PREPARING FOR CLIMATE CHANGE
JANUARY 26-27, 2021

Note: Presentations and additional materials are uploaded to
https://forestadaptation.org/learn/Detroit

JANUARY 26
AGENDA:

- **10:00** Welcome and overview Eric Candela, American Forests Leslie Brandt, Northern Institute of Applied Climate Science, US Forest Service
- **10:15** Presentation: Changing Climate in the Detroit Region Matt Peters, Northern Institute of Applied Climate Science, US Forest Service
- **10:45** Presentation: Vulnerability and Adaptive Capacity of Trees in the Detroit Region Leslie Brandt and Annamarie Rutledge, Northern Institute of Applied Climate Science
- **11:30** Presentation: The Impact of Urban Sprawl on Forest Landscapes in Southeast MI Robert Goodspeed and Dimitrios Gounaridis, University of Michigan
- **12:00** Wrap up and Adjourn

NOTES:

Welcome and overview

- **Eric Candela, American Forests**
    - Urban forests are valuable assets in our communities
    - Contribute important ways to our social, public health, economic well being
    - Climate changing, prior to pandemic we had this debate about the condition of our roads and the need to do something to improve them
    - Correlation between climate change and implications that increasing temperatures and precipitation events and state of urban forests
    - Plan for and anticipate impacts
    - These communities don't grow and change over night
    - Detroit Reforestation Initiative - voluntary coalition of nonprofit, city, state, federal agencies as well as practitioners
    - Formed in 2016 with intention of trying to help and improve capacity and quality of urban forestry in Detroit
    - Climate vulnerability assessment is one investment they've made over the last years
- **Leslie Brandt, Northern Institute of Applied Climate Science, US Forest Service**
    - Recording sessions and will be available on link used for website when workshop is wrapped up
    - NIACS - Leslie Brandt, Matt Peters and Annamarie Rutledge involved in Detroit assessment
        - NIACS is chartered organization funded by US Forest Service, partnerships with universities, nonprofit and tribal conservation organizations

        - Delivering information about climate and carbon for natural resource managers
        - Purpose is to:
            - Provide science translation, professional training, and technical assistance
            - Pursue new scientific research and science synthesis related to carbon biogeochemistry, climate impacts, and tree species responses
            - Lead climate change communication and outreach for land managers via several regional and national outlets
    - Urban Forestry Climate Change Response Framework - first piloted in Chicago region and has expanded to other areas such as Austin, TX
    - Regional Assessment of Impacts and Tree Species Vulnerability → Local Vulnerability Assessments → Adaptation Projects and Planning
    - Objectives:
        - Understand impacts of climate change on Detroit region
        - Gain knowledge about vulnerability of Detroit's trees to current and projected climate changes
        - Develop a sense of how climate change can interact with other factors
    - Quick poll: Who's in the room? County, sector, profession
        - Majority: Wayne 33%, Nonprofit 33%, urban forester arborist 25%
        - Other counties: Oakland 28%, Other 30%, Washtenaw 8%, Livingston 3%
        - Other sectors: Municipal government 18%, variety after
        - Profession: Other 20%, sustainability/resilience professional 13%

Presentation: Changing Climate in the Detroit Region

- **Matt Peters, Northern Institute of Applied Climate Science, US Forest Service**
- Ecologist, expert in modeling forest change
- Climate Change Projections of the 7-County SEMCOG Region, Southeast Michigan Council of Governments
- Land Cover/Land Use of Region: 36.2% developed, 28.4% forested, 30.3% agricultural
- Individual counties vary in degree of land use
- Observed trends 1960-2019:
    - Annual temperatures up 0.4F/decade
    - Minimum temperatures up 0.4F/decade
    - Maximum temperature up 0.5F/decade
    - Annual precipitation up 0.9in/decade
    - Seasonally greatest change in the winter season up 0.7F/decade, spring up 0.5F/decade, summer up 0.4F/decade, fall up 0.3F/decade
    - Precipitation up most in fall and spring up 0.4in/decade, winter up 0.2in/decade summer up 0.1in/decade
- Climate Projections: Computer-based simulations using mathematical formulas to recreate the physical processes
- 61 models from 27 groups globally, only some have been downscaled

