

Insects & Institutions: Mosquito Distributions and Agency Management under Conditions of Climate Change and Uncertainty

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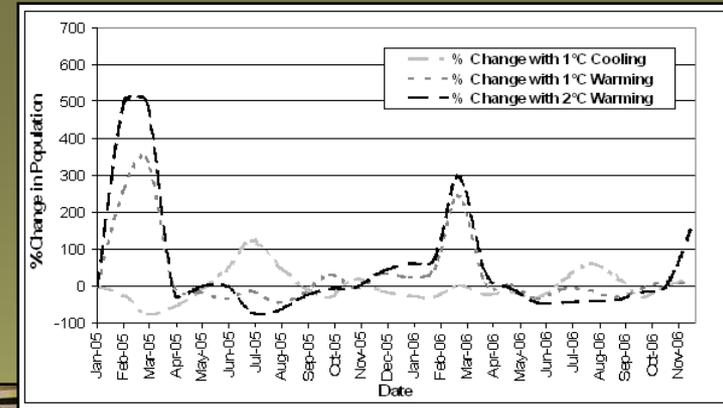
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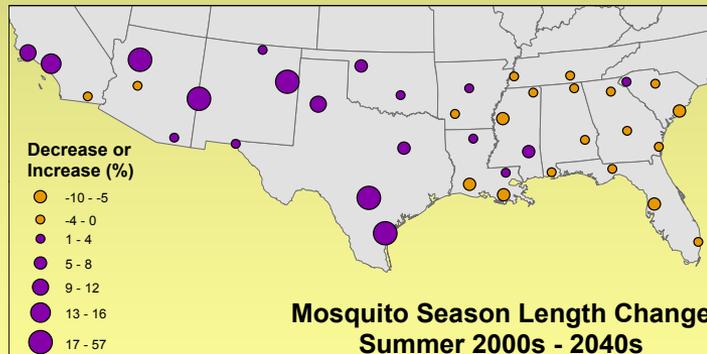
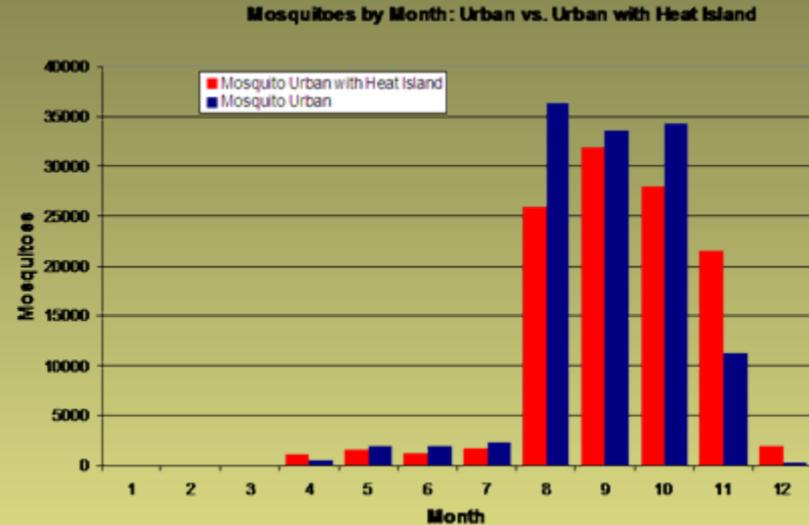
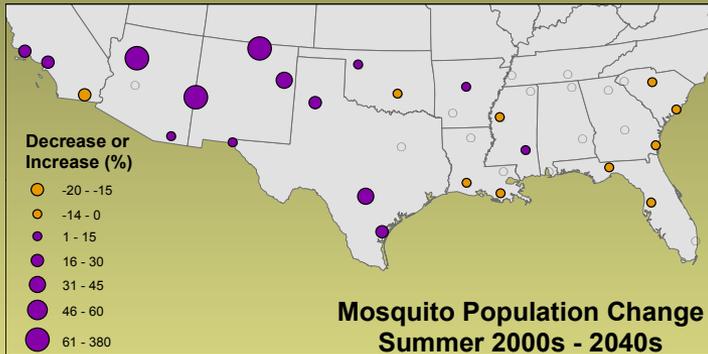
National Science Foundation
WHERE DISCOVERIES BEGIN

