related to lawns and  
163 wildflowers.

<b>Owner of a grass lawn</b>	<b>%</b>	<b>Member of wildflower or pollinator organization</b>	<b>%</b>
Yes	82.8	Yes	40.9
No	17.2	No	59.1
<b>Resident of HOA</b>	<b>%</b>	<b>Already created wildflower plot</b>	<b>%</b>
Yes	21.2	Yes	57.1
No	78.8	No	42.9
<b>Would you create a 6 x 6 ft. wildflower plot</b>	<b>%</b>	<b>Are you concerned about pollinator declines</b>	<b>%</b>
Definitely no	0.8	Not at all	1.1
Probably no	2.8	Slightly	1.0
Unsure	3.8	Moderately	6.7
Probably yes	14.1	Very	20.0
Definitely yes	78.5	Extremely	71.1

164

165

## 166 **What barriers are most important in preventing people from** 167 **converting patches of lawns to wildflowers?**

168 The most selected answer was that none of the barriers would prevent respondents from  
169 converting lawns to wildflowers (36.4% of respondents; Fig. 1). Two of the personal barriers were the  
170 highest, ‘Maintenance time’ (27.8%) and ‘Not knowing what to do’ (27.0%). Other personal factors had  
171 lower response rates: ‘Maintenance cost’ (12.6%), ‘Appearance’ (8.3%), and ‘Loss of space for  
172 recreation’ (3.8%) (Fig. 1). ‘Undesirable plants’ was the third highest response rate (15.1%) but external  
173 barriers related to animals were both low: ‘Undesirable wildlife’ (3.4%) and ‘Bee stings’ (2.6%) (Fig. 1).  
174 External barriers from other people all had intermediate response rates: ‘Fines or infractions from local  
175 government’ (13.9%), ‘Violations of homeowner association policies’ (12.8%) and ‘Opinions of  
176 neighbors’ (9.1%).

177

178 **Fig. 1. Barriers to Lawn to Wildflower Conversion.** Percent of responses to the question: “Of the  
179 following items, select those that might prevent you from converting a portion of your lawn to  
180 wildflowers (you may select multiple items)”. Items were rearranged to be in descending order based on  
181 percentage of responses.

182

183

## 184 **How do results vary across demographic factors and personal** 185 **characteristics?**

186 We found that several demographic factors had large impacts on survey responses, especially age  
187 and income (Figs. 2 and 3, Table 3). For eight out of 11 barriers age had a highly significant impact, and  
188 for *all* barriers we found that younger people were more likely to say at least one barrier would prevent  
189 lawn to wildflower conversion than older people (Fig. 2, Table 3). People aged 18-34 were 8.4 times  
190 more likely to say that ‘Loss of space for recreation’ was as a barrier than those 65 or older (Fig. 2). This  
191 same age group was 4.3 times more likely to indicate ‘Maintenance cost’ (Fig. 2, Table 3), 3.1 times for  
192 ‘Fines or infraction from local government’ (Table 3), 3.1 times for ‘Bee stings’ (Table 3), 2.5 times for  
193 ‘Violation of HOA policies’ (Table 3), 2.1 times for ‘Undesirable plants’ (Table 3), 2.0 times for ‘Not  
194 knowing what to do’ (Fig. 2, Table 3), and 1.7 times more likely to indicate ‘Maintenance time’ as  
195 potential barriers (Fig. 2, Table 3). Income also shaped responses, with people living in households  
196 making \$35K a year or less being 2.2 times more likely to list ‘Maintenance cost’, and 1.6 times most  
197 likely to list ‘Fines from local government’ as barriers than people making \$75K to \$500K per year (Fig.  
198 3, Table 3). Conversely, we found that households making \$75K to \$500K per year being 2.2 times more  
199 likely to select ‘Appearance’ as a barrier than households making less than \$35K (Fig. 3, Table 3).

200

201 **Fig 2. Effects of Age on Survey Results.** Percentage of respondents, separated by age, who said that  
202 these factors might prevent them from converting a portion of your lawn to wildflowers. The factors  
203 shown are A) ‘Maintenance cost’, B) ‘Maintenance time’, C) ‘Loss of space for recreation’, and D) ‘Not  
204 knowing what to do’.