- Downscaling climate projections - spatial scale of GCMs are large (~2 degrees lat/lon), statistical techniques used to estimate values at finer scales (½-8 miles)
    - Several methods in practice
    - Each have advantages/limitations
    - Use observations to relate broader trends
- RPA 2020 Assessment
    - Mandated by Resources Planning Act (RPA)
    - Reports status and trends of the nation's renewable resources on all forests and rangelands
    - Historic climate observations
    - 5 climate models
    - 2 potential trajectories
    - 9 climate variables
    - www.fs.fed.us/research/rpa
    - Looked at annual temperature for Detroit region and observed values from RPA 2020 assessment as well as different models and trajectories scenarios on x-axis
    - Used models that reflected hot and warm scenarios and wet and dry scenarios
- Climate Models
    - HadGEM2-ES and IPSL-CM5A-MR models
- Potential Trajectories
    - RCP4.5 and RCP8.5
    - RCP=representative concentration pathway
    - 4.5=dramatic reduction in greenhouse gas emissions
    - 8.5=business as usual scenario for greenhouse gas emissions
- Scenarios
    - Warm/wet, hot/wet
    - Warm/dry, hot/dry
- Words of Caution
    - Projections are based on numerical models, trajectories estimate GHG emissions, land use change, population dynamics, technological advances, exclude policy
    - Each model contains uncertainty into the future, more uncertainty associated with precipitation and timing of conditions
    - Take into context, models use 30 year average to reduce uncertainty
- Precipitation
    - Annual and seasonal totals
    - Annual count of 1 and 2 inch events to represent extreme conditions
- Temperature
    - Annual and seasonal averages
    - Seasonal min, mean, max
    - Annual count of 0 and 90F days to represent extremes
- Graphs representing the following projections can be found in presentation, posted to https://forestadaptation.org/learn/Detroit
- Precipitation Trends - SEMCOG

        - Precipitation could vary among 30-year periods and by season
        - Annually up 2-3in by end of century
        - Spring up 0.2-2 in
        - Summer down 0.3-3in
        - Fall little change
        - Winter variable among models
- Precipitation Extreme Trends - SEMCOG
    - Precipitation could vary among 30-year periods and by season
    - Slight increase in 1in and 2in events
        - From 3.3 to 3.5 - 5.2 days
        - From 0.2 to 0.3 to 0.6 days
- Temperature Trends - SEMCOG
    - Temperature projections indicate consistent warming during century
        - Annually up 2.4 to 13F
        - Seasonally up 1.4 to 14.5F
- Temperature Extreme Trends - SEMCOG
    - Fewer days below 0F (down 2 to 4 by end of century)
    - More days about 90F (up 7.6 to 78.9 by end of century)
- Climate Projections Summaries Demo
    - Tool posted on https://forestadaptation.org/learn/Detroit
    - Spreadsheet contains graphs and Dashboard
    - Can look at entire region, or individual counties
- Extreme events - average number of days per year over a 30-year period
    - E.g., 0.6 days = 18 events within a 30-year period
- Climate change models are projection of climate values, at a much coarser resolution
    - Downscaled to a more local representation based on statistical methods and features on the landscape to get the statistical correlations
    - 30-year average
- There is a way to spatialize data for sub-county level analysis, data is available and can be provided as a map or map layers
- Each climate tool is specific in their development and what they're trying to portray

Presentation: Vulnerability and Adaptive Capacity of Trees in the Detroit Region
Leslie Brandt, Northern Institute of Applied Climate Science

- Vulnerability: The degree to which a **system** is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes (IPCC 2007)
- One great tool available: Climate Change Tree Atlas available at www.fs.fed.us/nrs/atlas
    - More appropriate for use in natural areas than highly developed areas, native trees
    - Does not project which species are going to move and when, but when habitat becomes suitable
- Decreasing: Quaking Aspen, at southern extent of its range in Detroit region
    - Under both scenarios, suitable habitat shifting northward

- Increasing: Tulip Tree/Yellow Poplar
    - At northern extent of Detroit region, increase in suitable habitat under low and high emissions scenario
- New habitat: Sugarberry
    - Could gain suitable habitat and could be planted here in Detroit region
- Also provides projections of migration potential - Sugarberry not expected to migrate this far north on its own. Likely to get here if people choose to plant it.
- Impacts: Non-native, less common species, shrubs, and cultivars
    - This is where hardiness and heat zones come in
    - Hardiness - based on coldest average temp over a 30 year period
    - Species tolerance compared to current and projected zones in the Detroit region
    - Heat zones based on number of days over 86F
    - Species tolerance compared to current and projected zones in the Detroit region
- Heat/hardiness data can be downloaded and viewed at: https://usfs.maps.arcgis.com/home/webmap/viewer.html?webmap=611d3e5ac1774a21a6ff55aceb8f588c
    - Current hardiness zone - about zone 6, projected to shift to zone 7 (under low emissions) and zone 8 (high emissions scenario)
    - Current heat zone - zone 4-5, projected to shift to zone 7-9 by end of the century
    - This can impact which species are available for planting
- Adaptive Capacity Factors
    - Disturbance Factors: Pest, disease, fire, drought, flood, pollution, heat, herbivory, invasive species, salt resistance
    - Biological Factors: Shade tolerance, edaphic specificity, propagation, pruning needed, establishment, rooting conditions
    - Low adaptive capacity tends to mean species is less tolerance of extremes, e.g., black cherry, intolerant of drought and flooding, limited planting sites
    - High adaptive capacity e.g., smoketree is drought and urban tolerant
- Combine information about potential impacts of climate change with adaptive capacity to assess vulnerability of individual trees
- Tree species assessed in Detroit
    - 187 species, 148 present in Detroit based on TreeKeeper data, 40 additional species of interest
    - Canopy, common sub-canopy trees native to Detroit region
    - Non-native species and many cultivars of trees that are currently present
    - Invasive tree species - tend to have high adaptive capacity
- Vulnerability matrix
    - Species were categorized into one of 5 vulnerability categories based on their zone suitability in the current and future and their adaptive capacity score
    - See Matrix in presentation slide
- Number of species in each vulnerability category - planted sites
    - The number of vulnerable species varied between the low and high emissions scenario

