



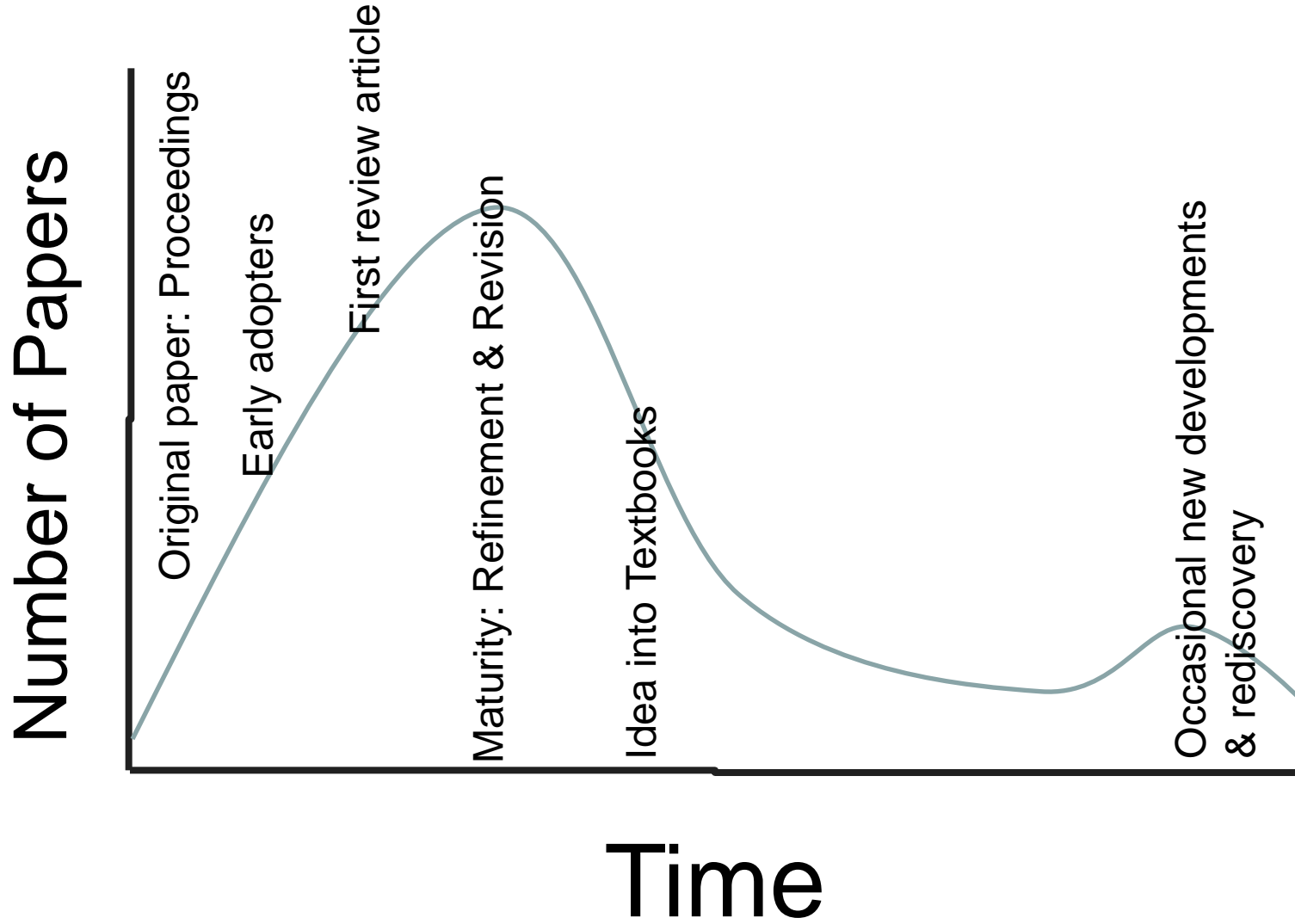
Analytical and Computer Cartography Winter Quarter 2017

Lecture 17: Current Research in Analytical and Computer Cartography

Current Research

- Already looked at major cartographic journals
- Will cover a sample of recent papers doing new research using analytical and computer cartography
- Note the methods, universities and value of the findings
- No attempt to be comprehensive, a moving target

The Nature of New Ideas



Citation maps

Web of Science [v.5.23.2] -... Web of Science [v.5.22]

cm.webofknowledge.com/viewCitationTree.do

Most Visited Google Breaking News, U.S., ... Google Calendar Web of Science [v.5.17... The New GauchoSpace Course Login | Online ... eGrades

AUTOMATION AND CARTOGRAPHY Citation Mapping Help

Manage Edit... Appearance Print...

1900 1925 1950 1959 1975 2000 2017

Re-create Map

Source: Web of Science™, <http://thomsonreuters.com/scholarly-scientific-research/>

Record details for the nodes are displayed below (double-click a node to show its details). Click a checkbox below to locate that node above.

AUTOMATION AND CARTOGRAPHY			
<input type="checkbox"/>	ANDERBERG, E	1973-MITTEILUNGEN DER OSTERREICHISCHEN GEOGRAPHISCHEN GESELLSCHAFT	IMPORTANCE OF COMPUTER CARTOGRA...
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<input checked="" type="checkbox"/>	KUBO, S	1984-IEEE COMPUTER GRAPHICS AND APPLICATIONS	ALIS - A GEOGRAPHICAL INFORMAT...

Displaying 1 - 10 of 35 << 1 2 3 4 >> Display 10 Records per page

DOI	10.2307/212211
Document Type	Article
Research Area	GEOGRAPHY
References	14
Times Cited	34
Language	ENGLISH

Metaanalysis

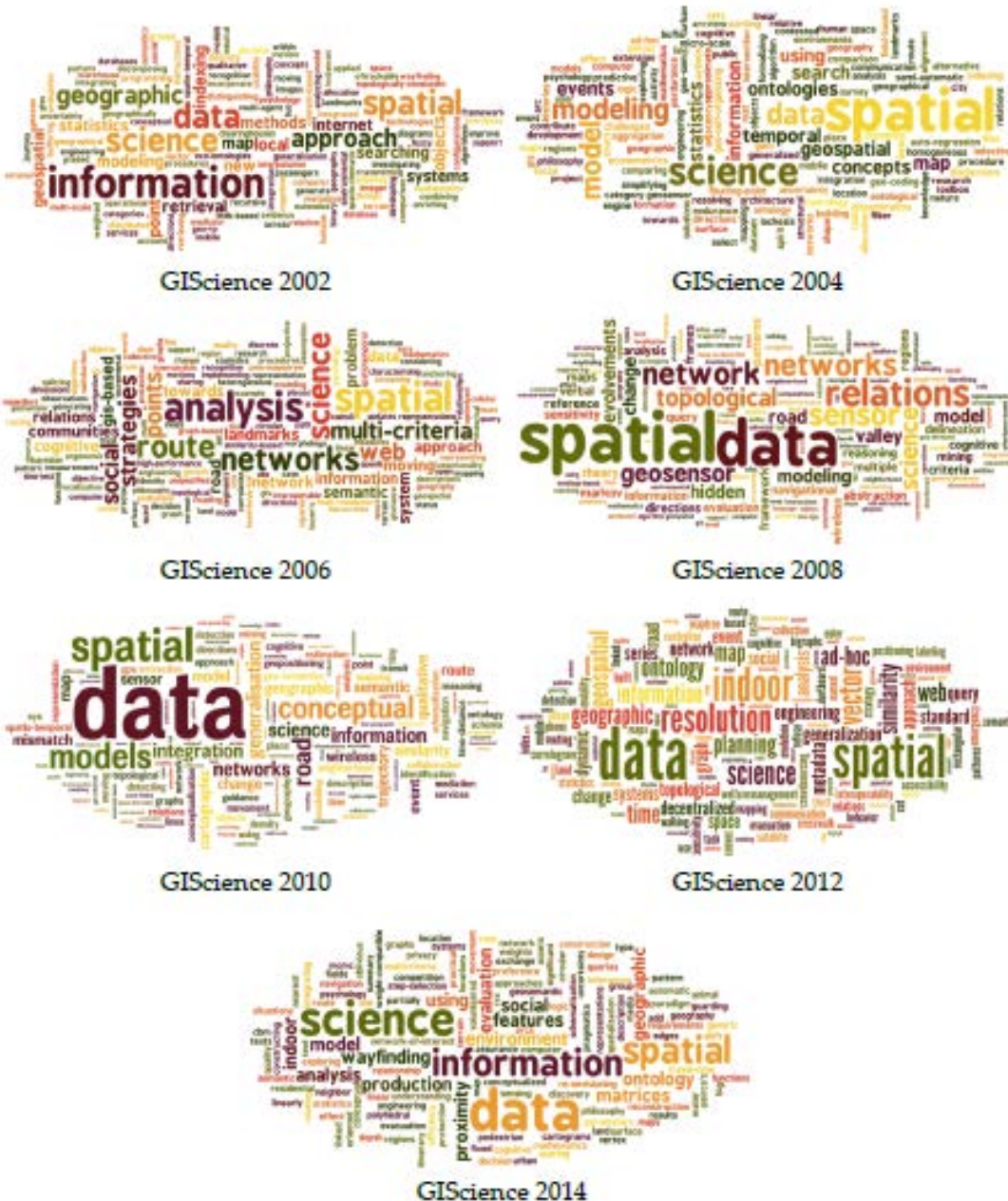


Figure 2: Word clouds of full papers of the GIScience conference 2002–2014.