THE UNIVERSITY OF
ARIZONA
TUCSON ARIZONA

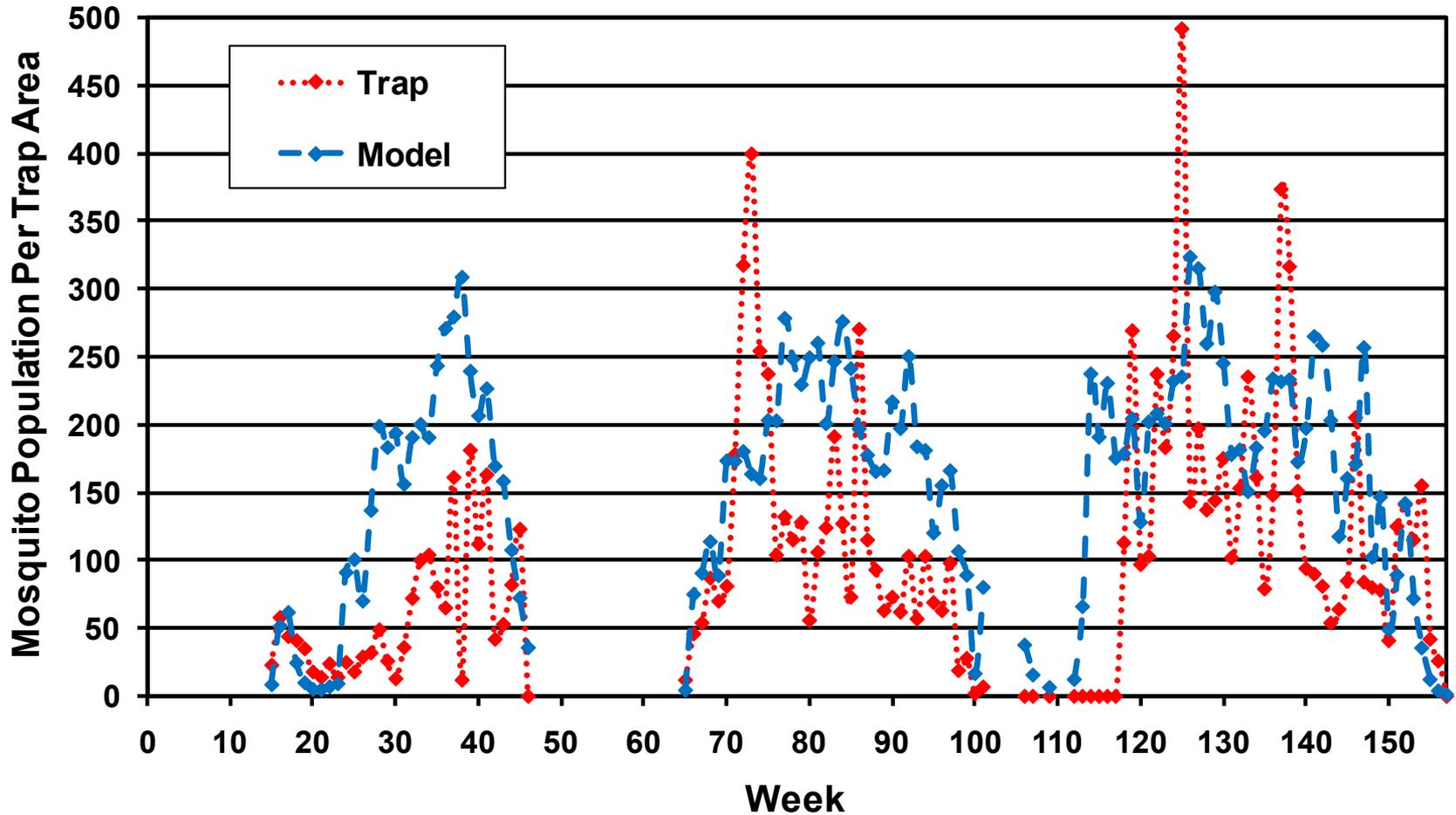
- How might mosquito populations respond to climate change?
- How do management institutions respond to mandates and mosquito population change?
- The work has involved modeling, trapping of mosquitoes, and **interviews and surveys of managers.**
- All with the goal of dealing with disease hazards (e.g. dengue, West Nile, etc.).