    - Under a low emissions scenario, very few species fell under the moderate-high or high vulnerability category.
    - Under the high emissions scenario, the most common vulnerability category was moderate-high.
- Number of trees in each vulnerability category - planted sites
    - If we instead look at the number of street trees planted, many more trees are in the low-moderate range
    - This means either managers are selecting for more adaptable trees already, or they are experiencing a much lower mortality, as you'd expect.
    - There are still a lot of trees in the moderate-high vulnerability category under a high emissions scenario, so those trees may some we may want to keep an eye on in the near future.
- Vulnerability of Detroit's top 20 most common trees
    - A lot of the most commonly planted species have low vulnerability. Under a low emissions scenario, most of the species have low-moderate vulnerability.
    - Many more species have moderate-high vulnerability under the high emissions scenario.
- Northern temperate trees will become stressed
- Key Points
    - Species at southern extent of their ranges are expected to lose habitat
    - Species that are heat, drought, and flood-adapted and pest/disease resistant have high adaptive capacity
    - Most common species in Detroit are not vulnerable under a low emissions scenario, but more are vulnerable under a high emissions scenario

Annamarie Rutledge, Northern Institute of Applied Climate Science

- Vulnerability of the Urban Forest
    - This section will provide an overview of vulnerability in Detroit's urban forest, including impacts and adaptive capacity.
    - It will focus on the vulnerability at a more local level, and will examine some impacts in Detroit's city council districts to determine which will be more vulnerable to climate change and thus, point to where resources can be strategically implemented to build climate resilience.
- Community Vulnerability
    - When assessing the vulnerability of an entire urban forest or ecosystem, it's important to keep other factors in mind.
    - When assessing impacts:
        - You'll want to consider how physical factors like elevation or soil type may affect your susceptibility to drought or flooding.
        - You'll want to consider how biological factors like a high proportion of vulnerable trees or the presence of particular pests or diseases may make your impacts more pronounced.

        - You'll also want to consider human-influence factors such as the amount of impervious surface, the influence of the urban heat island, or past management in your particular site.
    - When considering adaptive capacity of your urban forest, you'll want to consider:
        - Biological factors such as the amount of biological or genetic diversity of urban forest
        - The amount of funding available to support urban forestry efforts
        - Organizational and technical factors such as the number of trained staff to do the work, or how flexible policies are.
        - Finally, you'll want to consider social factors such as support from the community to assist with tree care and planting.
- Region-wide Impacts
    - A changing climate has the potential to affect physical and biological stressors to Detroit's urban forest.
    - Significant impacts for the SEMCOG region include invasive plant species, pests and pathogens, urban heat islands, and flooding and runoff.
- Japanese Chaff Flower
    - Invasive plant species can out-compete native trees in urban natural areas.
    - As non-native, invasive plants shift their range in the face of a changing climate, hotspots are projected to develop, allowing for species to establish and spread.
    - Researchers have mapped the future distribution of invasive plants in the Early Detection and Distribution Mapping System.
    - As an example, the map shows the distribution of Japanese Chaff Flower and its habitat suitability by the end of the century.
    - This species is currently on the watch list in Michigan, and it's projected to expand across the SEMCOG region by the end of the century.
    - (Japanese Chaff Flower readily invades bottomland forests, wooded riverbanks, roadsides, ditches and field edges, can form dense monocultures shading and outcompeting native plant species).
- European Buckthorn
    - Here is another example with European Buckthorn, which is an invasive currently established in Michigan.
    - By the end of the century, this species is projected to retract in all counties with the exception of St. Clair County where it is projected to be unsuitable.
    - Many common invasives in the Midwest such as garlic mustard, multiflora rose, common burdock, tree-of-heaven, Japanese knotweed, purple loosestrife, spotted knapweed, and wild parsnip are projected to remain stable across the region by the end of the century.
- Oak Wilt
    - Oak wilt, a high-mortality oak disease caused by a fungal pathogen, is a prominent concern to Detroit's land managers.
    - The disease benefits from cool, moist conditions for transmission, and from hot, dry conditions for progression.

