

Emerging Strategies for Freshwater Protection

Rebecca Esselman

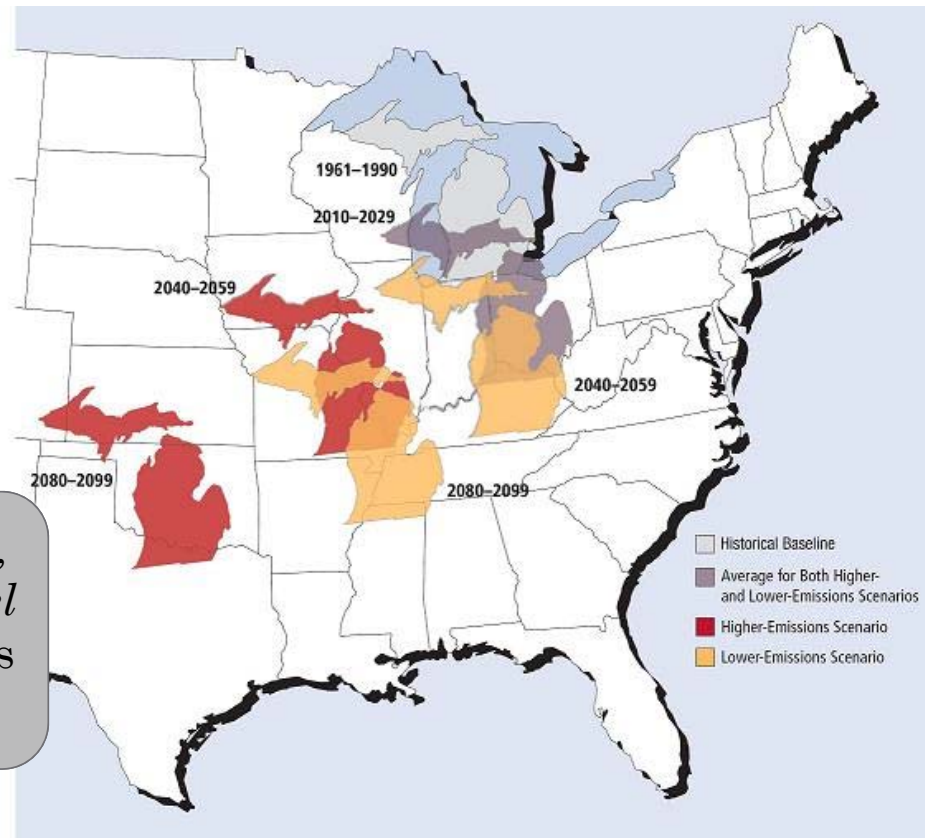
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A Migrating Climate

The climate future generations experience will be fundamentally different than the climate today.

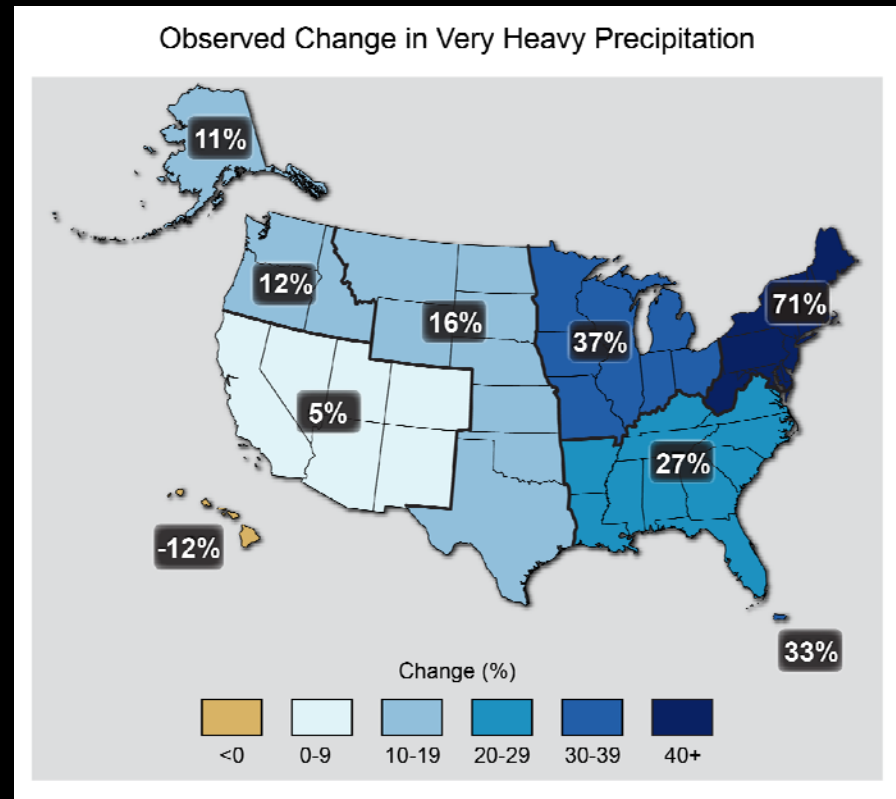
By the end of this century, Michigan summers will *feel* more like current summers in Arkansas.