Climate and Model Projections: *precis*



Pasco County, Florida (1995-1997)



What Do The Results Tell Us?

1

- Precipitation *timing*, and not necessarily seasonal amount, can cause major mosquito population explosions
- Urban areas enable mosquito breeding in semi-arid locations
 - Artificial water bodies, irrigation, and water detention by impervious surfaces
- Thus, in arid West, projected drier conditions \neq less mosquitoes

2

- Warming temperatures (urban or climate change) are projected to extend the season when mosquitoes can survive
 - Especially Spring and Fall

Social Science Questions

- how do traditional bureaucracies and agencies adapt, adjust, and learn when faced with this new dynamic, uncertain, and largely anthropogenic hazard?
- how can agencies re-gear their operations, work logics, and budgets as mosquitoes proliferate and their breeding is altered under conditions of urban development and climatic change?

Method 1: Interviews

- 14 intensive & open-ended interviews
 - Pima County Health Department
 - Consumer Health and Food Safety
 - Epidemiology Department
 - Maricopa County Vector Control
 - Tucson Water
 - Arizona Department of Health Services
 - Maricopa County Health Department
 - City of Phoenix
 - University of Arizona
- On-line survey
 - 21 respondents
 - AZ, CA, NV
 - 16 agencies
- Results:
 - Areas of internal tension or disagreement
 - Knowledge, prediction, control, politics, and comparison

Knowledge & Training

- A sense of the field:
 - “Even after almost 8 years as a manager and establishing several different mosquito control programs - I would never really know what was happening until I went into the field, saw the places larvae were developing, how many sites were dry, spoke with district residents without them knowing who I was, etc.” (**1200614**)
- A sense of training:
 - “I started medical entomology all my graduate school- Masters and doctorate- so it was never on the job training.” (**2021126**)

Prediction

- Unpredictability
 - “We do not have adequate predictive tools to guess where WNV will be or when, let alone why... It is too complex a relationship between natural environment, human activity, weather, avian populations (including fledgling success and herd immunity in older birds), etc.” (**1200614**)
- Predictability
 - “Mapping of mosquito production sites and adult mosquito populations can accurately determine the risk of mosquito-borne diseases of an area and focus control measures over time” (**2021126**)

Adulticide and Larvicide

- Treating Sources
 - “Our main focus is to remove/treat breeding sources before the larvae emerge into adults. It is more cost effective.” **(1210913)**
- Treating Populations
 - “In a disease outbreak adulticiding is the first option...not the last resort....you have to kill the older female mosquitoes to interrupt disease transmission...this a a common mistake of many mosquito abatement programs...they wind up counting cases rather than preventing cases!” **(1210839)**

Comparison and Context

- Inherent *difference*
 - “I think this is a self-explanatory issue - look at the diversity in Arizona - some counties have a lot of desert, some have a lot of mountains and others have both. This doesn't include those counties along the Colorado. To compare them to each other would be ridiculous. (**6061003**)
- Inherent *pattern*
 - “You can compare and learn much that transfers from one county to the next, even if one is ag and another urban” (**1300607**)

Scalar Politics

- Available Resources
 - “Abatement districts require money. Money comes from people and politics. The formation of a Mosquito Abatement District has nothing to do with the environment - mosquitoes are everywhere!”
(1210836)
- Cynical Logic of Local Control
 - “State is notoriously bad at coordinating anything. Most of their responsibilities they push down to the county level.” (6050232)

Summary: Tensions

- Training: Book or Field?
- Prediction: Anticipation or Response?
- Abatement: Larvicide or Adulticide?
- Politics: Enabling or Disabling?
- Learning: Comparison or Case-by-Case?