    - Paired with higher precipitation in the spring and increased temperatures and drought in the summer, oak wilt could thrive in the Detroit region.
    - It's currently found throughout Michigan, including the southwest region.
    - Climate suitability for oak wilt remains relatively high for each of the time periods including the historical period from 1981-2010 as well as projections into 2040 and 2041-2070 under a moderate greenhouse gas emissions scenario seen here.
    - Oak wilt suitability is projected to move northward, eventually covering much of the oak range in eastern Canada, but continues to remain a threat to the SEMCOG region.
- Urban Heat Islands
    - Extreme heat is one of the most prominent climate issues in Detroit.
    - An urban heat island is an urban area that is significantly warmer than its surrounding rural areas due to human activities.
    - Impervious surfaces (e.g., concrete and asphalt) absorb heat and radiate it into the air, which increases surface temperatures.
    - Meanwhile, tree canopy and additional vegetation apply a cooling effect on the surrounding area.
    - The interaction of these land covers result in areas of the city that are warmer in summer months, and are thus more vulnerable to extreme heat events.
    - This map shows the greatest areas of vulnerability in dark red.
- Urban Heat Islands
    - Map shows the heat vulnerability along with the distance to cooling stations and a 15-minute walking radius around them.
    - 29% of Detroit's population lives within a 15 minute walk of designated cooling centers.
    - Extreme heat poses a variety of health threats, including heat-related illnesses and mortality as well as worsening air quality due to increased smog, which can aggravate conditions like asthma.
    - There are several notable deserts in areas west of downtown in City Council District 7, and on the east side of downtown in District 5, crossing through into District 4.
    - Access is not equal for all, and is a concern especially for areas that have high heat vulnerability and for individuals who are at higher risk from exposure to extreme heat.
- CAPA Strategies Study
    - In August, 2020, local organizers and volunteers in Detroit collected over 130,000 temperature and humidity data points in the morning, afternoon, and evening to create a heat watch report for the area
    - This provided images of the distribution of temperature and humidity, describing how heat varies among urban neighborhoods due to local landscape features.
    - Notable observations for the Detroit area include the presence of asphalt roadways and canopy cover.

    - Wide, asphalt roadways absorb heat and remain hot during the day and hotspots are created by residential stretches of low canopy cover.
    - Cooler areas of the city are seen in shaded, residential neighborhoods that are kept cooler during heat waves by the high canopy cover.
    - These are some features to look for and consider when planning climate adaptation strategies for the future.
- Runoff Exposure
    - Much of the soil is poorly drained throughout Detroit and in the spring and fall when the ground is already wet and less likely to hold more water, the city is projected to be met with more rainfall - up to 25 percent by the end of the century
    - One of the major concerns with additional rainfall is that Detroit's aging stormwater systems could be overwhelmed by increased precipitation, resulting in flooded streets and basements and lead to sewage overflows in the Detroit River and Lake Erie.
    - Detroit's Climate Change Vulnerability Report from the University of Michigan conducted a flood assessment that examined the vulnerability of infrastructure systems and household-level vulnerability, which is the map seen here.
    - The analysis of infrastructure focused on exposure factors and the primary factor was the runoff burden that is created during intense storm events, which is determined by land cover, soil type, and slope.
    - The exposure factor at the household-level is determined from floodplain designations (100 and 500 year) and household sensitivity is determined by the age of housing stock as well as the median household income.
    - System flood vulnerability, which is similar to the heat assessment, is concentrated around the downtown core, extending northward.
    - Household flood vulnerability is high in southeast Detroit, along the Rouge River in the northwest, and along the Detroit River.
- Ecological Adaptive Capacity Factors
    - Examples of adaptive capacity factors in ecosystems can include things like species diversity, connectivity, age class diversity, and genetic diversity.
    - These ensure that there are a number of different species and at different ages within a given community, that there is variation in the genetic composition, and that there is interconnected land that allows for the movement of energy, matter, and species across the landscape.
    - Having these different types of adaptive capacity protects the ecosystem and allows the system to be more resilient to change.
- Urban Tree Canopy
    - Detroit Tree Canopy Assessment by American Forests, which illustrates the amount of tree canopy in each of Detroit's 7 City Council Districts.
    - Districts with lower canopy cover may experience warmer temperatures and an increase in stormwater runoff as trees play an important role in mitigating the urban heat island effect and also help to intercept rainfall.

    - Canopy coverage varies by district; the highest canopy cover is found in District 1 at 37.5%, followed by Districts 2, 4, and 7 at nearly 27%, while the lower end of coverage is found in District 3 (22.5%), District 5 (19.6%), and District 6 (15.6%).
- Number of Vulnerable Trees
    - Graph shows the number of trees by district and vulnerability level under a low emissions scenario at the top, and high emissions scenario on the bottom.
    - The vulnerability for each species in Detroit was determined as part of the tree species vulnerability analysis, which looked at habitat suitability by the end of the century as well as adaptability scores.
    - Looking at the number of trees by district and vulnerability, one of the major observations is that under a low emissions scenario, the majority of trees fall under a low-moderate vulnerability level, while many trees shift to a higher vulnerability level under a high emissions scenario.
    - You can also see that there are several districts that stand out among the others. For example, although District 5 has one of the lower tree canopy cover percentages, it also has the highest number of trees in the low-moderate and moderate vulnerability categories under a low and high emissions scenario.
- Diversity by Genus
    - Break-up of tree diversity by genus in the Detroit region.
    - Maple is the most common genus in the region, making up over 43% of all tree species.
    - Next is honey locust at 15%, followed by sycamore at 8%, elm and basswood at about 5%, oak and ash at about 4%, and pear, mulberry, and hackberry all under 2%.
    - Some maple species such as Norway, silver, and sugar maple are more vulnerable to increasing temperatures.
    - In addition, if a pest that prefers maples, such as the Asian longhorned beetle, that could make the area especially vulnerable.
    - (The Asian longhorned beetle has also posed notable risk to city trees. While not currently detected in Detroit, the city currently has over 65,800 maple trees, ALB's favorite host. Populations are currently found in Ohio, Massachusetts, and New York and typically transported into new regions by logs and firewood.)
- Adaptive Capacity of Urban Forests
    - In urban environments, adaptive capacity is complex and is based on several major themes – organizational, economic, and social.
        - The organizational theme includes things like plans and policies as well as trained and sufficient staff.
        - Examples of the economic theme includes things like budgets and the ability to receive grants.
        - The social theme includes things like community support and having a volunteer base.
- Key Points
    - A variety of factors that are important to consider when it comes to the overall vulnerability of the urban forest including physical, biological, and