Some research tools

- DOI: papers and data
- Supplemental material, citations to SourceForge, etc
- Interactive PDFs: Links etc
- Online support for submittal, review and publication
- Online only, eTexts, eBooks, eJournals
- Endnote, Zotero, Mendeley
- Google Scholar, Web of Science
- Researchgate, LinkedIn, etc

Mendeley

The image shows a screenshot of the Mendeley website homepage as viewed in a web browser. The browser's address bar shows the URL <https://www.mendeley.com>. The page features a dark blue header with the Mendeley logo on the left and navigation links for "Sign In", "Create account", and "Download" on the right. Below the header, a horizontal menu lists "Reference Management", "Research Network", "Datasets", and "Careers", with a search bar on the right. The main content area is a large banner with a background image of a laptop and a notebook. The banner text reads "Empowering researchers to organize their references" in white. A red button labeled "Create a free account" is positioned in the lower-left corner of the banner. At the bottom of the banner, there are four white boxes with blue text: "Reference management", "Research network", "Datasets", and "Careers". The browser's taskbar is visible at the bottom, showing various application icons and the system clock displaying "10:05 AM 3/7/2017".

Homepage | Mendeley x

Secure | <https://www.mendeley.com>

Apps Google Google Calendar Breaking News, U.S., V Breaking News and O Web of Science [v.5.1] The New GauchoSpac Course Login | Online eGrades ScholarOne Manuscript

Mendeley Sign In Create account Download

Reference Management Research Network Datasets Careers Search

Empowering researchers to organize their references

Create a free account

Reference management Research network Datasets Careers

10:05 AM 3/7/2017

The four papers


- Zhenlong Li, Cuizhen Wang, Christopher T. Emrich & Diansheng Guo (2017): A novel approach to leveraging social media for rapid flood mapping: a case study of the 2015 South Carolina floods *Cartography and Geographic Information Science*, DOI: 10.1080/15230406.2016.1271356
- Ian J. Irmischer & Keith C. Clarke (2017): Measuring and modeling the speed of human navigation, *Cartography and Geographic Information Science*. DOI: 10.1080/15230406.2017.1292150
- Eric Nost, Heather Rosenfeld, Kristen Vincent, Sarah A. Moore & Robert E. Roth (2017) HazMatMapper: an online and interactive geographic visualization tool for exploring transnational flows of hazardous waste and environmental justice, *Journal of Maps*, 13:1, 14-23, DOI: 10.1080/17445647.2017.1282384
- Michael J. Campbell, Philip E. Dennison & Bret W. Butler (2016): Safe separation distance score: a new metric for evaluating wildland firefighter safety zones using lidar, *International Journal of Geographical Information Science*, DOI: 10.1080/13658816.2016.1270453

Zhenlong Li et al. (2017)

CARTOGRAPHY AND GEOGRAPHIC INFORMATION SCIENCE, 2017
<http://dx.doi.org/10.1080/15230406.2016.1271356>



A novel approach to leveraging social media for rapid flood mapping: a case study of the 2015 South Carolina floods

Zhenlong Li ^a, Cuizhen Wang^a, Christopher T. Emrich^b and Diansheng Guo^a

^aDepartment of Geography, University of South Carolina, Columbia, USA; ^bSchool of Public Administration & Sustainable Coastal Systems Cluster, University of Central Florida, Orlando, USA

Study

- Twitter as a new data source for disaster management and flood mapping
- “Using the 2015 South Carolina floods as the study case, this paper introduces a novel approach to mapping the flood in near real time by leveraging Twitter data in geospatial processes”
- Analyzed the spatiotemporal patterns of flood-related tweets using quantitative methods to better understand how Twitter activity is related to flood phenomena
- Kernel-based flood mapping model was developed to map the flooding possibility for the study area based on the water height points derived from tweets and stream gauges
- Patterns of Tweets used to assign the weights of flood model parameters.
- Feasibility and accuracy of the model evaluated

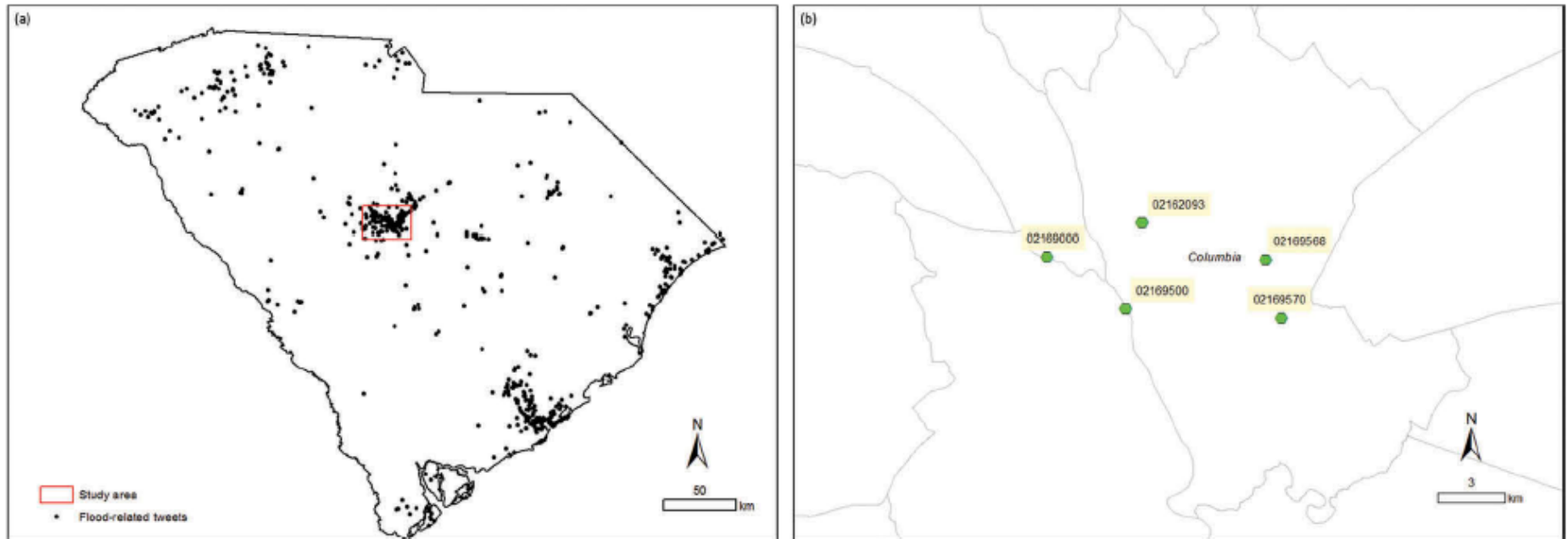


Figure 1. (a) Flood-related georeferenced tweets in South Carolina. The red rectangle indicates the study area (Columbia area). (b) Location of the five selected USGS Stream gauges within the study area.

