Climate Change & Urban Impacts on Forests (INSERT CITY)

Impacts are the direct and indirect consequences of climate change and urbanization on forests. Impacts could be beneficial or harmful to a particular forest or ecosystem type and the magnitude of those impacts depend on the sensitivity of the forest to change.

Answer **Yes or No. ?(unknown), or N/A** to the question based on any data you have or your personal knowledge/experience. If the question simply does not apply to your candidate site(s) (e.g. a question about residents' tree care and there are no residents), please write **N/A**. You can add more impacts in the blank spaces at the end of each table. Please comment on local factors that could make your area particularly susceptible to these impacts. If one of your candidate sites is significantly more susceptible to a given impact factor, please note this in the comments.

PHYSICAL IMPACTS ASSOCIATED WITH CLIMATE CHANGE

Regional Impact	Local Considerations	Yes/No/?	Comments/Other Local Considerations
Increases in precipitation could lead to increased soil moisture in the winter and spring.	Are the soils in your area well or poorly drained compared to the rest of the region?		
Decreases in summer or fall precipitation could lead to decreases in soil moisture later in the growing season.	Are the soils in your area well or poorly drained compared to the rest of the region and as a result is the site at particular risk for drought conditions?		
Heavy rain events could increase the frequency and severity of flooding events.	Is part of your area in a floodplain?		
Heavy storm events (e.g., hurricanes, derechos, and tornados) may increase in intensity and frequency.	Is your area particularly susceptible to wind compared to the rest of the region?		
Temperatures are projected to increase.	Does your area experience a strong urban heat island effect that could make it warmer than the surrounding area?		
Increased heavy precipitation events could increase runoff, leading to shifts in local soil and water pollution.	Does your area have relatively high levels of soil or water pollution (e.g. from agricultural or industrial sources)?		
Increased heavy precipitation events could increase runoff, leading to shifts in local soil and water pollution.	Does your area have a large amount of impervious cover that could reduce soil infiltration and increase runoff, reducing soil moisture in some areas and flooding in others?		

Physical Impacts Associated With Climate Change

Based on the PHYSICAL impacts detailed above, what do you think the PHYSICAL impact of climate change will be in your area? Place an "X" on the line below:

Low   **Moderate**   **High**

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BIOLOGICAL IMPACTS ASSOCIATED WITH CLIMATE CHANGE

Regional Impact	Local Considerations	Yes/No/?	Notes or Comments
Current climate projections do not provide a clear projection of how the intensity, frequency, and trajectory (tracks) of tropical and extratropical storms will change.	Are a large percentage of trees in the area susceptible to wind damage?		
While the total amount of annual snowfall will decrease, there may still be some heavy snow events through the end of the century and winter storms may become more intense.	Are a large percentage of trees in the area susceptible to winter storm damage?		
Many trees at the southern end of their natural or planted range are expected to experience a decrease in habitat suitability.	Based on the model projections, are many of the dominant trees in your area expected to have a *reduction* in habitat suitability and/or be otherwise vulnerable to climate change and associated stressors?		
Many trees at the northern end of their natural or planted range are expected to experience an increase in habitat suitability.	Based on the model projections, are many of the dominant trees in your area expected to have an *increase* in habitat suitability and/or have low vulnerability to climate change?		
Many pests and pathogens are expected to benefit from longer growing seasons, wetter spring conditions, and warmer temperatures.	Is your area currently experiencing a pest or disease outbreak of one or more pests/pathogens?		
Some pests or pathogens that prefer cool, wet conditions may decrease.	Is your area currently experiencing a pest or disease outbreak of one or more pests/pathogens that could see a reduction in favorable conditions from projected changes in climate?		
Warmer winters could be beneficial to some herbivores.	Is your area particularly vulnerable to herbivory from deer or other wildlife?		
As temperatures increase, suitable habitat for many invasive plant species could increase.	Are invasive plant species outcompeting native and/or desired planted species in your area? Is your forest susceptible to new invasive plant introductions?		
Warmer temperatures could lead to shifts in phenology (e.g., later leaf drop, earlier leaf out, plant/pollinator asynchrony) and winter freeze-thaw cycles are expected to see seasonal shifts to later in the fall and earlier in the spring.	Are any key tree species particularly sensitive to phenological shifts?		
Severe thunderstorms with straight-lined winds may become more frequent in the future.	Are a large percentage of trees in the area susceptible to wind damage?		