human-influence factors in addition to local factors such as heat islands, impervious surfaces, pathogens, and invasive species.
- Adaptive capacity is affected by tree cover and diversity, but it's also affected by social, organizational, and economic factors.
- A major takeaway is to see the entire forest and the interacting factors, and not just the trees!
- If you're interested in learning more, I would encourage you to read through the draft vulnerability assessment I emailed out, and it can also be found on the forest adaptation website under the Detroit training.
- You will also have an opportunity to provide feedback on that assessment as part of the post-workshop evaluation.

Presentation: The Impact of Urban Sprawl on Forest Landscapes in Southeast MI, 1985-2015

- **Dimitrios Gounaridis, University of Michigan**
  - Published in Landscape Ecology
  - Expanding green infrastructure as a response to environmental injustice and climate change
  - USDA, Michigan School for Environment and Sustainability, Taubman College, GLISA
  - Phases:
    - 1. Detect and quantify aspects of built-up expansion in Southeast Michigan
    - 2. Assess impacts on natural and rural areas
    - 3. Identify priority areas for scaling-up green infrastructure
    - 4. Apply the method to specific counties and cities (multi-scales)
  - Objectives:
    - 1: map buildings expansion by building type and not just buildings
    - 2: classify expansion by density (characterize sprawl)
    - 3: assess urban-rural-natural interactions and impacts of sprawl
    - Key points:
      - 300k new buildings over 30 years
      - Sharp increase of built-up in Wayne, Oakland, Macomb - urban periphery of Detroit
  - Objective 1: Specific building type, almost 75% single family housing
    - Key point: single family housing responsible for most built up expansion in Southeast MI
  - Objective 2: Density
    - Key Points:
      - 25% of single family houses are very low density (1 house/acre)
      - Almost 70% of single-family houses are low density (less than 5 house/acre)
  - Objective 3: Impact on forests

        - Forests (patches and urban canopy) remained relatively stable - no extensive deforestation
        - Forests became more fragmented and less connected in areas with urban sprawl
- **Robert Goodspeed, University of Michigan**
    - A new spatial model for prioritizing green infrastructure investment in Southeast Michigan
    - Multi-criteria analysis case studies
        - Southeast Michigan (regional)
        - Detroit Reforestation Initiative
        - Washtenaw County
    - Case Study: Southeast Michigan (Regional)
        - Green infrastructure vision for southeast michigan (SEMCOG, 2014)
            - Increase urban tree cover
            - Potential green streets
            - Potential conservation and recreation
        - Our project's problem: broad support for investing in green infrastructure in the region, but existing plans do not provide spatially detailed prioritization that incorporates their many different economic and social benefits
        - Approach: conduct a regional multi-criteria analysis combining multiple layers illustrating different benefits. Focus is on forms of green infrastructure with trees
        - Partner: SEMCOG
        - Study area: 7 counties, 4.7 million population, area of 4,598 sq miles
        - Goal: conduct more specific analysis, prioritize where to plant more trees in each SEMCOG GI vision category
        - Region-wide GI priority map, 6 MCA Factors
            - Stormwater management
            - Social vulnerability
            - Access to green space
            - Urban heat island
            - Air quality
            - Habitat connectivity
    - Case Study: Detroit Reforestation Initiative
        - Partner: DRI
        - Study area: Detroit, population 674,841 and area 142.9 sq miles
        - Goal: Align DRI's tree planting strategy with MCA analysis to identify future tree prioritization, including info for how many trees should be planted in proposed area and the cost
        - UM-DRI Suitability Criteria:
            - Air quality
                - Estimated PM2.5
                - Estimated ground-level ozone