205

206 **Fig 3. Effects of Income on Survey Results.** Percentage of respondents, separated by household income,  
207 who said that these factors might prevent them from converting a portion of your lawn to wildflowers.  
208 The factors shown are A) ‘Maintenance cost’, B) ‘Appearance’, and C) ‘Fines or infractions from local  
209 government’.



210

211 **Table 3. Impacts of Demographics on Survey Responses.** Results testing the independence among  
 212 various demographic factors and the counts of respondents who said each factor might prevent them from  
 213 converting a portion of their lawn to wildflowers. Table shows  $\chi^2$  test statistic and asterisks or bold font to  
 214 indicate P-values (\*<0.05, \*\*<0.01, and entries with P < 0.001 are bolded).

215

<b>Reason</b>	<b>Age</b>	<b>Gender</b>	<b>Income</b>	<b>Education</b>	<b>Member of a HOA</b>	<b>Member of wildflower or pollinator org.</b>	<b>Already made wildflower plot</b>
Maintenance cost	<b>166.15</b>	0.57	<b>48.05</b>	5.66	1.40	<b>41.62</b>	<b>68.63</b>
Maintenance time	<b>59.054</b>	0.02	4.59	<b>26.64</b>	9.44**	9.38**	<b>58.57</b>
Bee stings	<b>36.37</b>	0.03	2.65	13.10*	0.31	<b>25.86</b>	<b>36.15</b>
Undesirable wildlife	20.56**	0.52	3.07	12.86*	5.59*	<b>15.86</b>	<b>20.35</b>
Undesirable plants	<b>47.51</b>	0.12	12.91*	4.86	0.76	<b>17.97</b>	<b>40.46</b>
Loss of space for recreation	<b>104.61</b>	0.36	7.57	3.63	0.15	6.44*	<b>22.23</b>
Not knowing what to do	<b>79.69</b>	<b>16.11</b>	8.34	9.02	0.03	<b>81.93</b>	<b>216.56</b>
Appearance	13.82*	0.55	<b>28.75</b>	9.11	7.84**	<b>15.46</b>	<b>23.83</b>
Opinions of neighbors	21.59**	0.03	12.17*	4.49	<b>81.54</b>	0.02	1.50
Violation of HOA policies	<b>59.22</b>	0.45	1.30	8.46	<b>760.65</b>	1.11	5.58*
Infractions from local government	<b>95.12</b>	0.94	<b>22.30</b>	6.18	6.57*	5.72*	4.11*
None of these apply to me	<b>221.14</b>	7.79**	7.87	10.85	<b>53.42</b>	<b>62.38</b>	<b>162.08</b>

216

217

218 Other demographics had smaller effects on responses, such as gender, education level, and  
219 membership in an HOA. We found that women were 1.4 times more likely to say that ‘Not knowing what  
220 to do’ would prevent them from participating (Fig. 4, Table 3). This was the only barrier that gender  
221 played a significant role in the response. People with higher education levels selected ‘Maintenance time’  
222 more than those with less education (Fig. 4, Table 3). Specifically, those with a doctorate degree were 1.9  
223 times more likely to select ‘Maintenance time’ than those with high school education (Fig. 4). Finally,  
224 people in homeowners’ associations were 11.5 times more likely to select ‘Violation of HOA policies’  
225 and 2.8 more likely to select ‘Opinions of neighbors’ as potential barriers (Table 3, Fig. 4).

226

227 **Fig 4. Other Demographic Factors on Survey Results.** Percentage of respondents who said that these  
228 barriers might prevent them from converting a portion of your lawn to wildflowers. The barriers shown  
229 are A) ‘Not knowing what to do’ and how responses vary across gender, B) ‘Maintenance time’ and how  
230 responses vary across income level, and C) ‘Opinions of neighbors’ and how responses vary across  
231 membership to a homeowner’s association.