Workflow

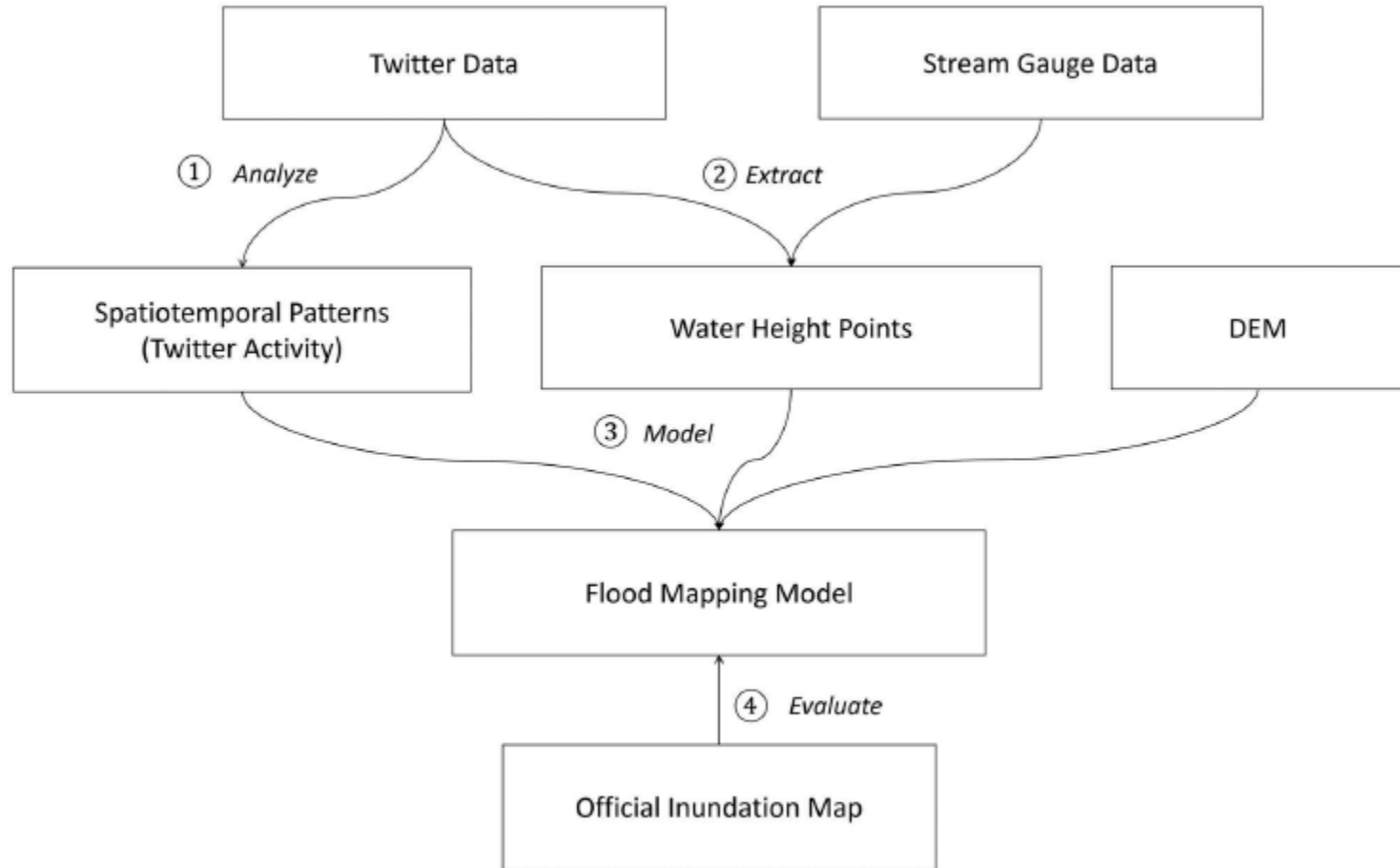


Figure 2. Overview of our research approach.

Modeled flooding

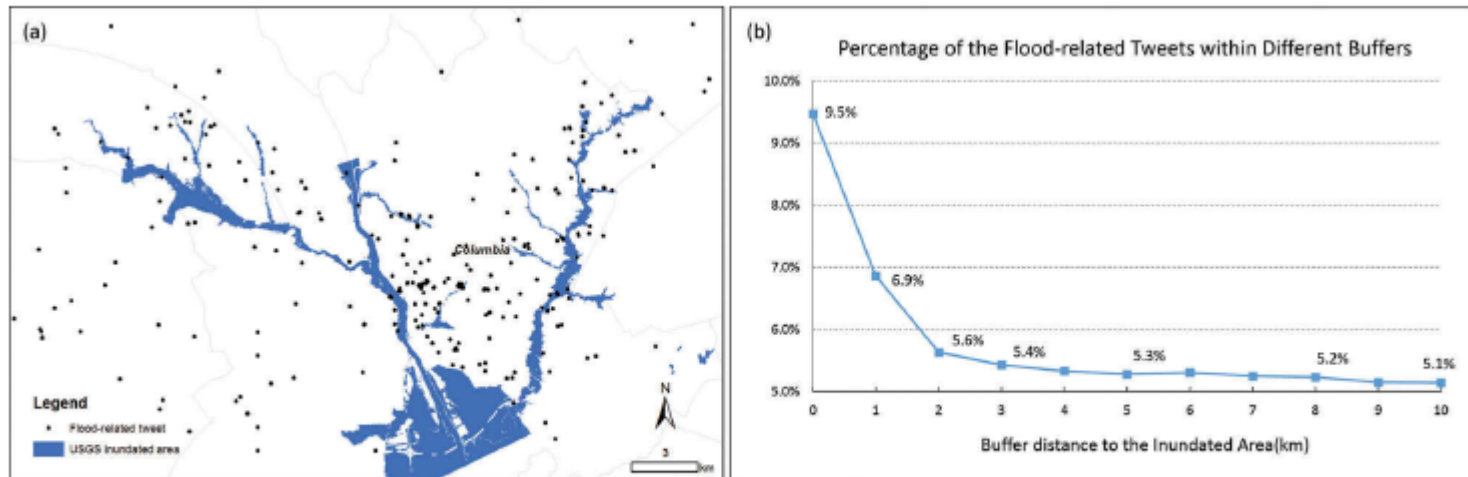


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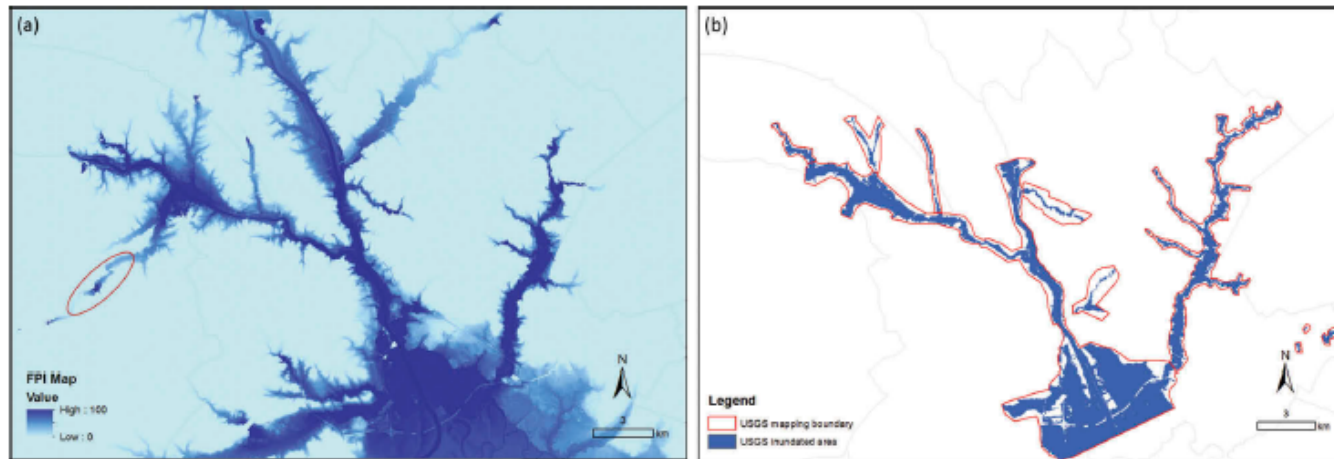


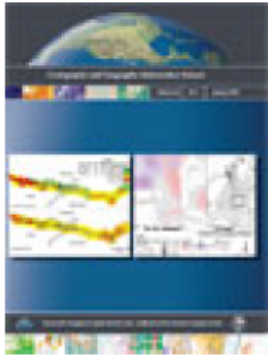
Figure 9. (a) Final FPI map based on 25 FPI surfaces. Larger value (darker blue area) indicates a higher possibility of being flooded. (b) USGS inundation maps (red polygon shows the mapping boundary used by USGS).

Social Media Data as Map Information

“Using the 2015 South Carolina floods in October as the study case, this paper proposed a novel approach to extracting potentially useful information from social media data (tweets) to assist rapid flood mapping, thus represents an improvement in situational awareness during a flooding event.”

“The preliminary results showed that the model output provided a consistent and comparable estimation of the flood situation across the whole study area. Such a map, which can be generated in near real time, is useful for improving situational awareness during or right after the flooding event. This is of particular importance when social media (and/or stream gauges) is the only data available during the floods.”

Irmischer & Clarke (2017)



Cartography and Geographic Information Science

ISSN: 1523-0406 (Print) 1545-0465 (Online) Journal homepage: <http://www.tandfonline.com/loi/tcag20>

Measuring and modeling the speed of human navigation

Ian J. Irmischer & Keith C. Clarke

To cite this article: Ian J. Irmischer & Keith C. Clarke (2017): Measuring and modeling the speed of human navigation, *Cartography and Geographic Information Science*

To link to this article: <http://dx.doi.org/10.1080/15230406.2017.1292150>

Irmischer & Clarke (2017)

- Navigation, the goal-related movement through space and time
- Modeled the speed of movement of humans engaged in navigation in wooded environments with varied terrain
- Movement models were developed using spatiotemporal analysis of multiple subjects' trajectories with GPS
- Trajectory data were merged with land-cover data to analyze human navigation over varying slopes and terrain.
- Tested Tobler's hiking function and Naismith's rule
- The model created from this study was shown to outperform those classic human movement speed estimators by predicting route completion time within 10% accuracy (M = 11.1min, 95% CI [9.8, 12.4] min).

The test area



Figure 2. USMA navigation training area.