Courtesy UCS 2009, original work by Hayhoe et al.

Key Climate Changes for Michigan

- Warmer average temperatures
- Warmer low and nighttime temperatures
- More potential for extreme heat
- Shorter winters
- More total precipitation
- More severe precipitation events





Climate Change in Michigan

- Precipitation change impacts are the greatest immediate threat.
- More severe drought in the summer also looming

Impacts to rivers and lakes:

Altered thermal and flow regimes

- Higher average water temperatures
- Changes in timing of thermal cues
- Lake turnover
- Lower flows/water levels
- More extreme changes in flow

Preparing the Huron River for Climate Change

Goals are to

- moderate stream temperatures and flow to stay within the natural range of variation that climate change threatens.
- ensure biological communities are robust and able to withstand disturbance

<https://www.youtube.com/watch?v=o71iYZSPVlU>

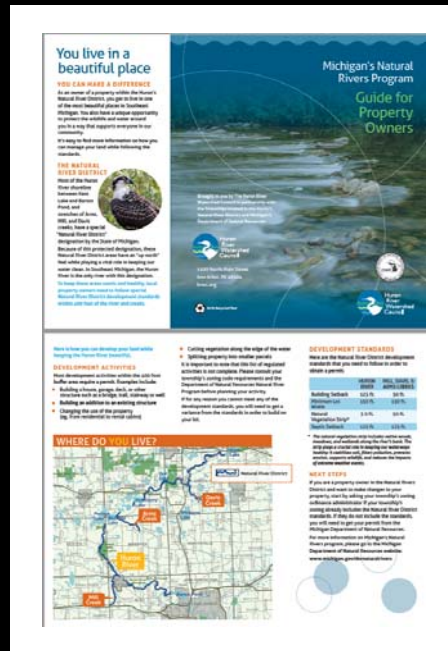


Strategy 1

*Forests keep water cool
when air temperatures are
high*

Ensure Natural River
District development
standards-

- Re-energize municipal staff and local elected
- Encourage local administration of standards
- Educate property owners on their responsibilities



Strategy 1

- Ecological benefits
 - Groundwater recharge and surface water shading moderate air temperatures impact on water temp
- Community benefits
 - Scenic river
 - Meet water quality standards

HRWC's work to bring attention to the importance of the Natural Rivers designation of the Huron has been unparalleled. They have brought the importance of the district to the forefront of community conversations. Most importantly, HRWC has fostered an ongoing dialogue among residents, local governments, parks, the State of Michigan, and conservation organizations in a non-threatening, partnership driven manner. - Patrick Ertel, MDNR



Strategy 2

*Creating habitat for fish
provides refuge from heavy
rain and drought*

Dropped and anchored 30
trees along a 1500 meter
stretch of river in urban
area to improve habitat
and increase fish
populations

Strategy 2

- Ecological benefits
 - Habitat and flow diversity restored
 - Increase populations of fish and inverts
 - Refuge from extreme events decreases mortality
- Community benefits
 - Better fishing opportunities in underserved urban area
 - Better fishing to support nearby fly fishing outfitter