Biological Impacts Associated With Climate Change

Based on the BIOLOGICAL impacts detailed above, what do you think the BIOLOGICAL impact of climate change will be in your area? Place an "X" on the line below:

Low   **Moderate**   **High**

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HUMAN ACTIVITY & URBAN IMPACTS

Regional Impact	Local Considerations	Yes/No/?	Notes or Comments
Heavy human-use can result in compacted soils and decrease regeneration.	Is there evidence of excessive off-trail activity resulting in trampling and desire lines?		
Illegal dumping and vandalism may result in altered soil conditions and ecosystem function.	Is there evidence of active dumping or vandalism on site?		
Local manufacturing or proximity to transportation corridors can increase local air pollution and quality.	Is there evidence of poor air quality and contamination that might impact ecosystem function?		
Land use legacy may result in localized soil pollution and contamination impacting ecosystem function.	Is there evidence of past or active disposal/discharge of waste that may impact soil quality?		
Adjacent land use and activities may result in increased propagule pressure from non-native and invasive species (e.g. nurseries, landfills, etc.) or result in altered ecosystem function (e.g., increased nitrogen or heavy metal deposition).	Are there nearby land uses that contribute to invasive species or pose a threat to ecosystem function?		
Urban development may result in land transformation and habitat loss.	Is there any encroachment or threat of land development in or adjacent to the site?		
Management may actively try to control natural disturbance regimes (e.g. fire prevention) and result in altered ecosystem function.	Are there natural disturbance regimes, such as fire, that are actively prevented?		
Urban forests may be used for hunting or subject to poaching, as well as foraging sites for the public.	Is there active hunting or harvesting of plants on site?		
Human activity may result in invasive plant species introduction.	Is there any evidence of invasive plant species directly introduced or managed for in the site? Or is the area susceptible to future plant invasions (e.g., adjacent to a nursery, landfill, etc.)		

Human Activity and Urban Impacts

Based on the Human Activity and Urban Impacts detailed above, what do you think the overall impact of human activities and urbanization will be in your area? Place an "X" on the line below:

Low   **Moderate**   **High**

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Now that you have reviewed all climate and urban associated impact factors for your site(s), **please list or copy/paste the top 5 impact factors** that you think will have the greatest influence on your area. You can select from any of the factors listed in each of the three tables above (Climate Change - Physical, Climate Change - Biological, and Urban-Human Activity).

	Regional Factor	Local Consideration(s)	Comment on why this factor is so important for your site.
1			
2			
3			
4			
5			

Overall Impacts

Based on the OVERALL impacts detailed above, what do you think the overall impact of climate change and urbanization will be in your area? Place an "X" on the line below:

Low   **Moderate**   **High**

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Adaptive Capacity

Adaptive capacity is the ability of a system to accommodate or cope with potential climate change and urbanization impacts with minimal disruption. Answer **YES, NO, or,?(unknown)** to the following questions for your project area. You can add more factors in the blank spaces. If one of your candidate sites is significantly more or less characterized by an Adaptive Capacity Factor, please note this in the comments.

BIOLOGICAL ADAPTIVE CAPACITY

Adaptive Capacity Factor	Local Consideration	Yes/No/?	Comments
Species-rich communities have exhibited greater resilience to extreme environmental conditions and greater potential to recover from disturbance.	Is the plant species composition sufficiently diverse? (i.e., no overabundance of a particular family, genus or species)		
Greater genetic diversity may help species adjust to new conditions or sites by increasing the likelihood that some individuals within a species will be able to withstand climate-induced stressors	Is there a high level of genetic/seed source diversity within the tree species planted in your area?		
Reduced concentrations of one species or genotype in a particular area can reduce the spread of pests and/or pathogens.	Are species or genotypes arranged spatially (either naturally or artificially) across your area to reduce high concentrations of one type in a particular location?		
Older trees can be more vulnerable to breakage from windstorms or susceptible to pests and/or pathogens as they reach the end of their lifespan.	Are many trees in your area reaching the end of their lifespan?		
Structural and age diversity can increase forest resilience and recovery from disturbance (e.g., wind/storm events).	Do you have a high diversity of age classes in your tree canopy?		
Tree condition is an important determinant of tree response to climate-induced stressors, urbanization, plant invasions, and/or pest outbreaks.	Are the trees in the area generally in good health/free of damage?		

Biological Adaptive Capacity

Based on the biological adaptive capacity factors detailed above, what do you think the overall adaptive capacity is of your area? (more "yes" answers will generally mean higher adaptive capacity). Place an "X" on the line below:

Low   **Moderate**   **High**

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ORGANIZATIONAL & TECHNICAL ADAPTIVE CAPACITY

Adaptive Capacity Factor	Local Consideration	Yes/No/?	Comments
Trained forestry professionals may be more likely to recognize potential problems and identify appropriate solutions.	Is your area currently overseen by a tree board and/or department staffed with forestry professionals?		
Tree care ordinances and policies can be helpful to natural area management.	Is a tree care ordinance, planting list, or flexibility in policy in place that is sufficiently flexible to allow for adjustments in species and management activities in light of climate change or silvicultural practices?		
Tree care ordinances and policies can inhibit best practices when they do not consider natural area management or when they are not updated in light of new information.	Are there tree care ordinances or policies that limit best management practice (e.g., tree cutting ordinances, herbicide ordinances, etc.)?		
A diverse mix of species and genotypes relies on the availability of young trees for planting.	Are current nursery suppliers able to provide a wide mix of species and cultivars?		
Knowing the mix of species, age classes, and conditions of trees can help determine how many trees could be vulnerable.	Does your area have a current and comprehensive tree inventory or stand/community map?		
Long-term plans can be helpful in identifying goals and objectives, as long as they can be adjusted given new information.	Does your area have a long-term plan (such as a forest management plan, or similar) that is sufficiently flexible to allow for adjustments in species in light of climate change?		
A disaster response/recovery plan can help ensure that damaged trees are properly managed and replaced with a resilient mix of trees that are properly planted and maintained.	Does your area currently have a disaster recovery/response plan?		
Proper thinning and tree care can reduce the susceptibility of trees to disease, mortality, and drought stress.	Does thinning or other management practices occur which select for species, improve structural diversity, and/or support forest health?		
Sharing resources can help with recovery and response following extreme storms.	Is your area part of a mutual aid network?		
Conducting risk and hazard assessments can help reduce vulnerability to extreme storm events.	Does your organization conduct tree risk/hazard tree assessments?		

Organizational and Technical Adaptive Capacity

Based on the organization and technical adaptive capacity factors detailed above, what do you think the overall adaptive capacity is of your area? (more "yes" answers will generally mean higher adaptive capacity). Place an "X" on the line below:

Low   **Moderate**   **High**

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ECONOMIC & SOCIAL ADAPTIVE CAPACITY

Adaptive Capacity Factor	Local Consideration	Yes/No/?	Comments
As trees die, planting new trees presents an opportunity to increase diversity and plant more resilient species.	Is there sufficient funding to plant and care for trees?		
Proper care and maintenance can reduce the vulnerability of existing forests.	Is there sufficient support in the community among residents, organizations, etc. for the establishment and maintenance of forests?		
Publicly funded programs can increase management capacity and engage local stakeholders and residents.	Are any public incentive programs in place to encourage the establishment and maintenance of forests? (e.g. Weed Warriors or other volunteer programs)		
Residents who value forests are more likely to care for them.	Do residents in your area value forests as an important resource?		
Even if funding is limited, a large volunteer base can help reduce costs and increase awareness about urban forested natural areas.	Is there a sufficient volunteer base to aid in the establishment and maintenance of forests in the area?		
Organizations can help find and pool resources to help care for and establish forests.	Is there an active network of organizations engaged in caring for forest resources in your area?		
Incentives can increase public participation and interest.	Are any public incentive programs in place to encourage the planting and/or care of forests?		

Social and Economic Adaptive Capacity

Based on the Social and Economic capacity factors detailed above, what do you think the overall adaptive capacity is of your area? (more "yes" answers will generally mean higher adaptive capacity). Place an "X" on the line below:

Low   **Moderate**   **High**

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Now that you have reviewed all Adaptive Capacity factors for your site(s), **please list or copy/paste the top 5 adaptive capacity factors from above** that you think will have the greatest influence on your area. You can select from any of the factors listed in each of the three tables above (Biological, Organizational/Technological, and Social/Economic):

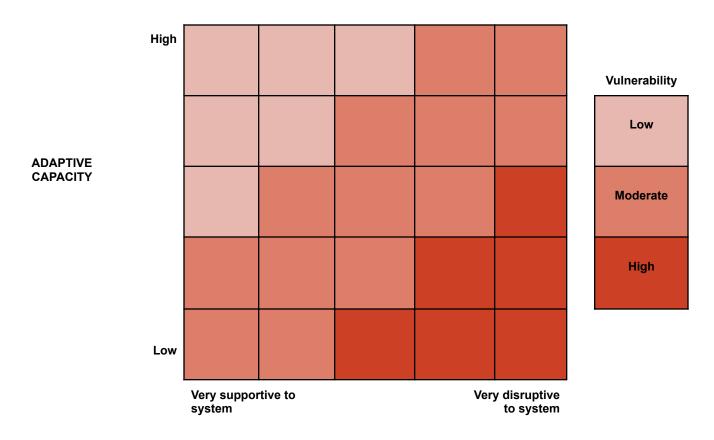|	Regional Factor	Local Consideration(s)	Comment on why this factor is so important for your site.
1			
2			
3			
4			
5			

Overall Adaptive Capacity

Based on the OVERALL adaptive capacity factors above, what do you think the overall adaptive capacity is of your area? (more "yes" answers will generally mean higher adaptive capacity). Place an "X" on the line below:

Low   **Moderate**   **High**

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Vulnerability

Vulnerability is the susceptibility of a system to the adverse effects of urbanization and/or climate change. It is a function of its potential impacts and its adaptive capacity. Based on your determination of impacts and adaptive capacity, plot your assessment of vulnerability for your study area on the figure by typing an "X" in the corresponding box:

ADAPTIVE CAPACITY (High to Low, vertical axis)

IMPACTS — Very supportive to system / Very disruptive to system (horizontal axis)

Vulnerability
- Low
- Moderate
- High