Tobler's Hiking Function

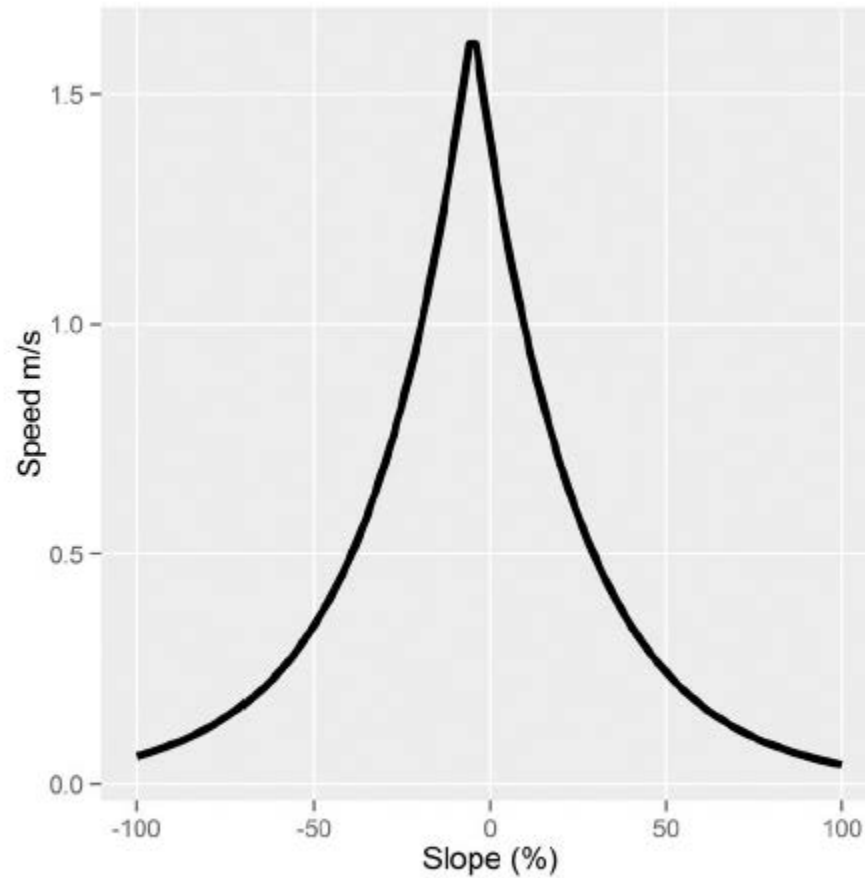


Figure 1. Tobler's hiking function.

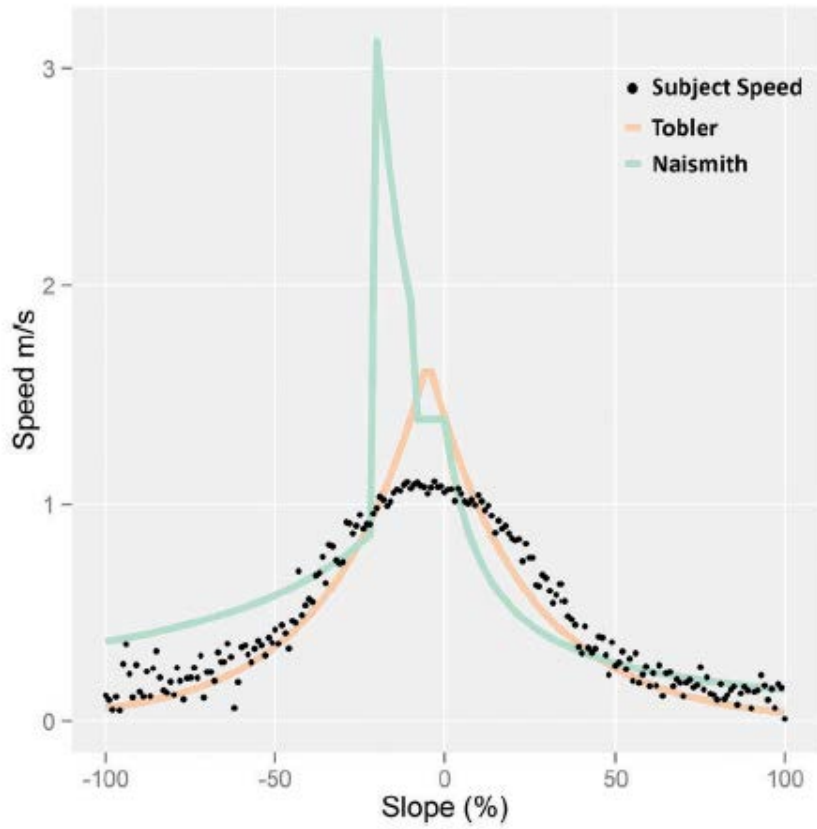


Figure 4. On-road speed of navigation – males.

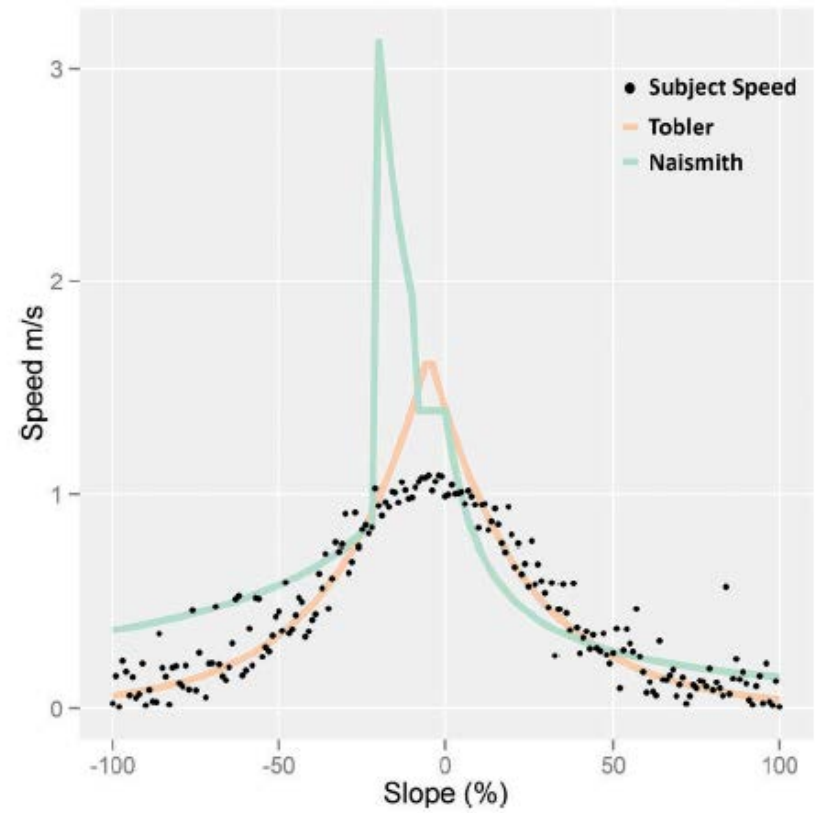


Figure 5. On-road speed of navigation – females.

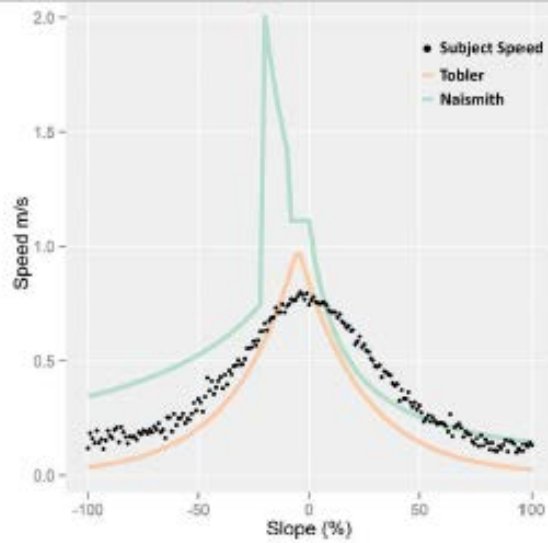


Figure 6. Off-road speed of navigation – males.

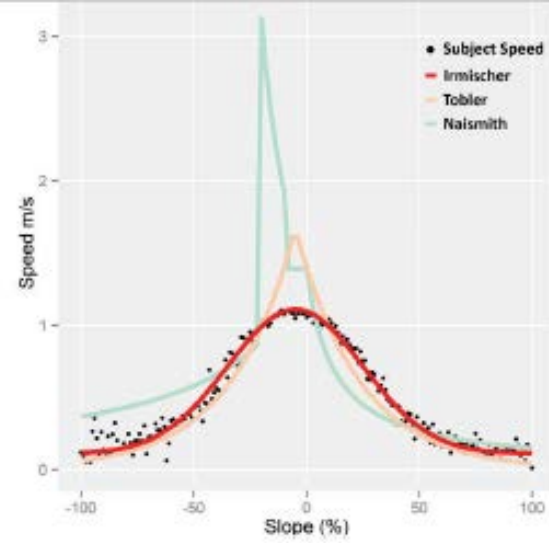


Figure 8. Irmischer model of on-road navigation speed – males.