Strategy 3

Dam management can reduce harm caused by extreme floods and droughts

Network mainstem dam operators and owners

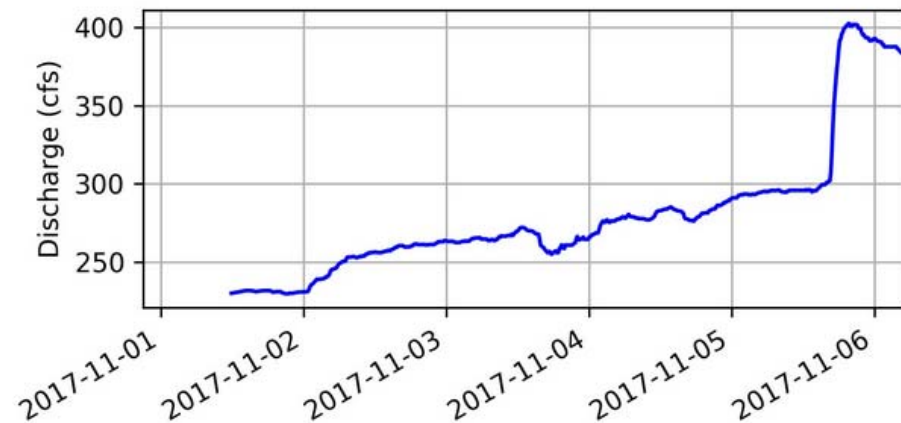
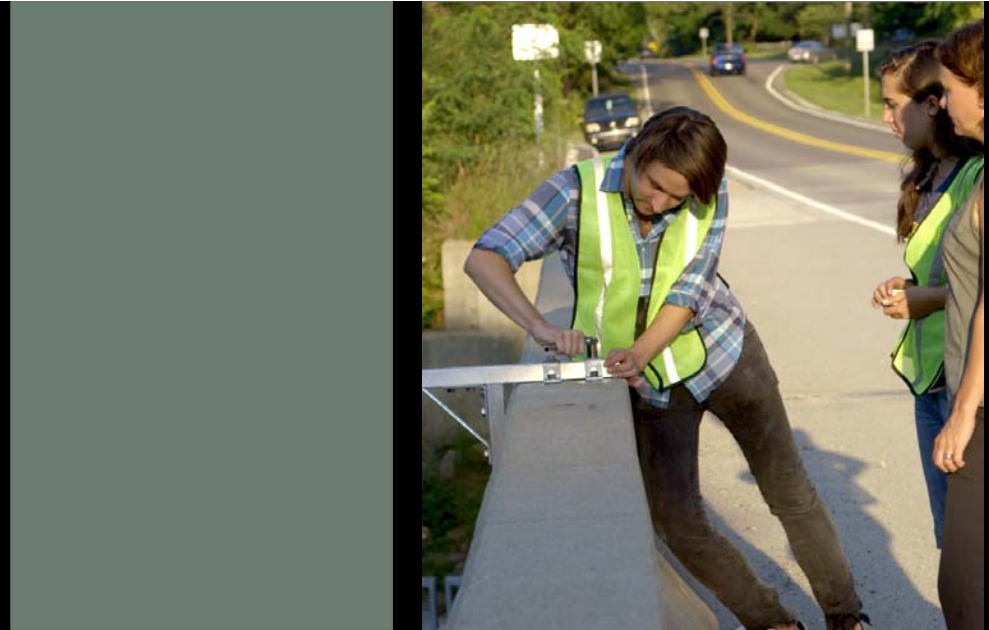
Develop environmental flow targets

Improve flow data

Pilot flow targets

Strategy 3

- Ecological benefits
 - Improved spawning success
 - Drought protection
- Community benefits
 - More flow data allowing for improved dam management, flood forecasting and flow advisories
 - Public safety improved as a result of networked operators
 - Multiuse flow management supports multiple priorities





Strategy 4

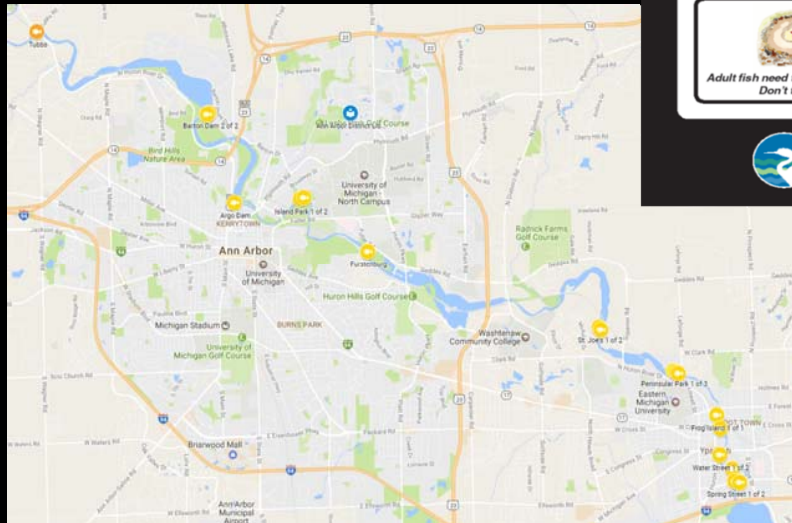
Broader adoption of catch and release fishing will keep native fish populations robust and resilient

Signage at popular catch and keep fishing spots

Postcards at bait and license shops

Strategy 4

- Ecological benefits
 - Higher spawning success
 - More robust native fish populations
- Community benefits
 - Better fishing opportunities
 - Less illegal activity



RELEASE YOUR CATCH!

