

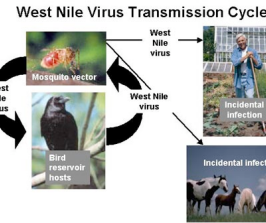
Visualization of space-time patterns of West Nile virus

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 CPSC 533c: Information Visualization
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West Nile Virus

- Introduced in North America in 1999
- Transmitted by mosquitoes
 - These mosquito species are highly ornithophilic
- Corvids (crows, jays) are primary reservoir
 - High mortality
- Amplification cycle as mosquitoes feed on infected birds
- Humans infected by mosquitoes as a side-effect
- Theorized spillover effect as birds die off and mosquitoes switch to feeding on humans
 - Would result in observable lag between bird deaths and human infections

West Nile Virus

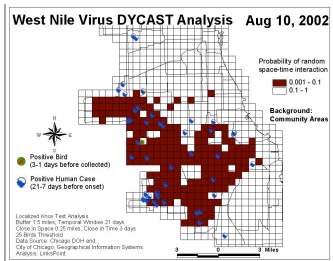


Source: The Centers for Disease Control and Prevention:
<http://www.cdc.gov/ncidod/dzbid/westnilecycle.htm>

Dynamics of WNV in the field

- Public reporting of dead birds can be used to track WNV activity
- DYCAST (Dynamic Continuous-Area Space-Time) system
 - Identifies clusters of dead birds within lattice cells
 - Result: daily raster map of WNV activity
 - WNV activity = high risk of human infection
 - Binary risk/no risk classification ("lit" / "not lit")

DYCAST Results



Analysis problems

- What is the relationship between WNV activity in birds and human cases of WNV?
- What patterns of WNV activity are predictors of human cases?
- Do different areas have different relationship between WNV activity and human cases?
 - Lag between dead birds and human onset may vary according to climate, population density, etc

DYCAST Animation



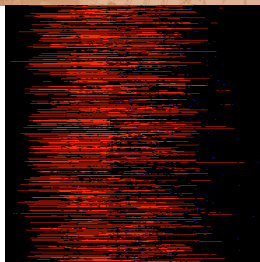
Scientific Visualization vs Information Visualization

- The visual representation is given (x, y and t)
- However, animation or 3D visualization is difficult to use
- Similarities may not be adjacent in space or time
 - Other forms of juxtaposition are necessary
- Use a derived variable, or in this case, a time-series
 - Human case "risk histories"
 - Sequence of daily risk values for the cell in which a human occurs

Risk Histories

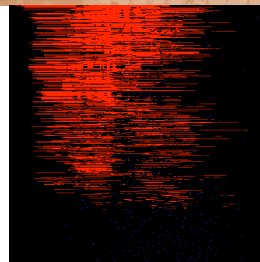
X dimension: time
 Y dimension: individual human cases

Red: risk
 Black: no risk
 Blue: date of human onset



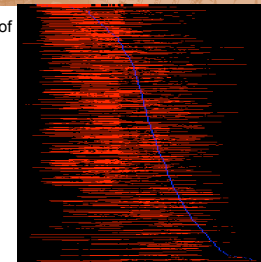
Risk Histories

Sorted according to number of lit cells



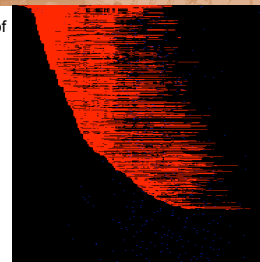
Risk Histories

Sorted according to date of human onset



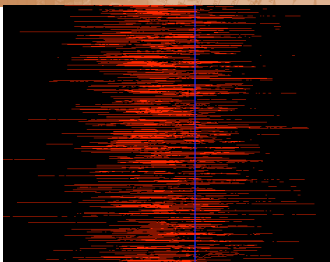
Risk Histories

Sorted according to date of first risk



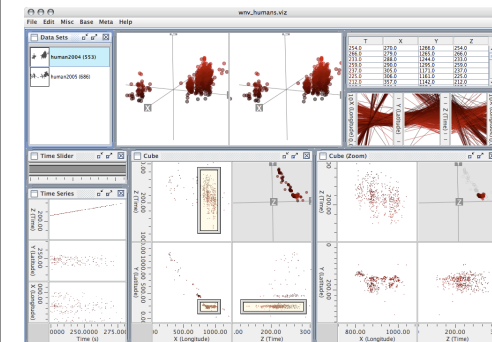
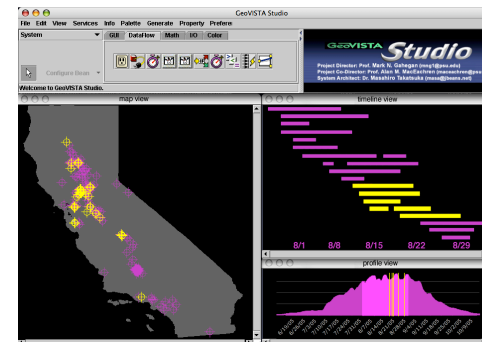
Risk Histories

Shifted to align human onsets



Extracting Meaning: What Good Is It?

- Are similar risk histories spatially correlated?
 - If so, what underlying circumstances do they have in common?
- Phase one: use linked views to explore spatial relationships
- Phase two: use automated clustering to discover similarities in risk histories



Project Progress Summary

- **Completed goals:**
 - Command-line utilities to extract risk histories
 - Implement sorting
 - **In progress:**
 - Select visualization toolkit, assemble layout
 - **To do:**
 - Develop interface between toolkit and command-line
 - Create linkages between views
 - Clustering of risk histories
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