232

233 Respondents who were either a member of a native plant or pollinator organization or had already  
234 created a wildflower plot selected fewer barriers overall than other respondents (Tables 2 and 3).  
235 Membership in native plant or pollinator organization reduced number of barriers selected for six of 11  
236 potential barriers (Table 3). And having previously created a plot strongly reduced number of barriers  
237 selected for eight out of 11 potential barriers (Table 3). Specifically, membership in a native plant or  
238 pollinator organization reduced likelihood of selecting ‘Not knowing what to do’ by 1.7 times and those  
239 who had already created a wildflower plot reduced likelihood of this response by 2.7 times (Table 3). The  
240 only three barriers that were not impacted by if the respondent had already made a wildflower plot were  
241 external factors from other people: ‘Opinions of neighbors’, ‘Violation of HOA policies’, and ‘Fines or  
242 infractions from local government’ (Table 3).

243

## 244 Discussion

245 We surveyed over 3200 people about what factors might prevent them from converting grass  
246 lawns to native wildflowers. Survey respondents were from around the United States and Canada but did  
247 not represent a random sample of the general public. Instead they represented members of native plant

248 societies, other plant and pollinator organizations, or people who were interested in plants and concerned  
249 about pollinator declines (see Table 2). This audience skewed heavily female (77%), and was older, more  
250 educated, and higher income than the general population (Table 1, S1 Table). Among the 11 barriers we  
251 included that could prevent lawn to wildflower conversions, most (9 of 11) had fewer than 15% of people  
252 select them. The most common response in the survey was “None apply to me” (36.4% of people). This  
253 suggests that the population we surveyed was, overall, keen to convert lawns to wildflowers. In fact, 57%  
254 of respondents had already created wildflower plots (Table 2) and our results should be interpreted  
255 accordingly. By taking that into consideration, our survey results point to two main conclusions: 1)  
256 ‘Maintenance time’ and ‘Not knowing what to do’ are the most important barriers to lawn to wildflower  
257 conversions, and 2) age and income play large roles in shaping barriers to creating wildflower plots.

258

## 259 **Most important barriers to creating wildflower plots**

260 The two most common barriers to homeowners creating a wildflower plot were ‘Maintenance  
261 time’ and ‘Not knowing what to do’. ‘Maintenance time’ has previously been found to be a significant  
262 concern of homeowners when surveyed about lawn management decisions [18, 22, 25] as respondents  
263 value a landscape design that allows them to enjoy their yard with minimal impact on their already  
264 limited time. ‘Not knowing what to do’ may have been an important barrier for two reasons. First, lawns  
265 and landscapes featuring native plants are not common [26] and often not an accepted part of community  
266 culture [20, 27]. Therefore, knowledge about creating or maintaining such landscapes may not be  
267 commonplace. However, our results are skewed by a larger percentage of respondents involved in plant  
268 and pollinator organization, so it is likely that the general population would have chosen ‘Not knowing  
269 what to do’ more frequently. Our data supports this idea as 33% of our respondents who were not part of  
270 a native plant or pollinator organization selected ‘Not knowing what to do’ as a barrier compared to 18%  
271 for members. Second, there are many different methods for converting lawns to native plants [28] and  
272 numerous native plants to choose from that require different growing conditions. This excess of  
273 information and options could lead to confusion or analysis paralysis [29]. Outreach efforts by Xerces  
274 Society (<https://xerces.org/>) and Lawn to Wildflowers (<https://lawntowildflowers.org>) are attempting to  
275 address these two barriers by presenting simple and clear protocols for creating wildflower habitat, and  
276 resources for selecting plants and seeds that are not overwhelming.

277 Another significant barrier to plot creation related to the potential opinions and objections of the  
278 homeowner’s local governments, HOAs, and neighbors. These concerns, while not as common as those  
279 regarding ‘Maintenance time’ and ‘Not knowing what to do’, persisted even within those individuals who  
280 already created a wildflower plot. Previous studies into the cultural norms surrounding US yards have

281 found that the types of yards that neighbors had significantly affect how a homeowner designs their own  
282 yard [19]. Finding a method that allows homeowners to incorporate ecologically beneficial features such  
283 as wildflower plots in a way that does not compromise the propriety of their neighbors will be essential  
284 [23]. An important thing to note is we expect the general public's concerns about external factors (such as  
285 neighbors) to be stronger than what we found, which could be difficult obstacle for programs promoting  
286 pollinator-friendly lawns. This could be because our surveyed audience was presumably more open to  
287 these concepts, as they largely belonged to native plant societies and have some background knowledge in  
288 the importance of urban ecology. Further examination of the perception of those outside of our skewed  
289 audience will be essential when engaging the public with initiatives encouraging the creation of  
290 wildflower plots within traditional lawns [30].