Factor 1

- "If you don't address the breeding sites, it doesn't really matter how many adult mosquitoes you kill; you're not truly addressing the issue." (0.63)*
- "I think there are too many variables for accurate prediction of mosquito population areas; all we can do is keep surveillance going to try and identify the risks and address them as they happen." (0.22)*
- "What I need to know about mosquitoes I learn from books." (-1.80)*
- "We know where West Nile Virus hotzones are going to be, the kinds of neighborhoods." (-1.74)*

p < .05; Asterisk () indicates significance at p < .01*

Factor 1: Illegibility & The “Horizontal” Imaginary



Mosquito collection at Globe
Berry wash, Pima County,
Arizona.



Abandoned hot-tub,
Tucson, Pima County,
Arizona.

Factor 2

- "The most important environments for mosquitoes are ones made by people, like streets, parks and retention basins, as opposed to washes and native vegetation areas." (1.06)*
- "You can't compare counties to each other; they all have different levels of resources plus the type of problems they have are totally different from one to the next." (-0.69)*
- "Whether an area has an abatement district is a political question, not an ecological one." (-0.88)*
- "When I started learning about mosquitoes, it was on the job training." (-1.30)*

p < .05; Asterisk () indicates significance at p < .01*

Factor 2: Legibility & The “Vertical” Imaginary



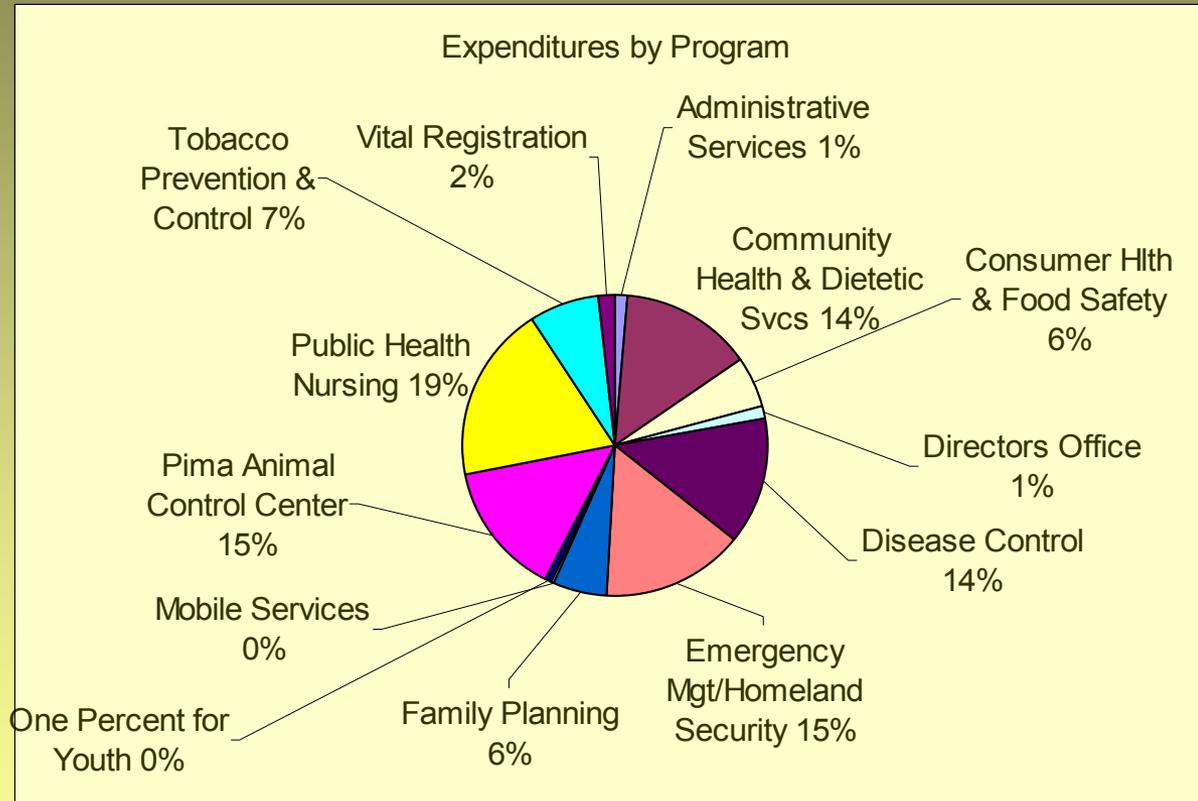
Vector Control, Maricopa
County, Arizona.