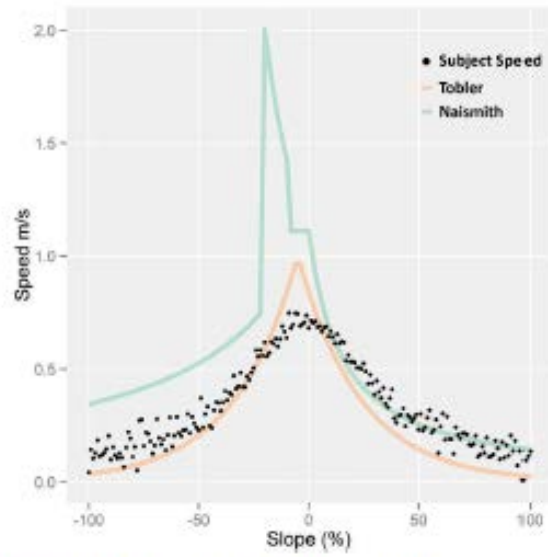


Figure 7. Off-road speed of navigation – females.

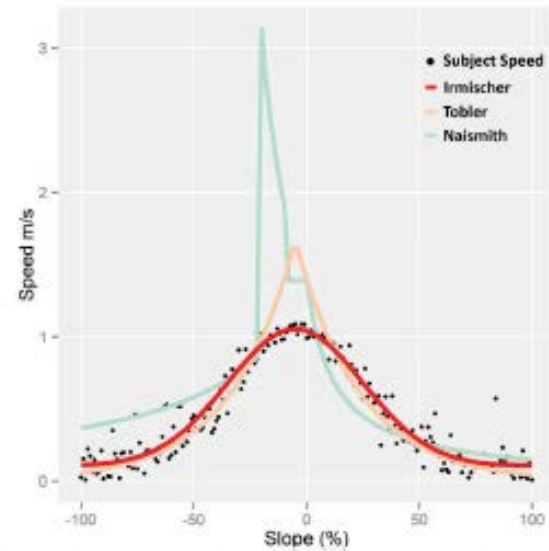


Figure 9. Irmischer model of on-road navigation speed – females.

Conclusion

- Developed and tested a model of navigation speed.
- Exploration of navigation, locomotion, and wayfinding has developed a methodology and framework to define the cognitive cost of navigation, which amounted to 34% of the task time in the West Point data.
- The ability to predict and model the speed of navigation has widespread use:
 - Models of navigation speeds can be used to help wilderness recreation aficionados plan how far they can travel in a day along specified routes.
 - Archaeologists can use these models to predict time-space computations of ancient travel.
 - Back-country search and rescue teams can use the equations to estimate ranges of lost persons.
 - The military will undoubtedly benefit by using these models to plan missions that require overland navigation.
- Research has developed a model for human navigation that includes both wayfinding and locomotion.

Nost et al. (2017)



Journal of Maps

ISSN: (Print) 1744-5647 (Online) Journal homepage: <http://www.tandfonline.com/loi/tjom20>

HazMatMapper: an online and interactive geographic visualization tool for exploring transnational flows of hazardous waste and environmental justice

Eric Nost, Heather Rosenfeld, Kristen Vincent, Sarah A. Moore & Robert E. Roth

HazMatMapper

- Online and interactive geographic visualization tool designed to facilitate exploration of transnational flows of hazardous waste in North America (<http://geography.wisc.edu/hazardouswaste/map/>).
- Build using Java and D3
- Little is known about how waste trading may affect specific sites within USA/Mexico/Canada.
- Assembled a novel geographic dataset describing transnational hazardous waste shipments from 2007 to 2012 through two FOIA requests for documents held by the US EPA
- HazMatMapper supports multiscale and site-specific visual exploration of US imports of hazardous waste from Canada and Mexico
- Discuss the dataset and design process behind HazMatMapper and demonstrate its utility for understanding the transnational hazardous waste trade.



Figure 1. HazMatMapper in action: (a) central map; (b) configuration controls; (c) advanced context controls; and (d) information panel.

Need Transport Form

Please print or type. (Form designed for use of 5015 (12/01) (operator) DL3799026 SC 7PW 3/3/2011 Form Approved OMB No. 2000-0708)

UNIFORM HAZARDOUS WASTE MANIFEST		1. Generator ID Number R-50388 A204374 B152	2. Page 1 of 3	3. Emergency Response Phone No. (800) 483-3718	4. Manifest Tracking Number 003896230 FLE
5. Generator's Name and Mailing Address Clean Harbors Canada Inc. 7842 Progress Way Delta, BC V4G 1A1 Company's Phone: (604) 450-0694		6. Exporter name and address		7. Manifest number	
8. Transporter 1 Company Name Alchemat Transport Inc (BRO)		2560 42/11		U.S. EPA Number CANADA	
9. Transporter 2 Company Name Clean Harbors Environmental Services Inc		Importer name and address		Importer EPA ID ARD069748192	
10. Designated Facility Name and Site Address Clean Harbors El Dorado LLC 309 American Circle El Dorado, AR 71730 Facility's Phone: (870) 863-7173		# of containers		Container type	
11. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))		UN2828, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I		UN2828, WASTE ALKALI METAL DISPERSIONS, 4.3, PG I	
UN waste code		Waste description		Packing group	
001		DM		0.997	
005		DI		2.085	
Quantity		Quantity unit		EPA waste code	
				D001 D003	
				D001 D003	
14. Special Handling Instructions and Additional Information 1. RI-CB487251 ERG 130 LYSS 2. RI-CB487251 ERG 130 SXBS					
15. GENERAL CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/ placarded, and are in accordance with proper condition for transport according to applicable international and national governmental regulations. I export shipment and I am the Primary Exporter. I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent. I certify that the waste minimization statement identified in 40 CFR 261.23(a) (1) or a large quantity generator or (2) (1) as a small quantity generator is true.					
Generator's/Owner's Printed Name: [Redacted] Signature: [Redacted] Date: 10/26/11					
16. International Shipments: <input checked="" type="checkbox"/> Export to U.S. <input type="checkbox"/> Export from U.S. Port of entry: BLVD, WA. Date leaving U.S.: 10/27/11					
17. Transporter Acknowledgment of Receipt of Materials: Transporter 1 (Printed Name): [Redacted] Signature: [Redacted] Date: 10/26/11					
Transporter 2 (Printed Name): [Redacted] Signature: [Redacted] Date: 10/27/11					
18. Discrepancy: <input type="checkbox"/> Quantity <input type="checkbox"/> Type <input type="checkbox"/> Residue <input type="checkbox"/> Partial Rejection <input type="checkbox"/> Full Rejection					
19. Alternate Facility (or Generator): Facility's Name: [Redacted] Facility's Phone: [Redacted] Signature of Alternate Facility (or Generator): [Redacted] Date: [Redacted]					
20. Recipient: Expected management method: HD-60, HD-60					
21. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in item 18a: [Redacted] Signature: [Redacted] Date: 11/17/11					

Clean Harbors has the appropriate permits for and will accept the waste the generator is shipping.

Figure 2. Sample RCRA manifest. Information coded into the spatial database is highlighted. Personal information is screened.