            - Traffic volume
        - Social Equity
            - Low tree canopy
            - Heat vulnerability index
            - Heat island locations
            - Distance to parks
        - Stormwater Management
            - Runoff from land use
        - Public Health
            - Asthma rate
    - Two new factors:
        - Traffic volume: average annual daily traffic, method of kernel density with 400 meter buffer
        - Asthma rate: current asthma prevalence among adults 18 and older
- Case Study: Washtenaw County
    - Partner: Washtenaw County Parks and Recreation Commission
    - Study Area: Washtenaw County, 344,791 population, area of 722 sq miles
    - Natural Areas Preservation Program (NAPP) purchases lands with special ecological, recreational, and educational benefits to ensure preservation and promote public uses and participation
    - Goal: Integrate MCA analysis for reviewing lands nominated by landowners and deciding future forestation prioritization
    - Three types of lands
        - Conservation lands (21)
        - Preserved recreation lands (33)
        - Inactive nominated lands (107)
    - Customized weighting system
        - Stormwater management (25)
        - Urban heat island (10)
        - Social vulnerability (10)
        - Habitat connectivity (25)
        - Access to green space (10)
        - Air quality (20)

Wrap up and Adjourn

- Visit forestadaptation.org/learn/Detroit for future trainings, workshops, and courses

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JANUARY 27
AGENDA:

- **10:00** Adapting Urban Forests to Climate Change: Approaches for Action Leslie Brandt, Northern Institute of Applied Climate Science, US Forest Service

- **10:30** Urban Adaptation Examples Panel-Moderator: Katie Grantham, SEMCOG Eliza Howell Park Project-Fai Foen, Greening of Detroit Detroit River International Wildlife Refuge-John Hartig, University of Windsor and International Association for Great Lakes Research Climate Adaptive Management Strategies for Urban Natural Areas-Tyler Mitchell and Kegan Schildberg, Huron-Clinton Metroparks
- **11:30** Breakout discussion groups
- **12:00** Adjourn

NOTES:

Adapting Urban Forests to Climate Change: Approaches for Action

- Leslie Brandt, Northern Institute of Applied Climate Science, US Forest Service
- Objectives:
    - Understand the concepts of resistance, resilience and transition
    - Become aware of tools for climate change adaptation planning
    - Learn what others are doing to adapt to changes in the region
    - Share your ideas with others
- Poll: What climate change impacts will have the greatest effect on the place you work?
    - Warmer temperatures - 19%
    - More variable precipitation - 11%
    - Fewer extremely cold days - 0%
    - More extremely hot days - 8%
    - Heavy rain events and flooding - 33% majority
    - Changing winter weather conditions - 3%
    - Shifts in hardiness and heat - 8%
    - New or more problematic pests/diseases - 14%
    - New or changing invasives
    - Other - 3%
- Adaptation is the adjustment of human or natural systems in response to climate change
- Adaptation activities can build on sustainable management, conservation, and restoration
- Adaptation options:
    - Resistance (persistence)
    - Resilience (autonomous change)
    - Transition (directed change)
- Climate and Health Action Guide: https://www.vibrantcitieslab.com/guides/climate-health-action-guide/
- Who is the action guide for?
    - Urban/community foresters, public health professionals, climate/sustainability professionals, planners, landscape architects
- Action guide has 5 main steps
    - Define project goals and objectives
    - Assess climate change impacts and vulnerabilities
    - Evaluate goals and objectives
    - Identify and implement adaptation actions

    - Monitor and evaluate effectiveness
- Urban forestry climate and health menu
    - Contains 9 broad strategies and 34 approaches
    - 1. Engage social systems to integrate climate change, urban forest, and human health actions
    - 2. Reduce the impact of human health threats and stressors using urban trees and forests.
    - 3. Maintain or increase extent of urban forests and vegetative cover.
    - 4. Sustain or restore fundamental ecological functions of urban ecosystems.
    - 5. Reduce the impact of physical and biological stressors on urban forests.
    - 6. Enhance taxonomic, functional, and structural diversity.
    - 7. Alter urban ecosystems toward new and expected conditions.
    - 8. Promote mental and social health in the face of climate change.
    - 9. Promote human health co-benefits in nature-based climate adaptation activities
    - Infinite tactics, can be designed by you
- Workbook + Menu
    - Menu is integrated in step 4 of the workbook
- Online workbook: adaptationworkbook.org
- Demonstration pages can be found at https://forestadaptation.org/adapt/demonstration-projects
- Example: Speak for the Trees Boston
    - Goals:
        - Increase the tree canopy coverage, especially in under-canopied and under-resourced neighborhoods.
        - Goals for residential and multi-family residential properties:
            - Give away 1000 trees to residents
            - Educate Boston residents on the proper tree planting and care practices
            - Implement follow-up engagement with residents who received trees
    - Impacts:
        - Warmer temperatures and altered precipitation.
        - Insects and disease
        - The urban heat island effect exacerbating conditions
        - Impervious cover à heavy rain events
        - Transplanted trees are inherently more vulnerable
    - Challenges:
        - The urban heat island effect disproportionately impacts lower-resourced neighborhoods.
        - Trees planted by residents in private yards may have to endure some less-than-ideal patterns of soil moisture.
        - Trees planted by residents in private yards may struggle to survive with increased occurrences of invasive disease/pests.