Factor 3

- "Whether an area has an abatement district is a political question, not an ecological one." (1.63)*
- "We know where West Nile Virus hotzones are going to be, the kinds of neighborhoods." (0.79)*
- "State agencies are now a hub for sharing information between counties. We are able to share knowledge with everybody, and amongst ourselves, and other players." (-0.92)*
- "We base our mosquito policy on the public health picture, not on political factors." (-1.55)*

p < .05; Asterisk () indicates significance at p < .01*

Factor 3: Politics & The “Cassandran” Imaginary



*Source: Pima County FY 04/05
Adopted Budget*

Factor Membership: tentative correlations

- All factors across a RANGE of institutional types
- Factor 1 (Illegibility)
 - *Exclusively* Biology/Zoology
- Factor 2 (Legibility)
 - Entomology, public health
 - Male
- Factor 3 (Politics)
 - Epidemiology, entomology, public health
 - Female



William C. Gorgas. Source: The University of Virginia. Permission pending.

An historic
tension...

‘In yellow-fever work this system of destroying mosquito larvae is the essential; everything else is secondary to it...caring for the cisterns, water barrels and containers is the essential work...’
(Gorgas 1915: 61).

An historic tension...



Fred L. Soper. Source: National Institute of Health.

'The mathematics of eradication is simple; what can be done in one square meter can be done in two square meters; what can be done in two square meters can be done in four. Thus, by geometrical progression the world is soon covered' (1962: 5).

Foundational Tensions

- Broadly horizontal (“flat”) ways of knowing and operating in space compete with vertical (“hierarchical”) ones, *within* institutions
- These reflect ontologies (fundamental views of *how things are*), which may correlate within disciplines and across other experiences and differences
- They *matter* when autonomous institutions need to set priorities related to public health and the environment

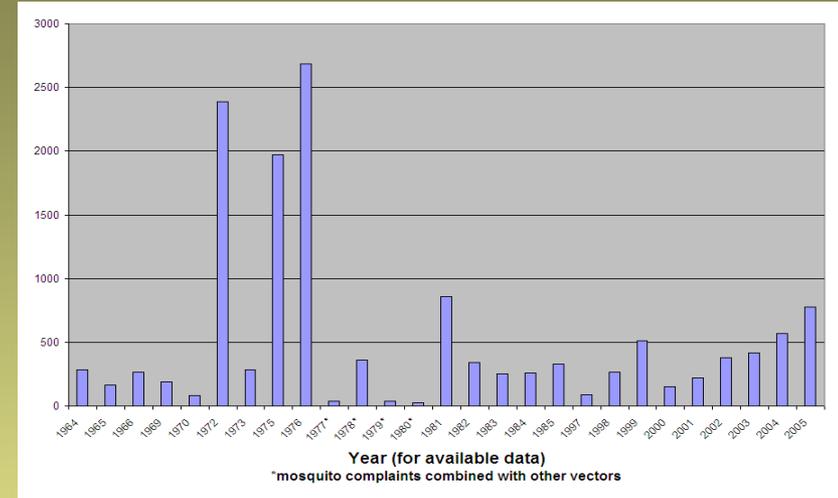
Method 3: Comparative Cases

- Pima County Health Department
 - State Historical Society: HD Monthly Reports 1964-1987
 - contemporary PCHD annual reports and websites
 - archives maintained by departmental staff
 - Interviews with managers of the vector control division
- City of Tucson Water
 - interviews and offices visits with key staff
 - vector control programs at Sweetwater Wetlands
 - department sources:
 - agency structure and fiscal arrangements

