IAFSM 2016 ANNUAL CONFERENCE
TINLEY PARK, ILLINOIS

Argonne NATIONAL LABORATORY

CLIMATE CHANGE RESILIENCY AND STORM WATER MANAGEMENT: A FEDERAL SITE'S PERSPECTIVE

PETER LYNCH
Environmental Engineer
Argonne National Laboratory
Facilities Management & Services,
Sustainability & Environmental
Programs

March 10, 2016

EXECUTIVE ORDER 13653
PREPARING THE UNITED STATES FOR THE IMPACTS OF CLIMATE CHANGE

- Federal sites' sustainability efforts driven by Presidential Executive Orders
- EO13653 builds on earlier sustainability EO's, requires "*new strategies* to improve the Nation's preparedness and resilience"
  - Strong partnerships across government
  - Risk-informed decision-making
  - Adaptive learning (past is prologue…)
  - Preparedness planning

New Strategies – Vulnerability Assessment

- DOE is 5th largest Federal asset holder – 133 million square feet, 2.8 million acres
- Climate trends show increase in extreme events
- National Laboratories already experiencing Climate effects

New Strategies – Vulnerability Assessment

- Start thinking Climate…
- Programmatic: How would extreme Climate *directly* affect research programs?
- Operations: How would extreme events impact infrastructure, safety, emergency management?
- What is most sensitive?

Similar to infrastructure vulnerability assessment

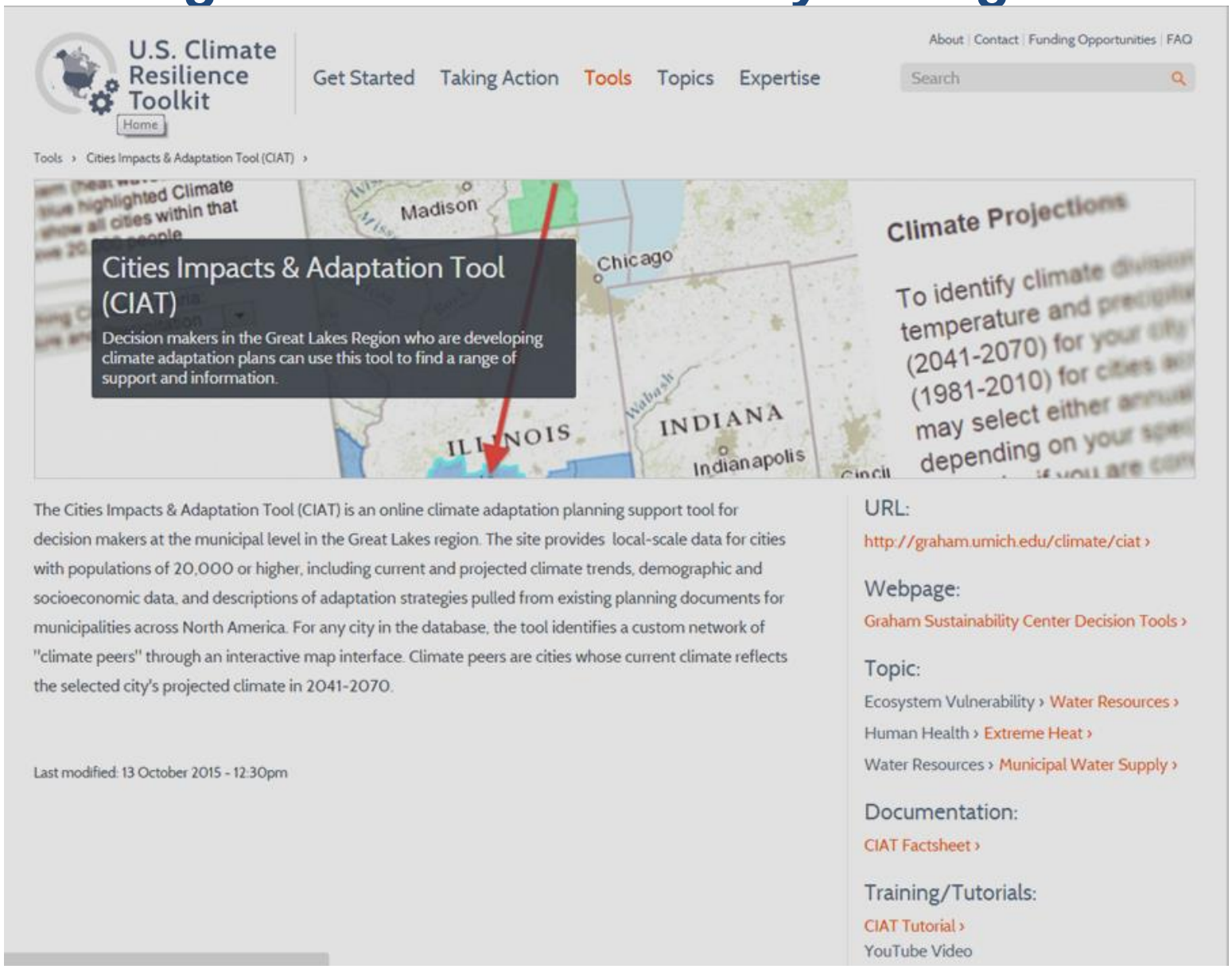
Climate Change Vulnerability Assessment – Key Elements?