291 'Undesirable plants' was the most selected nature-related barrier and this likely reflects the topic-  
292 specific knowledge and experience of our audience since weeds are a serious problem in plant restoration.  
293 Restoration experts say that non-native or invasive plants are the single biggest threat to success when  
294 restoring native prairies [31]. Therefore, it is actually quite encouraging that only 15% of people say that  
295 might prevent them from creating a wildflower plot since it is such threat to success. Still, it does suggest  
296 that promoting methods that could help suppress weeds could be an important tactic for outreach. Other  
297 nature barriers such as 'Undesirable wildlife' and 'Bee stings', as well as 'Loss of space for recreation',  
298 could also be more important to the general public, but our results suggest that these are of minimal  
299 concern to our audience and probably not something that native plant and pollinator organizations need to  
300 address.

301

302

## 303 **Impacts of age and income on barriers to lawn to wildflower**

### 304 **restorations**

305 Age was the most important demographic factor shaping our results. Across all barriers, younger  
306 people were more likely to be dissuaded than older people, the most dramatic example being with  
307 'Maintenance cost' (Fig. 3, Table 3). The reasons for these patterns are not clear but there are a few  
308 possible reasons. First, some argue that younger generations on average spend less time outside and may  
309 be less interested and concerned about nature and the environment [32]. If younger people are less  
310 interested in nature and native plants that could make them more easily dissuaded from creating a  
311 wildflower plot. Second, younger generations have lower incomes, are less likely to own homes, and may  
312 be more likely to move [33]. It makes sense that all these factors would make younger people less able to

313 actually create wildflower gardens, and perhaps these life experiences, also make them more pessimistic  
314 when imagining what would prevent them given the hypothetical situations we asked about. This  
315 highlights two major difficulties in reaching out to younger people: they likely have much less  
316 opportunities and resources to plant native wildflowers, and presumably are more easily discouraged from  
317 doing so even if they had the means. However, our results suggest that promoting lawn to wildflower  
318 methods that are clear, simple, and inexpensive could be helpful.

319 Income, education, gender, and membership in HOA's and plant and pollinators organizations  
320 also shaped responses. The results we found related to income were predictable and understandable.  
321 People with less money are more likely to be concerned with cost and fines from local governments.  
322 Interestingly, those with higher incomes were more concerned with appearances (Fig. 3). This could be  
323 because high income people live in neighborhoods where well or professionally manicured lawns are  
324 commonplace, and that may shape views on beauty expectations for yards [19]. Men were less deterred  
325 by 'Not knowing what to do' than women, but the reasons for this small effect are not known. Not  
326 surprisingly, people in HOAs were 11.5 times more likely to be deterred by HOA policies, but they were  
327 also 2.8 times more likely to be deterred by the 'Opinions of neighbors'. These results reinforce the idea  
328 that the influence of HOAs result in communities that self-enforce strong social norms regarding  
329 appearances of lawns [34].

330

## 331 **Conclusions**

332 One of the primary motivations for this study was to guide the outreach efforts of our public science  
333 project Lawn to Wildflowers and other organizations that are advocating for native plants and pollinators.  
334 Given the results of our survey we have the following recommendations for organizations promoting  
335 pollinator-friendly native plant gardens:

- 336 • Promote easy-to-maintain landscapes, and make clear that native plant landscapes could result in  
337 less maintenance time than mowed turfgrass.
- 338 • Give clear instructions on creating wildflower plots with only a few options. Instructions should  
339 be specific, easy to follow, and do not require purchasing specialized equipment.
- 340 • Provide, or link to, native plants guides or seed sources that have few enough options to not be  
341 overwhelming.
- 342 • Target older audiences.