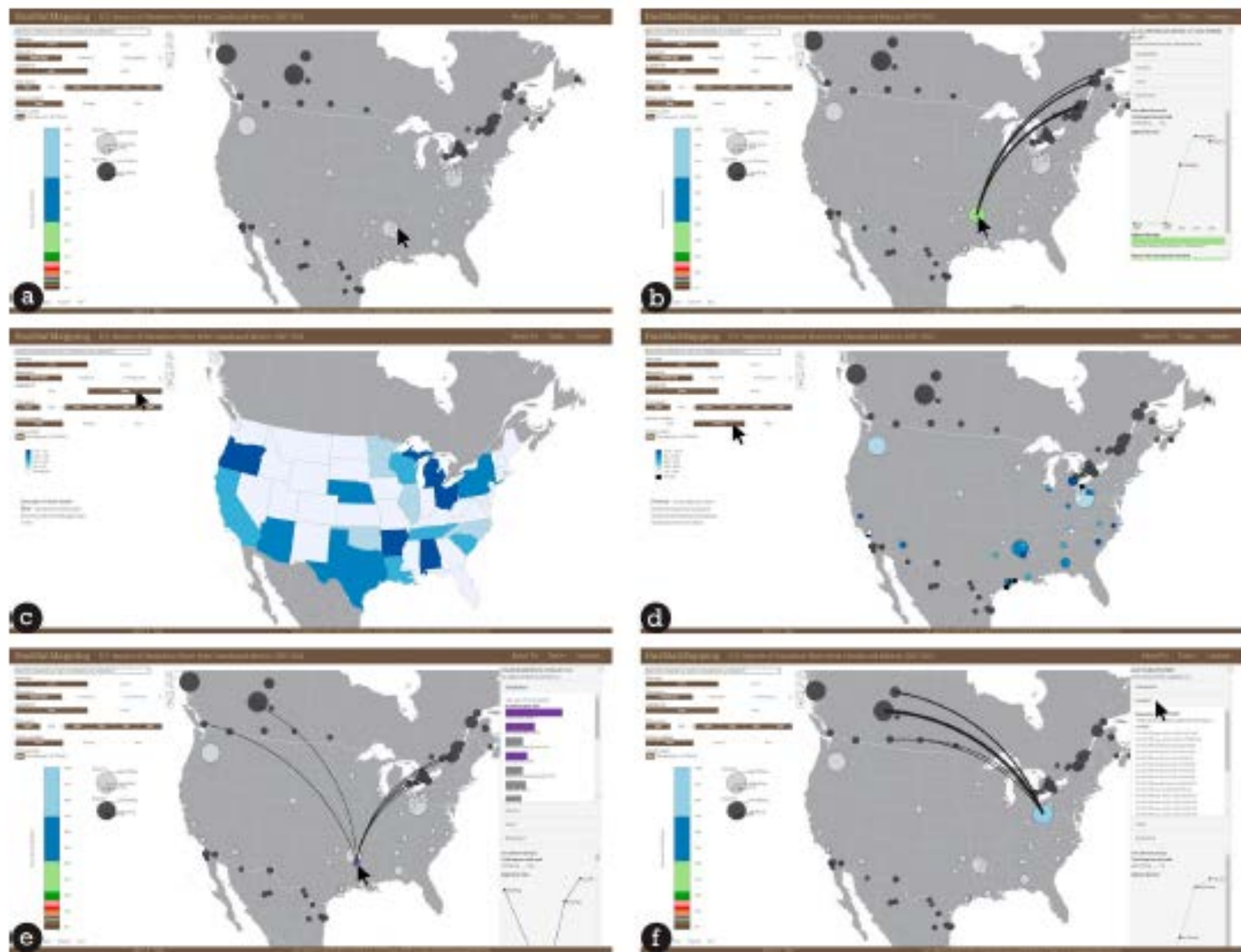
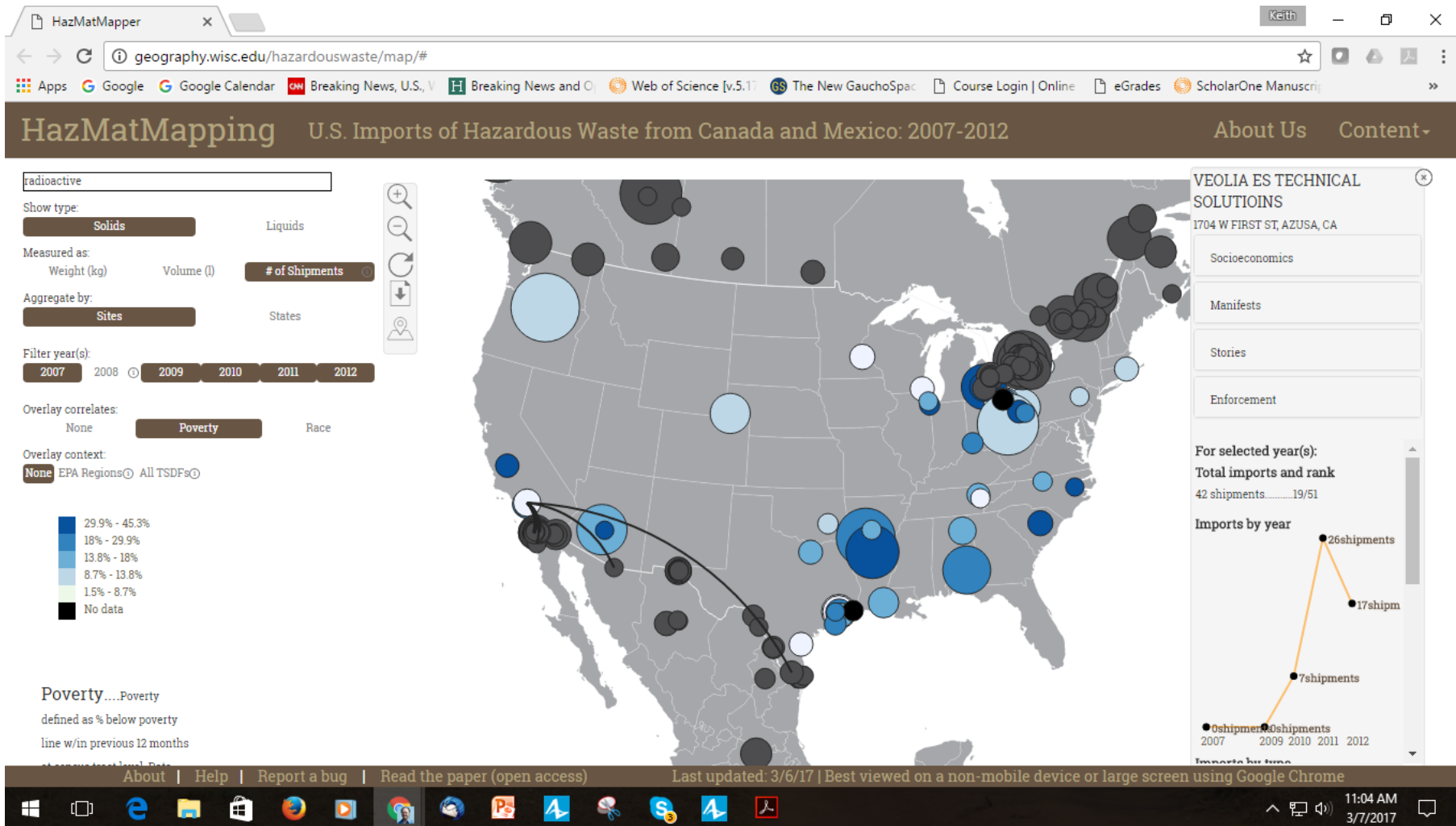


Figure 4. Using HazMatMapper through the four different interface controls: (a) proportional symbols of waste sites are the default view on the central map; (b) clicking on a site draws flow lines between exporters and importers; (c) accessing the configuration controls allows users to draw choropleths of waste imports binned by state; (d) users overlay poverty statistics through the advanced context controls; (e) clicking on a site retrieves further EJ-relevant site data in an information panel; (f) selecting 'manifests' in the informational panel lets the user download copies of the site's waste trade forms.

Radioactive Solid Waste to Azusa, CA



Conclusion

- Geographic visualization provides a number of opportunities for understanding the dataset on hazardous waste imports that we have assembled
- HazMatMapper interactive map enables map users to switch between context and detail, in the vein of Shneiderman's design mantra and in line with our attempt to overcome methodological nationalism

Campbell et al. (2016)

International Journal of Geographical Information
Science

ISSN: 1365-8816 (Print) 1362-3087 (Online) Journal homepage: <http://www.tandfonline.com/loi/tgis20>

**Safe separation distance score: a new metric for
evaluating wildland firefighter safety zones using
lidar**

Michael J. Campbell, Philip E. Dennison & Bret W. Butler

Campbell et al. (2016)

- Safety zones: areas where firefighters can retreat to in order to avoid entrapment from wildland fire. Currently, individual firefighter's or crew boss interprets vegetation conditions, topography, and spatial characteristics of potential safety zones
- Introduces a new metric for safety zone evaluation: the Safe Separation Distance Score (SSDS) and describes an algorithm for calculating pixel-based and polygon-based SSDS from lidar data.
- SSDS is calculated for every potential safety zone within a lidar dataset covering Tahoe National Forest, California, USA.
- Potential safety zones were clustered in space
- SSDS can be calculated for potential safety zones in advance of firefighting