- Establish context - timeframe, prioritize key facility functions, ID Lab critical functions, infrastructure
- Stakeholder interviews
- ID climate stressors
- Site-specific modeling to show how stressors actually would impact site
- ID, prioritize critical infrastructure and impacts from Climate
- Quantify Risk – ID potential solutions

Assessing Climate Vulnerability at Argonne

- Evaluation of Climate impact on Argonne's employees' ability to conduct their tasks safely and effectively
- Prioritize, categorize risks to assets: utilities, facilities, critical assets, natural resources
- Look at external risks
- Results form basis of Adaptation Plan – resiliency improvements

Assessing Climate Vulnerability at Argonne



Assessing Climate Vulnerability at Argonne

- NOAA U. S. Climate Toolkit

(https://toolkit.climate.gov)

- Vulnerability Assessment to employ Climate Change modeling and risk analyses expertise at Argonne

STORM WATER MANAGEMENT AND CLIMATE CHANGE RESILIENCE

Extreme Precipitation Events – Already Observed Risk

- All new construction LEED Gold
- Includes green infrastructure

- Some green infrastructure Clean Water Act permit-required
- Sustainability EO's drive most installations

Extreme Precipitation Events – Already Observed Risk

Installations at High-Flow Areas

Bioswale Receiving Parking Lot Runoff at New Advanced Protein Crystallization Facility

Bioswale in Large Parking Lot Manages Storm Water Prior to NPDES Outfall Discharge

Storm Water Modeling for Climate Change Resilience

- EO13653 (the “climate change” Executive Order) specifically recommends agencies conduct resilience assessments by establishing “strong partnerships” across government
- Another order, EO13690 (Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input, 2015)
  - Requires, among other things, that Federal agencies (DOE-Argonne) *conduct a hydrology study that is informed by expected changes in climate and land-use factors*

HYDROLOGIC MODEL

Hydrological Simulation Program FORTRAN

- HSPF is a continuous simulation model
- Used existing DuPage County HSPF model as a starting point (calibrated to Sawmill Creek)
- Argonne land-use refined from countywide scale
- Small scale catchments on Argonne property for future green infrastructure simulation
- Added hydrologic routing
- Routing of downspouts

HYDRAULIC MODEL

HEC-RAS

- Geometry of channel and structures from survey data and existing FEQ model from DuPage County
- CSGs for calibration

APPROACH

- More than 60 years of meteorological record from Argonne weather station
- Run HSPF simulation and produce timeseries of flows at outlet points
- Run PEAKFQ utility program (Bulletin 17B) for flood frequency analysis
- Run the HEC-RAS model with the 1% and 0.2% annual chance flood values
- Generate the flood profiles with HEC-RAS
- Map resulting inundation surface in GIS (ArcMap)

STREAM ASSESSMENT

Evaluation of erosion potential

- Qualitative stream assessment conducted in August 2015
- Stream channel and substrate conditions in project reaches

- Results used to evaluate erosion potential
- Shared with DuPage County for their watershed planning

APPLICATIONS—NOW AND LATER

- Floodplain maps for assessing current risk and reducing future risk
- Channel condition survey for erosion control
- Hydrologic model constructed at scale useful for simulating future land use and green infrastructure scenarios
- Hydrologic and hydraulic models can be rerun with future climate scenarios

QUESTIONS?