        - Opportunities:
            - A warming climate may allow for a broader range of species to be introduced to Boston's forest, increasing diversity.
            - Trees planted in residents' yards will likely have access to more soil moisture than street trees, especially during periods of less precipitation.
        - Adaptation Strategies and Approaches
            - Residents' yards can serve as bridges for the urban canopy
            - Species that are likely to show resilience and hardiness will be selected
            - Tree species diversity will be prioritized
        - Monitoring:
            - % trees planted after 2 weeks
            - % of trees that are given away that are eventually planted
            - Long-term communication with participants
            - % survival
- Key Points:
    - Adaptation options are on a spectrum from managing for persistence to managing for change
    - Adaptation workbook and menu provide an organizing framework to select adaptation options that will reduce vulnerability while achieving your management goals
    - Other cities are using the workbook and menu
        - One size does not fit all
        - Managers can pick and choose from the menu
        - Can be a mix of resistance, resilience, and transition strategies

Urban Adaptation Examples Panel, Moderator: Katie Grantham, Environmental Planner, SEMCOG

- **Fai Foen, Director of Green Infrastructure, Greening of Detroit**
    - **Ecological Rehabilitation in the Floodplain: Eliza Howell Park**
    - About Greening of Detroit
        - Founded in 1989
        - Community-focused environmental nonprofit, founded as volunteer-led tree planting organization in response to Dutch Elm Disease and Emerald Ash Borer
        - Core mission: improving quality of life for and with Detroit residents, by increasing Detroit’s urban forest and providing adult and youth workforce training
        - Over 133,000 trees planted in 30 years
    - Eliza Howell Park Infiltration Basin
        - Project: shallow, infiltration basin designed to capture road runoff to improve water quality in Rouge River
        - Partners: City of Detroit, OHM Engineering, & community partner Sidewalk Detroit
        - Location: South end of 250 acre park, Northwest Detroit

    - Park: 250 acres
    - Funded in 2017 by EPA/GLRI grant
    - Basin constructed in 2020, captures stormwater runoff from I-96 service drive and surface flow from park
    - Manages up to 112,000 gallons of stormwater per rain event
    - Native trees and plants specified for project
    - Community planting events key to outreach and engagement
- Climate change impacts
    - Increased and frequent rain events
        - Chose site-adapted species based on pre-settlement ecosystems
    - Increased temperatures
        - More difficult and expensive to establish young trees
        - Selected native species with better chance of surviving in natural area, than urban conditions
    - Potential for increase and variety of pests - long-term view
- Key Feature: Floodplain
    - Natural area in floodplain of Rouge River, most densely populated and urbanized area in MI
    - GSI project increases golding capacity of stormwater runoff, rehabilitating and increasing natural function to the area
    - Very important to know your sites!
- Key Feature: Tree Selection
    - Planting design references ecosystems and native tree species that existed before European settlers altered landscape, which were naturally adapted to existing site conditions
        - Flood Plain Forest
        - Swamp Hardwoods
        - Wet-Mesic
    - Consulted with staff and online resources of Michigan Natural Features Inventory
    - 2004 Flora of River Rouge Park
- Tree Species
    - Common witch hazel, witch hazel, redbud, musclewood, ironwood, hackberry, black gum, basswood, bitternut hickory, swamp white oak, american beech, sugar maple
    - 572 feet above sea level - Detroit River
    - Planted at or below 600’ elevation: hackberry, swamp white oak, black gum
    - Planted above 600’ elevation: basswood, musclewood, American beech, sugar maple
- Planting Design for Stormwater Management
    - Worked with engineer to understand site elevations in floodplain to determine planting layout

        - Contractor supported need to mark out elevations for site layout and volunteer planting event
        - 13,000+ sq feet asphalt parking lot removed
        - Used limestone aggregate to form a path
        - 50 trees, 144 shrubs, wetland and upland native seed mix planted by volunteers
        - 200 additional perennials planted this year
    - Climate Strategies
        - Engage people with all aspects of the work we do in community forestry. From collaborating with under resourced community groups to meet their tree planting needs, to identifying neighborhoods with low-canopy cover for resource prioritization, to recruiting volunteers.
        - Restore and increase tree, forest, and vegetative cover
        - Choosing native tree species, and those adapted for flooding
        - Different trees sizes for age diversity
    - Climate Actions
        - Maintain watering schedule, especially for upland species
        - Plan crew and volunteer maintenance days for invasive species
        - Provide opportunities for community education in person and online
        - Promote mental and social health in face of climate change and pandemic

- **John Hartig, University of Windsor and International Association for Great Lakes Research Climate Adaptive Management Strategies for Urban Natural Areas**
    - **Title: Enhancing Climate Adaptation and Resiliency at the Refuge Gateway in Trenton, Michigan**
    - Detroit River International Wildlife Refuge signed into law in 2001
        - First International Wildlife Refuge in North America
        - Only one of the few urban
        - Starts in Southwest Detroit, down Detroit River
    - Humbug Marsh
        - Last mile of natural shoreline on U.S. mainland of Detroit River
        - Wetland of international importance, purchased and protected - RAMSAR designation
        - Over 2,300 RAMSAR sites throughout the world, 40 in the U.S. and 1 in Michigan
        - Bald eagles, two dragonfly species, eastern fox snake, native Michigan orchid called Oval Ladies', rare sedge called hairy-fruited sedge
    - 44 acre industrial site, operated for 44 years as brake and paint plant
        - Left vacant for many years as industrial Brownfield site
        - Goal: Transform this site from industrial Brownfield into ecological buffer for Humbug Marsh
        - Planning process to clean up, rehabilitate, and enhance habitat
    - Monguagon Wetland System
    - Over 350 trees planted with volunteers working with Greening of Detroit