**DO NOT Catch-and-Keep Fish
April-May
IT'S THE LAW**



Fish reproduce in the Spring season.
Keeping fish during April-May
decreases the number of fish in the future.

**No debe quedar atrapado - y -
guardar pescados abril-mayo**

四月至五月期间：请勿捕鱼并带走



Adult fish need to guard their eggs so they hatch.
Don't take the adult fish away.

For information:
michigan.gov/fishing



Pavement Sealants and PAH contamination: the threat and local action

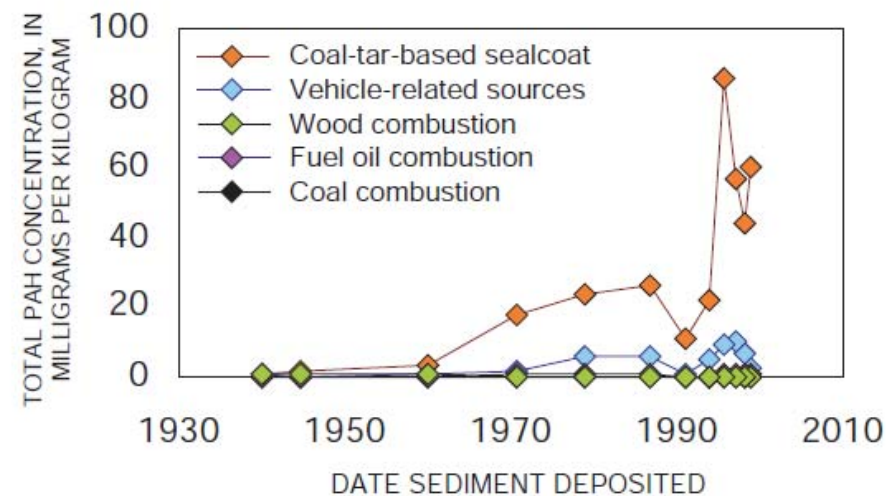
What are pavement sealants?

- Low traffic impervious surface sealant
- Commonly used on driveways and parking lots
- Commercially and non-commercially sold
- Sealants are commonly coal tar pitch based but can be asphalt based or a growing number of new base products.
- Asphalt based sealants have 1/1000th the PAH content as coal tar based



What is the problem?

- PAH concentrations in lake and stream sediments have been increasing
- 2003 study in Austin TX. Found coal tar sealants to be primary source
- Since then research has found strong links between sealants and
 - PAH contamination in ponds and rivers
 - Aquatic health impacts
 - Human health impacts



Coal-tar-based sealcoat (orange symbol) is the largest contributor to increasing concentrations of PAHs in Lake Killarney, Orlando, Florida, as determined by chemical fingerprinting. Similar patterns were seen in lakes across the central and eastern United States (Van Metre and Mahler, 2010).