Safety Zone

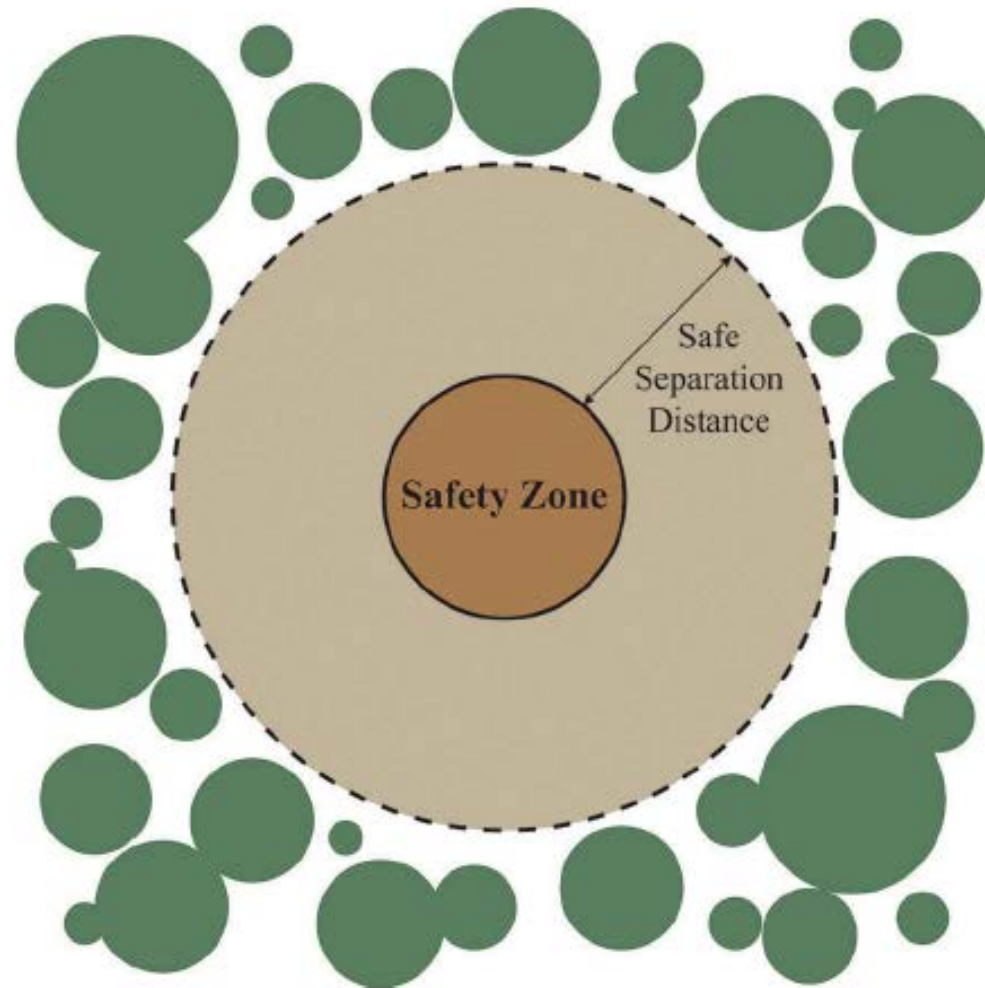


Figure 2. Basic safety zone example diagram (after Dennison *et al.* 2014).

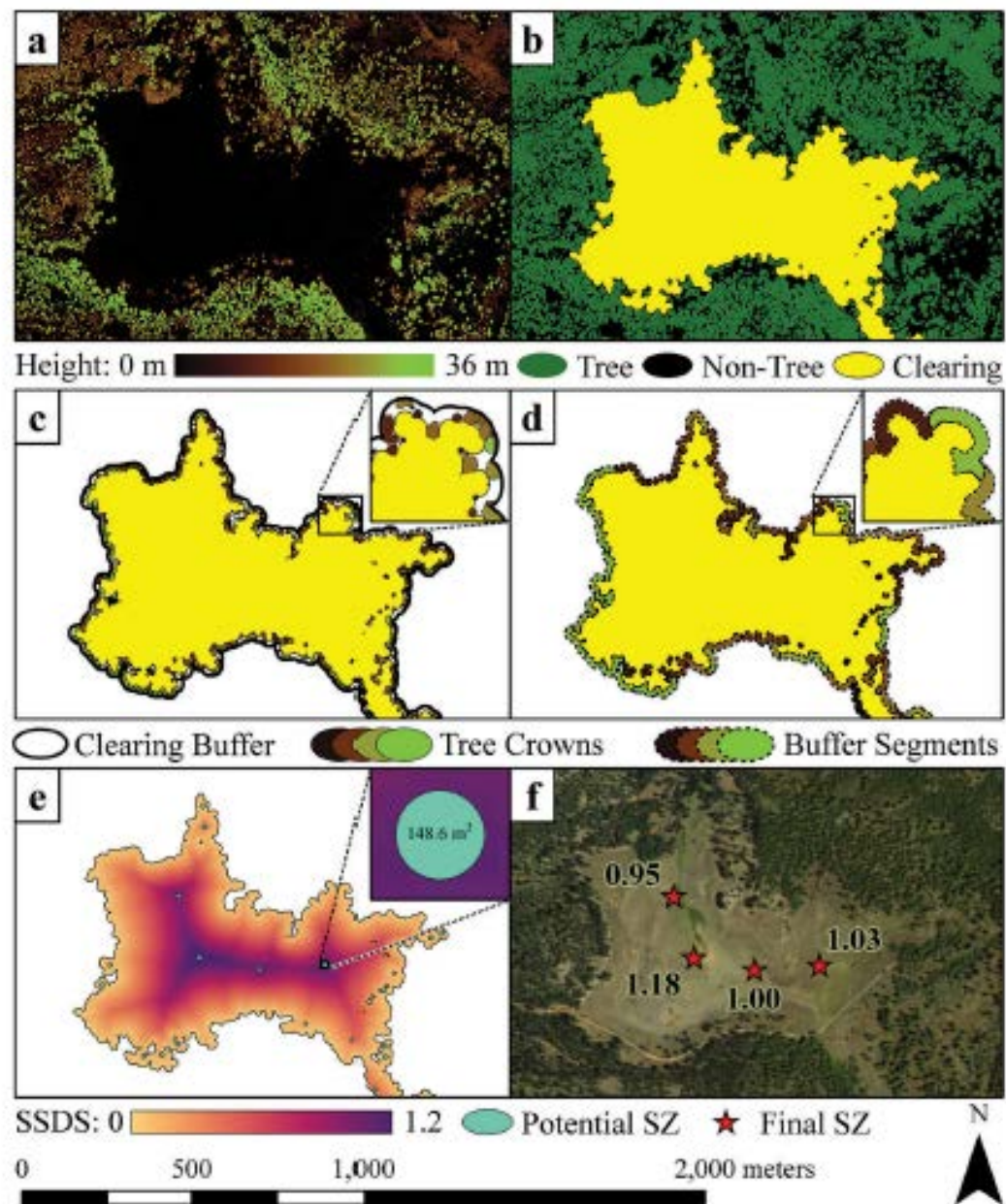


Figure 4. Model workflow from canopy height model (a) to clearing classification (b), surrounding tree crown delineation and height calculation (c), segment-based mean surrounding vegetation height calculation (d), pixel-based SSDS calculation and safety zone placement (e), and safety zone SSDS result (f).

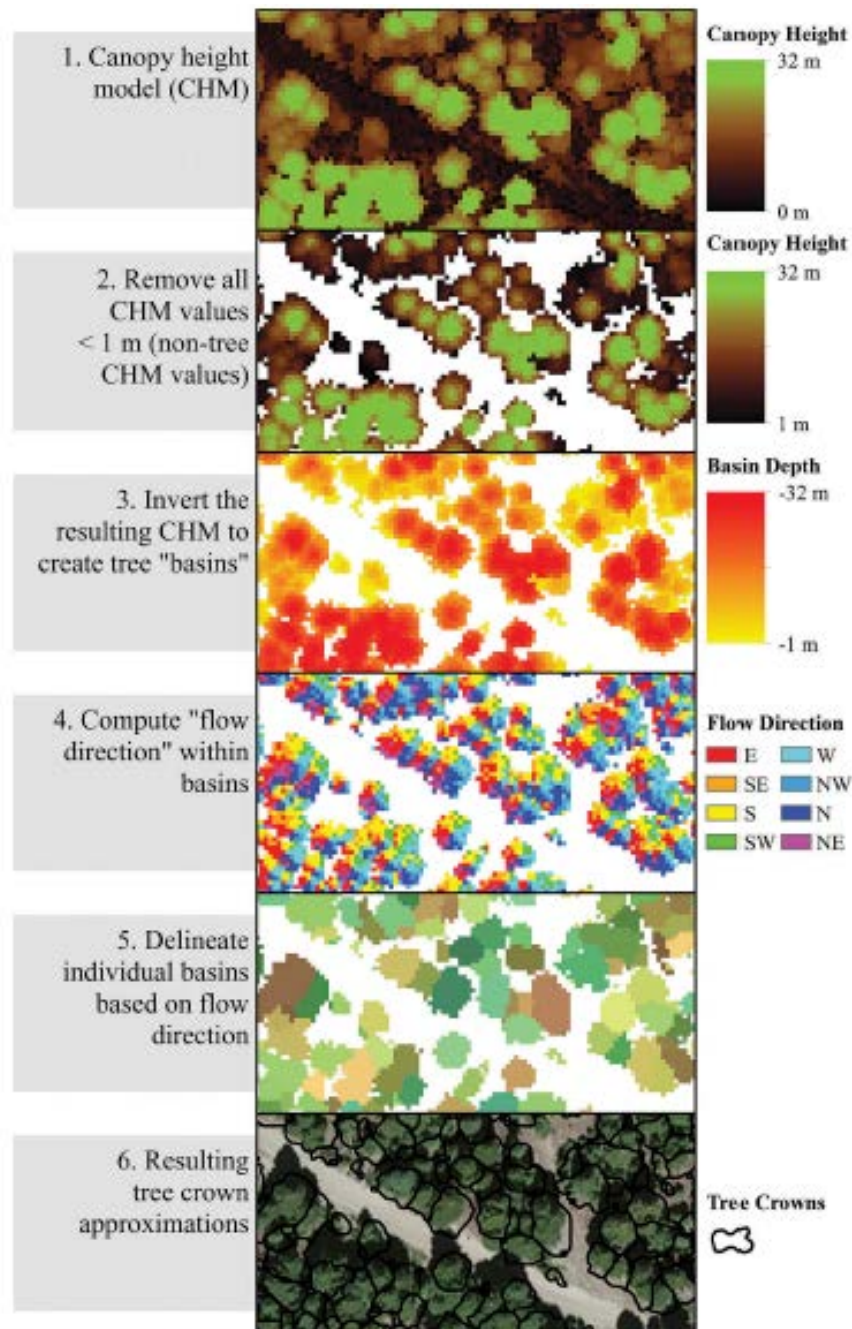


Figure 5. Tree crown delineation method.