- In total, 16 acres of wetlands restored (had lost 97% of coastal wetland habitat)
- 25 acres of upland buffer habitat restored
- Phragmites controlled on 2.5 miles of shoreline
- Invasive species controlled on 50 acres of upland habitats
- Visitors Center now present on the site as well as 600 foot fishing pier that goes into the Detroit River
- First project in the world to clean up industrial Brownfield site effectively, Excellence on the Waterfront Award in 2018
- Recommendations and Next Steps:
    - Work with local governments and NGOs to incorporate adaptation and resiliency projects into local master plans and efforts
    - Ensure projects recruit partners
    - Start with demo projects
    - Undertake projects that support learning
    - Engage citizen scientists, volunteers, university students, and/or researchers in monitoring
    - Measure environmental and social benefits from projects and communicate successes
    - Advocate for public education and outreach, especially events that highlight project successes and benefits

- **Kegan Schildberg, Natural Resource Coordinator for Huron-Clinton Metroparks**
    - **Huron Clinton Metro Parks - Climate Adaptive Management of Forest and Other Natural Areas**
        - Over 25,000 acres
        - 13 parks in five counties in SE MI
        - Wide variety of plant communities
        - Active stewardship since 2006
        - Primary goal to protect and restore natural areas and preserve unique biota of the region
    - Anticipated impacts of climate change on the Metro Park's forests and natural areas
        - Increased temperatures, 4.5 to 5 degree avg temperature increase
        - 25 to 30 less nights below freezing per year
        - 3 to 4 inches of precipitation per year
        - One more consecutive dry day per year on average
    - Natural communities will benefit or suffer under new climatic regime
        - Communities like Mesic southern forest (beech-sugar maple dominated) and rich tamarack swamp are expected to decline under future climate conditions
        - Dry southern forest and oak savannahs likely to benefit
        - Invasive species and diseases are likely to benefit as well (kudzu, oak wilt)
    - Adaptation strategies for natural community management at Metroparks
        - Invasive species and diseases mitigation

            - Get on ASAP; less time intensive and expensive to manage
        - Investing in diverse climate resilient communities and native plant species
        - Plan for and control the succession of communities in decline into ones suited for the new climate regime
        - Reintroducing natural processes, Rx burn
        - Restoring native communities that are future climate adapted
            - Investing efforts in creating/restoring white oak-hickory (oak wilt) dominated forests and savannahs as well as prairies
            - Manage invasive species in high ecological quality communities. Non-climate resilient communities will be shepherd through transition to new community
            - Use native plants that have ranges well to the south
    - Restoring natural process
        - Michigan native plants benefit from fire
        - Fire helps suppress non native plants
        - Fire helps create habitat diversity
        - Fire will help promote communities expected to do well under future conditions
    - Maintain a diversity of connected habitats
        - Don't aim to restore or maintain just one community type
        - Manage to the varying conditions in the field
        - Diverse habitats are more resilient
        - Habitat mosaics are beneficial to wildlife
        - Variety of communities are more interesting for patrons to explore
    - Tools and Resources
        - MI Flora - UoM Herbarium
        - Michigan Natural Features Inventory
        - Huron River Watershed Council - Tree Resilience Toolkit

CISMAS In MI:
https://www.canr.msu.edu/news/cismas_work_together_to_manage_invasive_species_msg17_cronk17

Breakout Discussion Groups

- Briefly introduce yourselves, and discuss:
    - What climate change challenges are you seeing in your work?
    - What actions have you already taken to adapt to those changes?
    - What additional adaptation actions are you considering?

Final Poll

- Which of the following resources do you plan on using or sharing with others?”
    - County climate summary spreadsheet
    - Detroit vulnerability assessment
    - Tree species vulnerability list
    - Climate and Health Action Guide and the adaptation menu Leslie
    - Heat and hardiness zone storymap

- Results:
    - Majority: Species list (65%) and action guide (65%), vulnerability assessment next at 61%, the rest spread out among resources

Wrap-up and Adjourn

- Next Steps:
    - Visit forestadaptation.org/learn/Detroit for future trainings, workshops, and courses
    - Email amrutled@mtu.edu if you're interested in CEU credits
    - Fill out post-workshop evaluation for day 1 and day 2 participants (will be emailed)
    - If you're participating in the Adaptation Workshop next week, please email Step 1 to amrutled@mtu.edu
    - THANK YOU for participating! We appreciate your attendance and feedback.