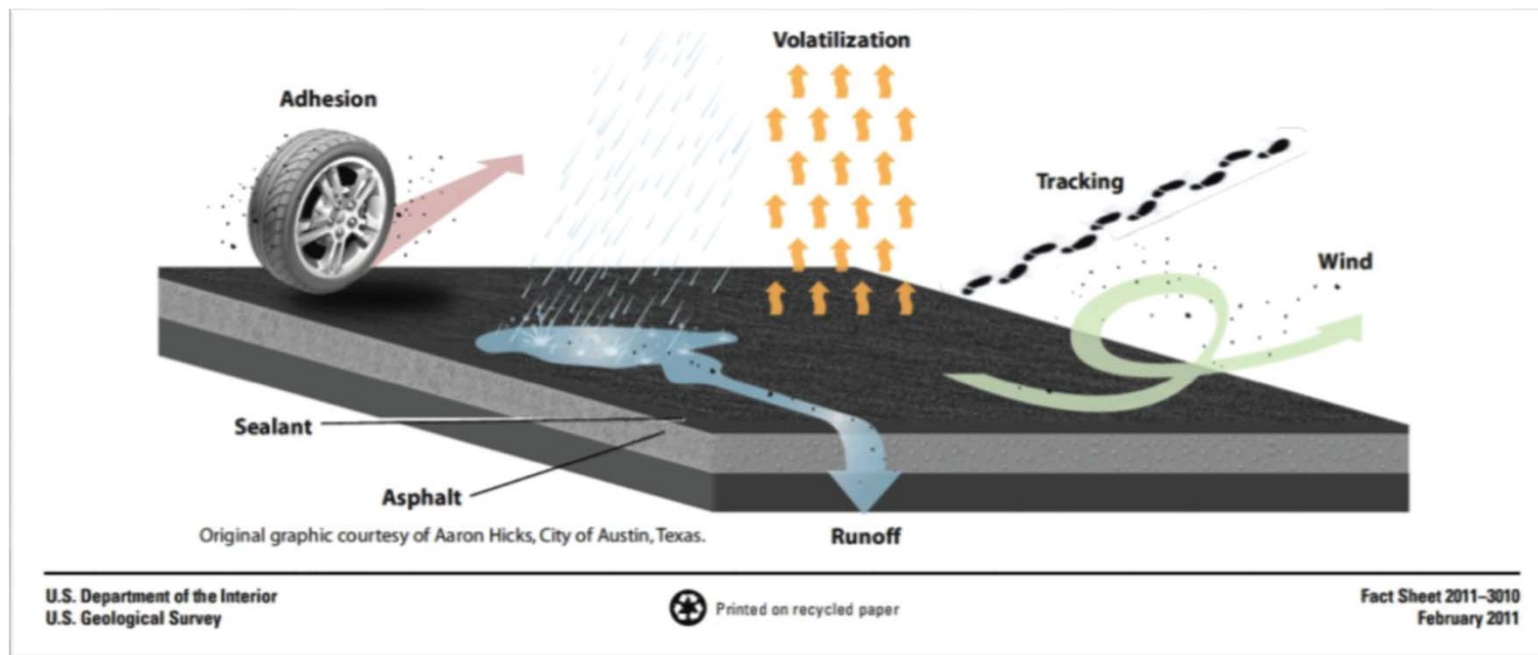
What are PAHs?

- PAH– Polycyclic aromatic hydrocarbon – organic compound containing hydrogen and carbon
- By product of the coal industry
- Relatively insoluble in water (more of a sediment problem than a water column problem)
- Found at high concentrations in coal tar pitch (base of coal tar sealant)

Asphalt Sealer	PAH Conc. (ppm)(dry wt.)	% PAH
TuffSeal/Acrypave	Non-detect	0
Bio-Seal/Aexcel Corp	Non-detect	0
Eco-Seal/ Rochester, NY	Non-detect	0
Carbonplex /EcoStar Science	Non-detect	0
GuardTop	Non-detect	0
Pitch Black	Non-detect	0
Crack Stopper/Gardner Gibson	12	0.001%
CMS-1P/QB/Western Colloid	59	0.006%
SafeSeal Michigan	40	0.004%
Henry Seal 532, Henry Company	50	0.005%
GSB 88 Gilsonite/ ASI	215	0.0215%
Paveshield/ NEYRA Industries	694	0.0694%
Common Regulatory Limit	1,000	0.100%
Jennite AE/NEYRA Industries	1,168	0.117%
Master Seal/Sealmaster	2,867	0.287%
Liquid Road/Sealmaster	16,272	1.627%
Black Diamond/ GemSeal	19,064	1.906%
Average Coal Tar Sealer	50,000	5.00%

Product PAH's. (n.d.). Retrieved October 16, 2017, from <https://coaltarfreeusa.com/p/>

How do PAHs move?



What are the environmental threats?

- Runoff results in high mortality of juvenile fish and aquatic invertebrates months after application
- Battery of other impacts documented for benthic macroinvertebrates, fish and amphibians including delayed emergence, deformities, increased disease susceptibility, organ abnormalities and stunted growth
- Contamination of sediments. Studies have shown large amounts of PAHs in the great lakes region attributed to coal tar sealant



Normal *F. heteroclitus* heart



F. heteroclitus heart after exposure to PAH mixture

<http://sites.nicholas.duke.edu/ecotoxicologylab/research/pahs-in-fish/>

Bryer, P. J., Elliot, J. N., & Willingham, E. J. (2006). The Effects of Coal Tar Based Pavement Sealer on Amphibian Development and Metamorphosis. *Ecotoxicology*, 241-247. doi:10.1007/s10646-005-0055-z

Metre, P. V., Mahler, B., Williams, S., Wilber, W. G., McIntyre, J., & Innes, A. (2017). *LakeLine*, 37(1), 4-33.

What are the health threats?