Pima County Health Department

Lack of within-agency
historical information

Limited resources



*Mosquito Complaints to Pima County Health
Department:
1964-2005*

Ad hoc monitoring

Nuisance mandate



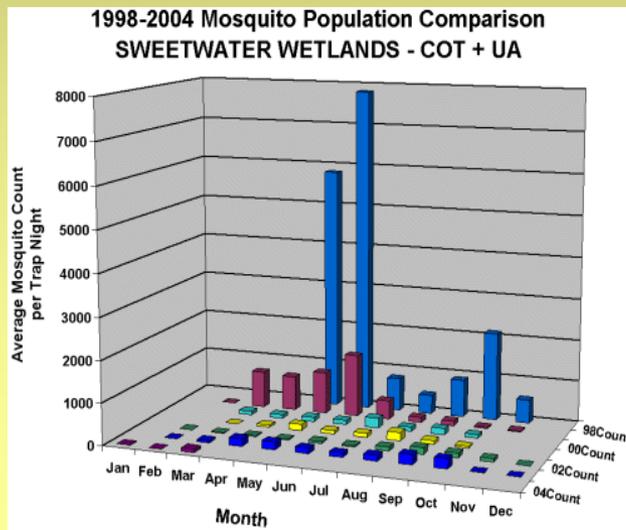
Tucson Water

Monitoring and reporting violations: Sweetwater Wetlands alternative to fine

Bat plan: “mosquito abatement was not given the emphasis it should have”



<http://ag.arizona.edu/OALS/ALN/aln45/wetlands4.html>



Enterprise Initiative
Abatement program additional
\$60,000/year

Hydrologists
“huge learning curve”

Memory, Resources, Territory, and Training in Institutional Learning

	County Health	Municipal Water
Institutional Memory	Poor historical record of efforts and techniques; little capacity to experiment	Unprecedented growth of responsibility for mosquito control; sets an agenda of response
Directed Resources	Extremely limited budget in an agency with multiple unrelated objectives	Self-funding mandate of “enterprise fund” makes vector control an unanticipated operating cost
Discipline/ Training	Sanitarian, Public Health, and Epidemiology; no entomologists on staff	Hydrology & Geophysics; no entomologists on staff
Management Territory/Geography	Nuisance practice favors “vertical” treatment	Water treatment mandate (artificial wetland) creates “unforeseen” mosquito hazard at site, leading to “horizontal” treatments

Can Institutions Learn? Yes!

- Diverse experts bring differing foundational ontologies to institutions
- These institutions, however, do the categorizing, remembering and forgetting, making decisions *for* their practitioners and constituents
- Thus: Institutions are built around operationalizing and generalizing existing spatialized principles of staff, *adapting as they go*
- **HOWEVER:** Politically, institutions must sort and activate what are often irreconcilable and incongruent spatial ontologies, raising the possibility of political cynicism, across the public and even within practitioner communities

Policy-Relevant Conclusions

- Anticipating Unintended Consequences
 - Lengthening knowledge histories: record-keeping and adaptive management
 - Where histories are short, assumptions will be driven by predominating spatial strategy/knowledge
- Acknowledging Irreconcilability
 - Embracing, rather than rejecting, the “parallax views” of different specialists
 - Where holism is the goal, invoking it as a mantra will be insufficient.
- Avoiding Cassandran Cynicism
 - Better acknowledging and working through political exigencies of institutions
 - Acknowledging the already-political differences between diverse specialists and locations.

Acknowledgments

- Craig Levy!
- Agencies
 - Pima County Health Department
 - Maricopa County Vector Control
 - Tucson Water
 - Arizona Department of Health Services
 - Maricopa County Health Department
 - City of Phoenix
 - University of Arizona
- National Science Foundation (#0617953)