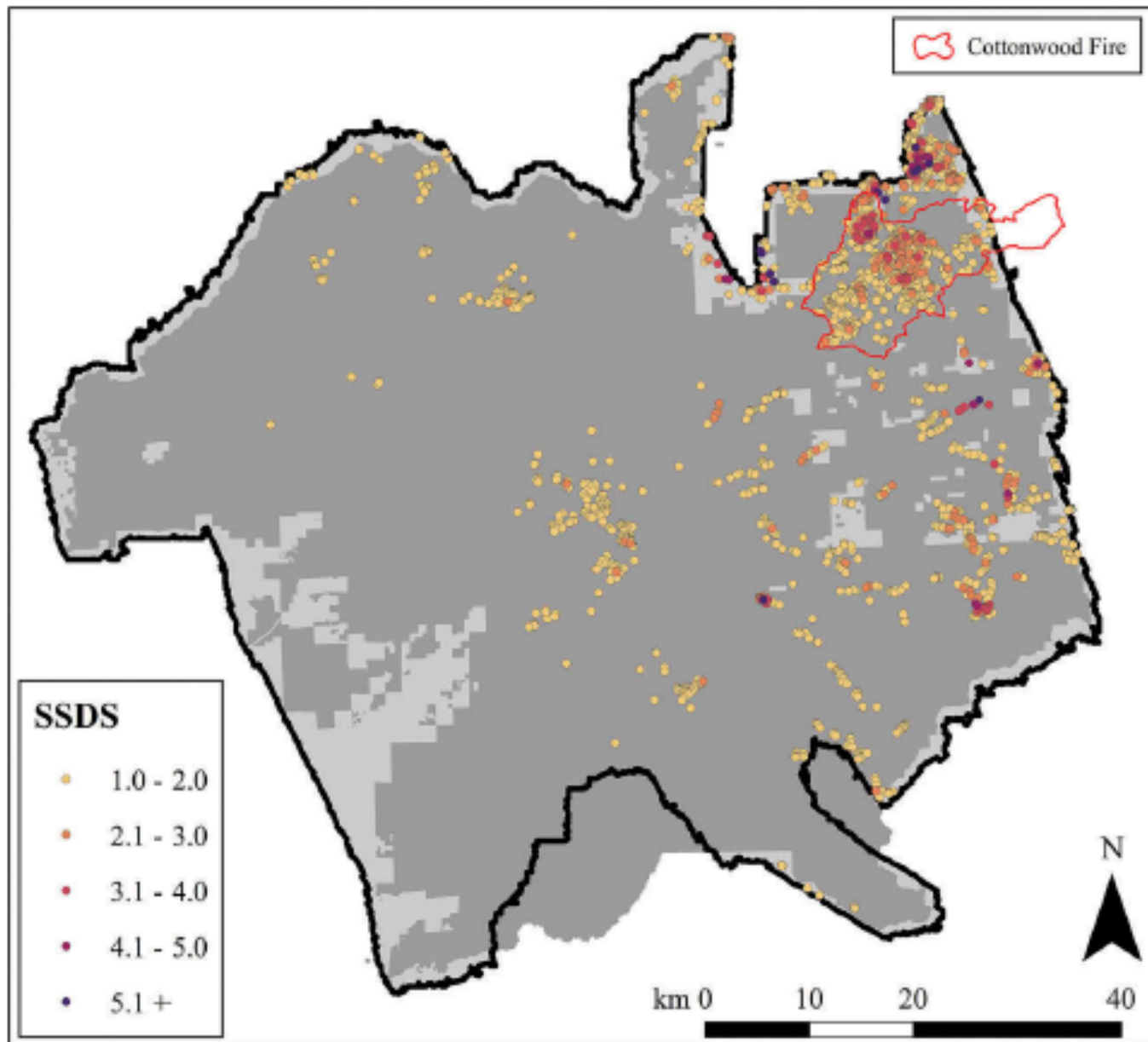


Figure 6. Potential safety zones with associated safe separation distance score values throughout the study area. The area burned by the 1994 Cottonwood fire is outlined in red.

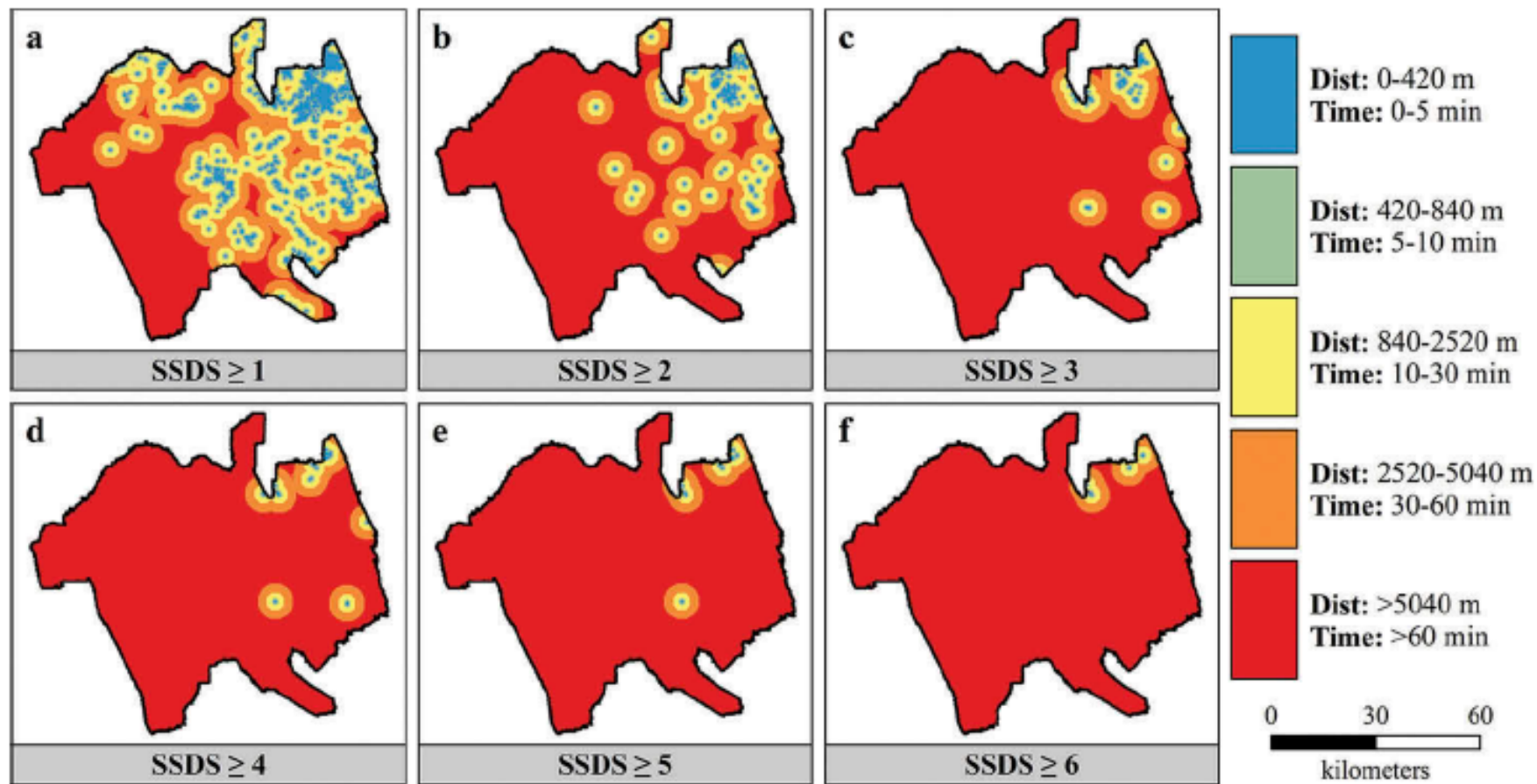


Figure 8. Euclidean distance and estimated travel time to nearest potential safety zone at a range of SSDS thresholds throughout the study area.

Findings

- Able to process LiDAR to extract clearings
- Adjust suitability for slope and wind
- Identify areas meeting a minimum standard
- Computed distance to safety
- Should make maps available for firefighters
- Can replicate elsewhere

Summary

- Li et al (2017) looked at using social media data for flood mapping
- Irmischer (2017) looked at human navigation and movement speed vs slope
- Nost et al. (2017) created an interactive map and infographic viewer for hazardous waste shipments in North America
- Campbell et al. (2016) used LiDAR and GIS to find safety zones in the Tahoe National Forest to protect firefighters

Conclusion

- New academic research adds to the scientific knowledge base behind analytical and computer cartography
- Improvement is usually incremental sometimes transformational
- Research and publishing has a set of tools and methods that can be learned (grad school)
- Whatever idea you have, someone has thought of it before!
- Can learn from both successes and mistakes