- SEVERAL PAH compounds have been found to be:
 - Carcinogenic (cancer)
 - Teratogenic (birth defects)
 - Mutagenic (mutations in dna)
- Studies suggest increased cancer risk up to 38 times
- Increased asthma risk and many other health issues
- Disproportionate impact on children

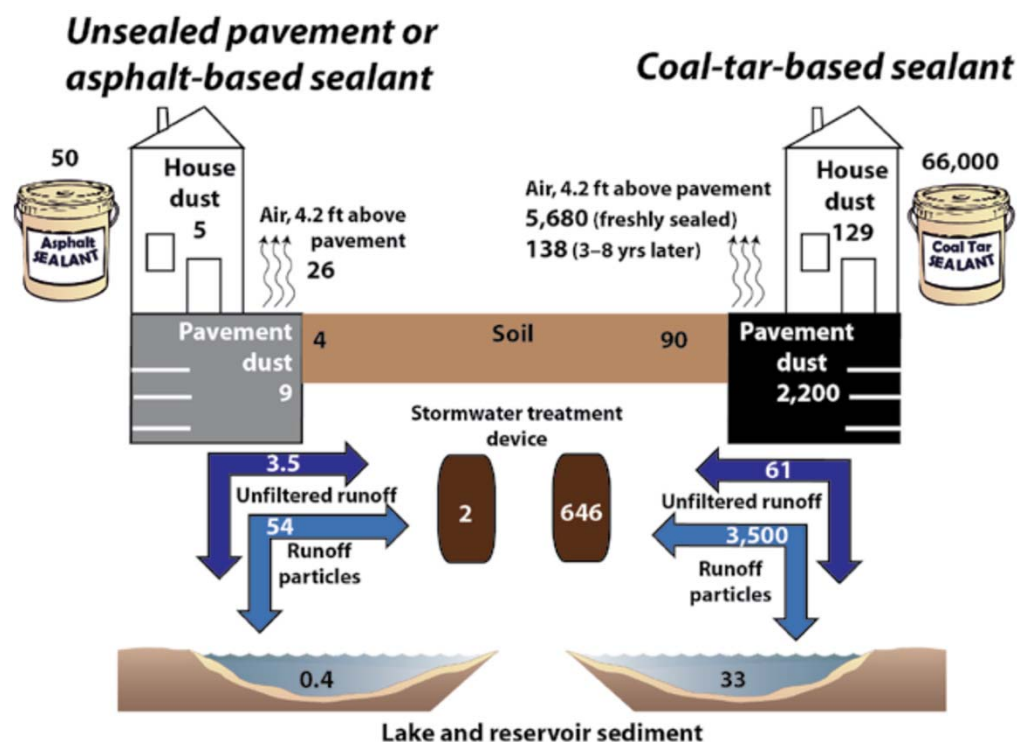


<https://coaltarfreeamerica.blogspot.com/2012/07/state-of-minnesota-asks-schools-to-stop.html>

Metre, P. V., Mahler, B., Williams, S., Wilber, W. G., McIntyre, J., & Innes, A. (2017). LakeLine, 37(1), 4-33.
Mahler, B. J., Woodside, M. D., & Van metre, P. C. (2016). Coal-Tar-Based Pavement Sealcoat—Potential Concerns for Human Health and Aquatic Life. USGS