- 343       • When targeting a younger audience, focus on promoting small wildflower plots that are cheaper  
344       to create, less time consuming to maintain, and simpler to give easy and specific instructions on  
345       creating. Alternative approaches using moveable pots or containers may also be more accessible  
346       and appealing.
- 347       • For lower income audiences focus on more cost-effective approaches like sowing seeds, and for  
348       higher income audience suggest more expensive options of larger potted plants to transplant,  
349       which may also have more attractive appearances.
- 350

351

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## 445 **Supporting information**

- 446 • S1 Appendix. Complete text of the online survey.
- 447 • S2 Appendix. The full dataset used in the final analyses.
- 448 • S1 Figure. Map showing location of 3249 people who took our online survey.
- 449 • S2 Figure. Advertisement that ran on Facebook and Instagram to promote our online survey.
- 450 • S1 Table. United States Census data from 2018 to compare to the demographic data collected  
451 in our online survey.

### Reasons that might prevent you from converting a portion of your lawn to wildflowers

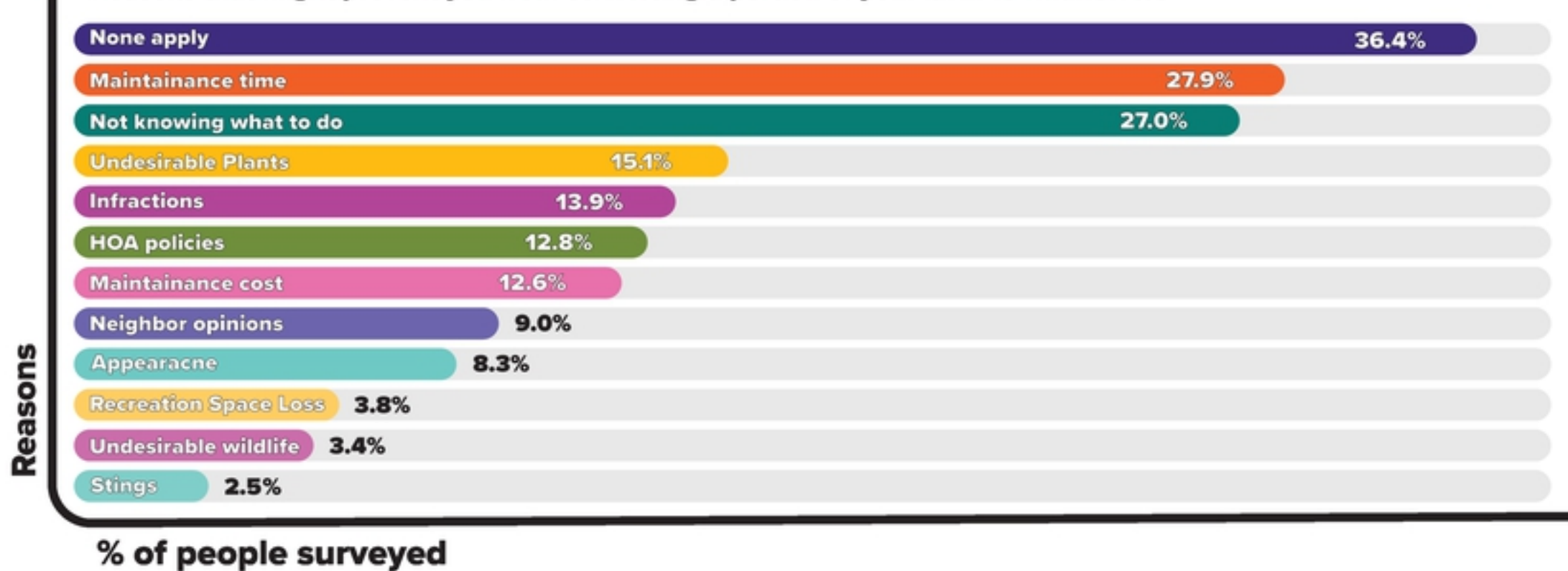


Figure 1

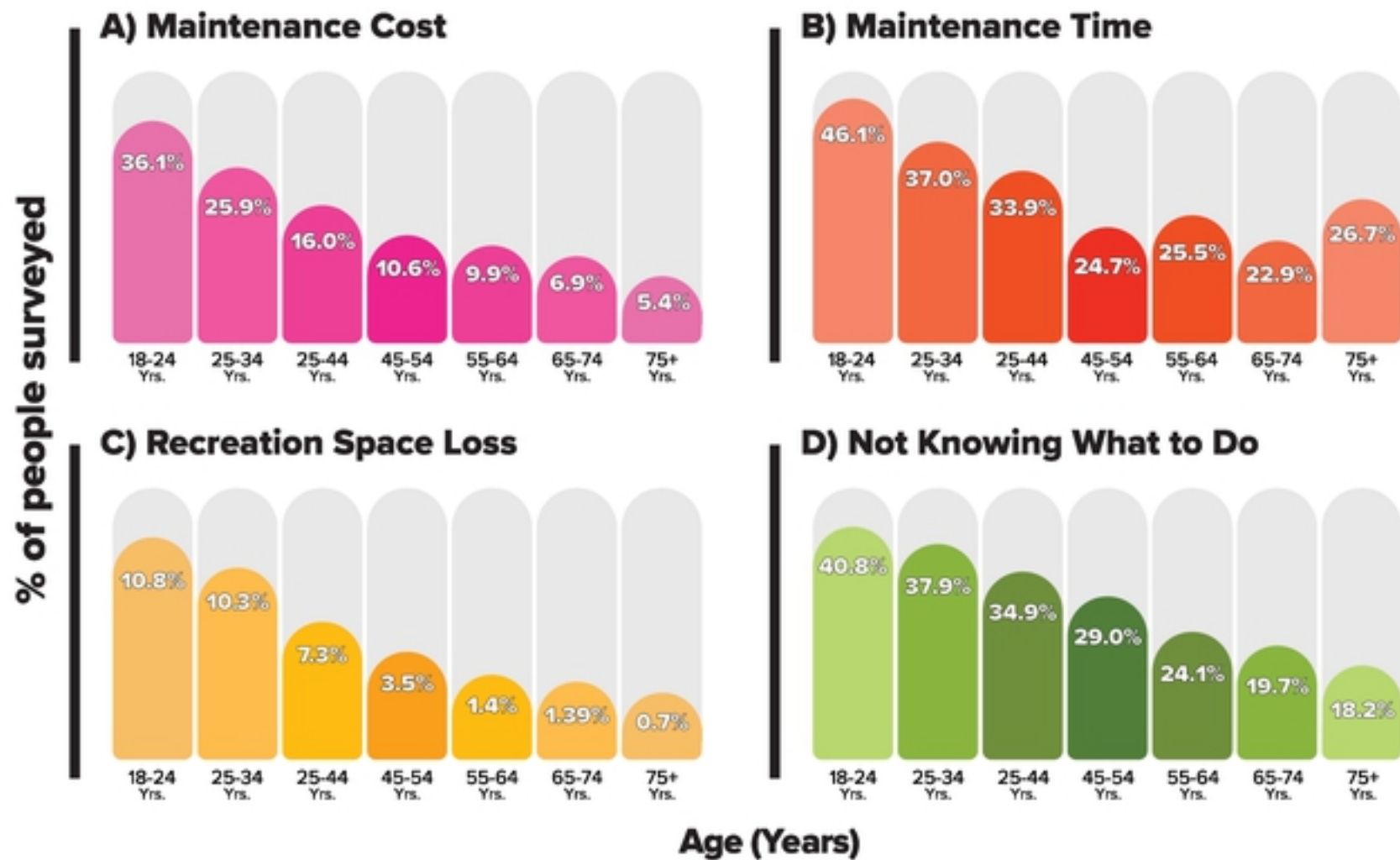


Figure 2

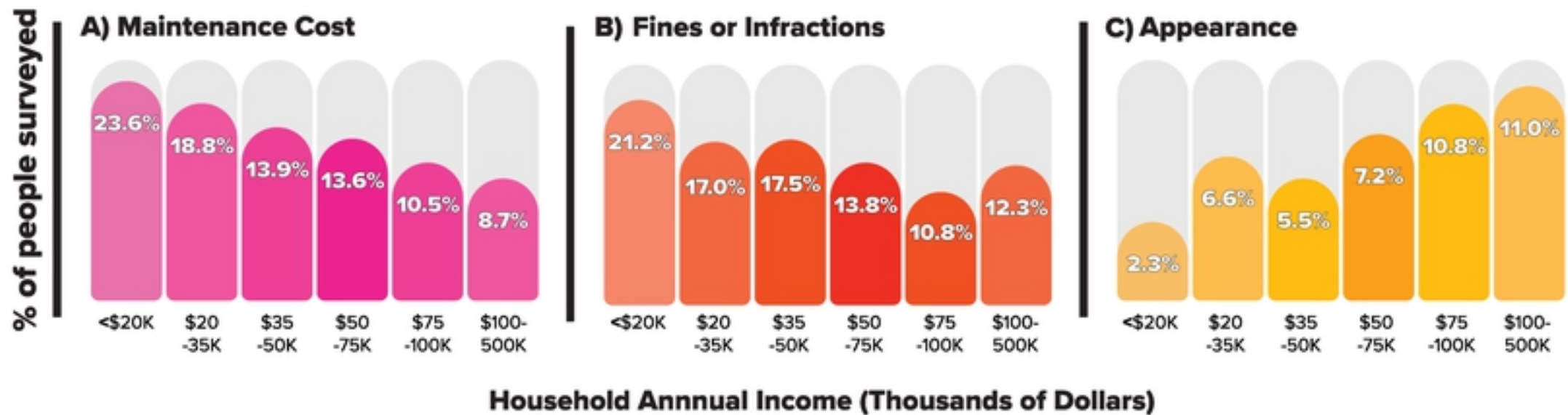


Figure 3

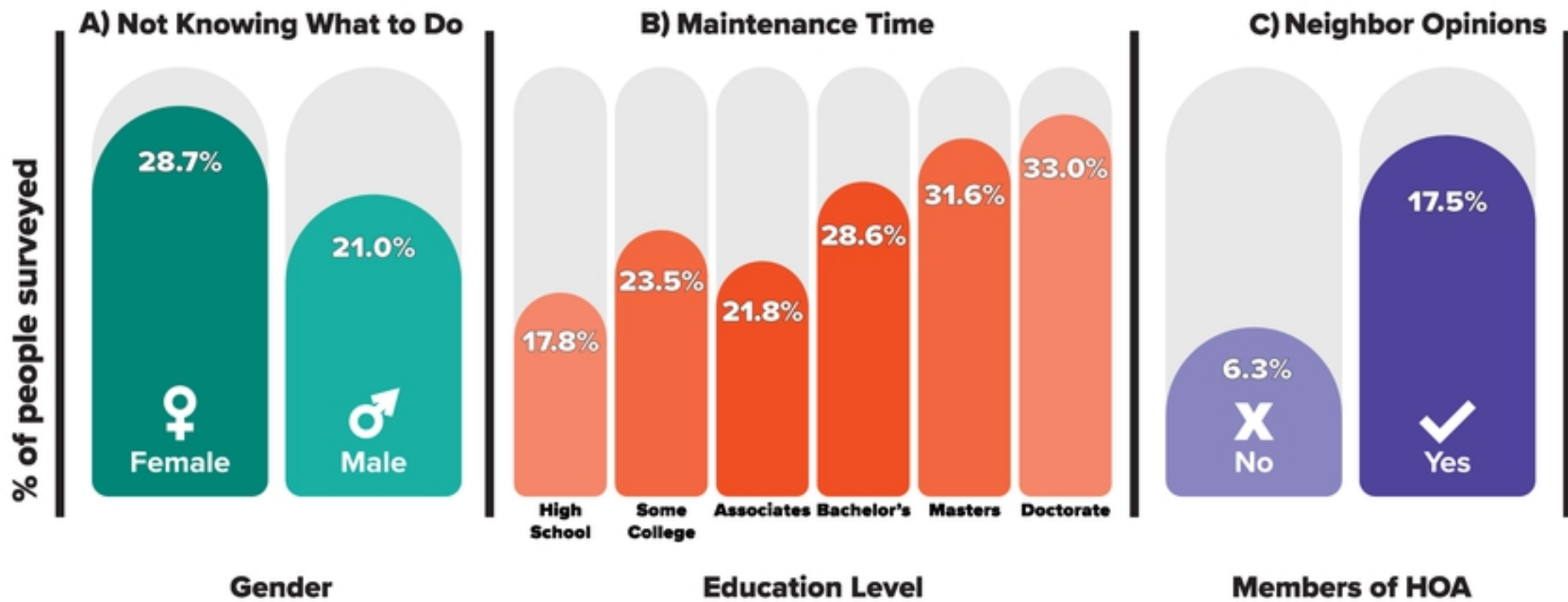


Figure 4