Pavement Sealcoat - History

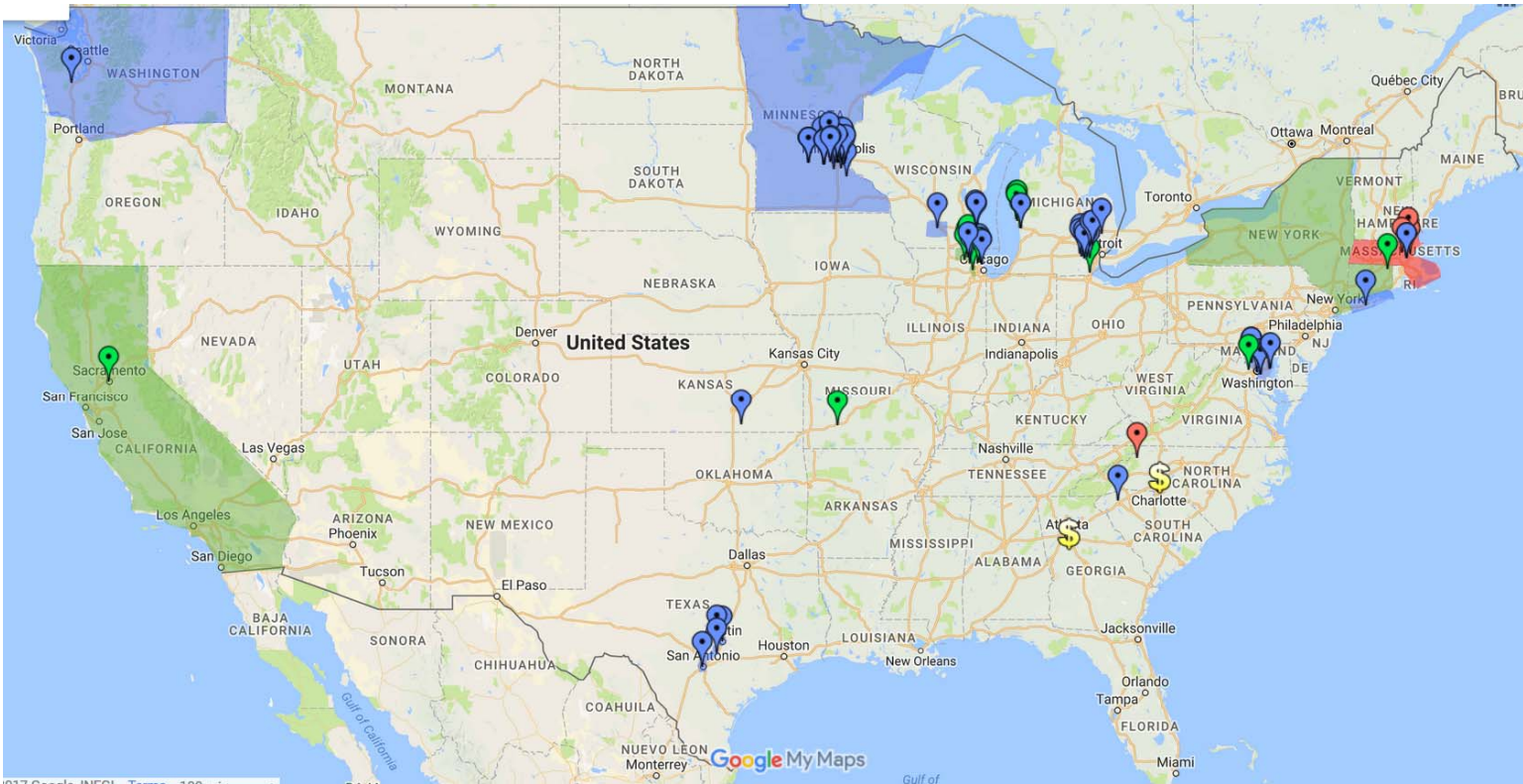
- Began in Austin, TX with USGS providing much of the initial science
- Austin, TX first municipal ban in 2005
- Ban has led to 58% decline in PAH content of sediments in Austin
- Additional research linked coal tar to aquatic and human health impacts
- Major hardware retailers removed it from shelves citing legal concerns
- Communities throughout the US starting taking local action



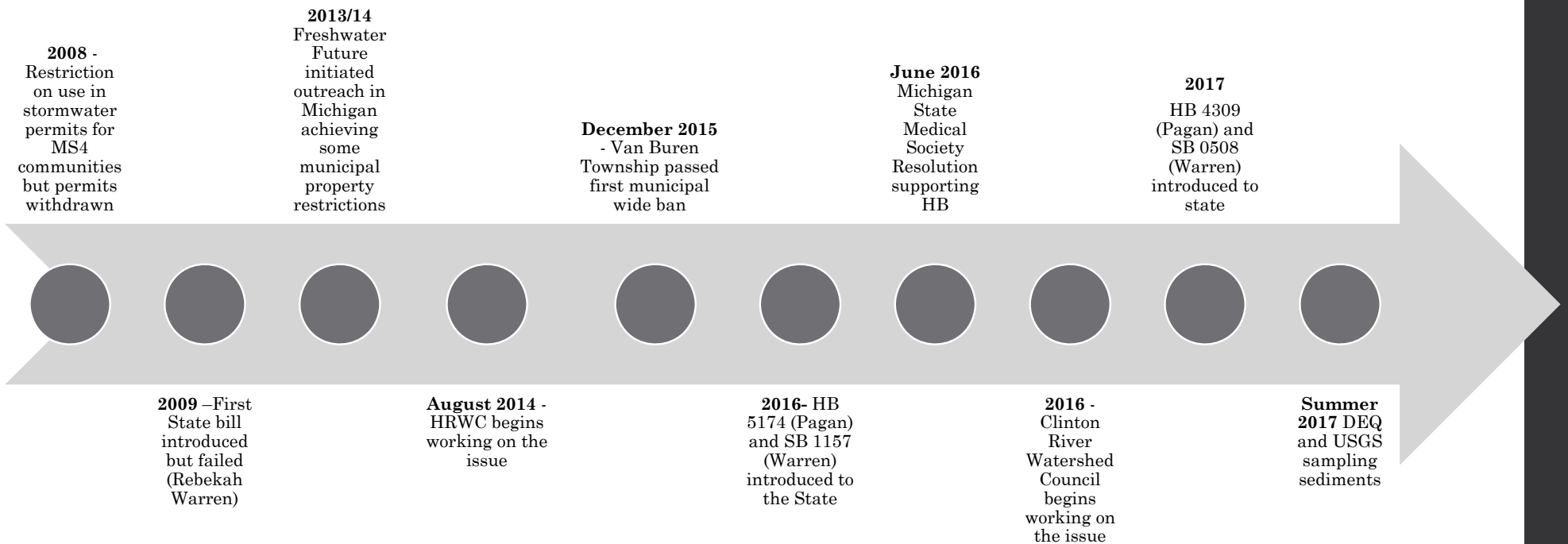
Mahler and Van Metre, 2017. LakeLine, NALMS. 13-18.

Communities taking action

22.5 million American's are now covered under a ban



Michigan story line



Population 318,905

Green – government restricted use, Blue – comprehensive ban

How we are getting it done

- Research
 - Local sampling
 - Literature review
 - Working with DEQ for additional sampling
- Outreach and Education
 - Brochure
 - Media coverage
 - Social media, newsletters, blogs, public presentation
- Advocacy
 - Presentations to Board and City Councils
 - Sample Ordinances
 - Worked through our Board initially to get audiences
 - Supporting State legislation
- Support of implementation and enforcement of bans
 - Connecting communities locally
 - Connecting local communities with seasoned veterans



New Pavement Sealcoat Products— Muddying the Waters

- Bans now stipulate PAH content thresholds because of emerging alternatives
- In Michigan, all comprehensive bans stipulate <0.1% PAH, by weight
- Coal Tar CAS #65996-92-1, 65996-93-2, 65996-89-6, 8007-45-2
- Steam Cracked Petroleum CAS # 64742-90-1, 69013-21-4
- Asphalt-based CAS #

Working with others nationally to establish standard protocol for product testing

Where we go from here:

- More local action
 - Ordinances should
 - Stipulate 0.1% PAH threshold
 - Require registration
 - Have significant penalty
 - Also, company or organizational policies
 - RFPs require use of safer alternatives
- More engagement from public health and medical professionals
- Utilize results of USGS and DEQ research in Michigan to inform policies
- Bipartisan support for state level legislation



More Useful Information

Minnesota Pollution Control Agency

<https://www.pca.state.mn.us/water/restriction-coal-tar-based-sealants>

USGS <https://tx.usgs.gov/sealcoat.html>

City of Austin <http://www.austintexas.gov/CoalTar>

Coal Tar Free America www.coaltarfreeamerica.blogspot.com

Huron River Watershed Council www.hrwc.org/coaltar

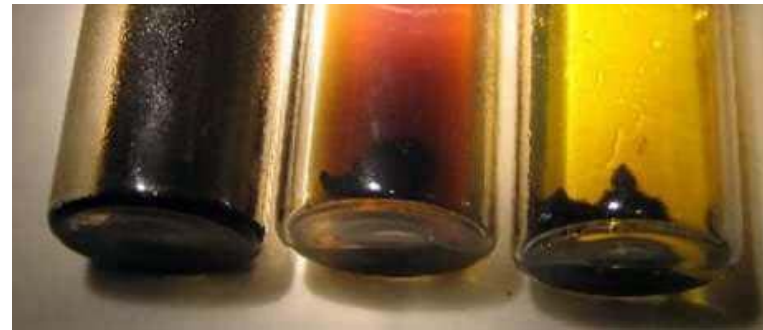
Thank You

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Field test for Coal Tar Sealcoat

Scraping test results (left to right): dark brown/black color: likely to be asphalt-based; reddish color: likely has some coal tar present; yellowish color: likely to be coal tar-based. Scraping description and photos courtesy of Tom Ennis.



Stoddard Solvent-based paint thinner containing mineral spirits, aliphatic petroleum distillates, and white spirits to be used as solvent. E.g. Klean-Strip brand paint thinner.

See <http://www.austintexas.gov/CoalTar>



Conclusions

- Climate adaptation strategies often have multiple benefits
- Articulating these benefits can assist in more swift adoption
- Benefits for residents, municipal staff, businesses and local elected officials all came into play in this project
- If people can see something in it for them, they are more likely to take action and may even go above and beyond.