

### 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

### First review article **Original paper: Proceedings** Number of Papers Maturity: Refinement & Revision Occasional new developments Early adopters Idea into Textbooks & rediscovery

### The Nature of New Ideas

Time

### **Citation maps**



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.

_													
Ľ		ARNOLKOLK, L	DER	INFORTANCE OF COMPUTER CARTOGR				^	AUTOMATION	UTOMATION AND CARTOGRAPHY			
			OSTERREICHISCHEN GEOGRAPHISCHEN							DOI	10.2307/212211		^
C	⇔	MARBLE, DF	1983-PROFESSIONAL GEOGRAPHER	THE COMPUTER AND GEOGRAPHY - S					Docum	ient Type	Article		
С	⇒	KUBO, S	1984-IEEE	ALIS - A GEOGRAPHICAL INFORMAT				Resea	rch Area	GEOGRAPHY			
			COMPUTER GRAPHICS AND						Re	ferences	14		
Die	nlav	ing 1 - 10 of 35	* (123	4	Display	10	Records	-	Tin	nes Cited	34		
01.					5159169	10 🗸	per page	~	I	anguage.	ENGLISH		¥
		(_) 🤤	📒 🖨 🧕	) 🖸 😭	۹ 🗗	<b>5</b>	🤻					へ 臣 (か) 9:55 AM 3/7/2017	$\Box$



### 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 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 10<sup>a</sup>, Cuizhen Wang<sup>a</sup>, Christopher T. Emrich<sup>b</sup> and Diansheng Guo<sup>a</sup>

<sup>a</sup>Department of Geography, University of South Carolina, Columbia, USA; <sup>b</sup>School 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



Fig

dif

#### CARTOGRAPHY AND GEOGRAPHIC INFORMATION SCIENCE 🛞 11 ith



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** 

Taylor & Francis

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: <u>http://dx.doi.org/10.1080/15230406.2017.1292150</u>

# 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.

100







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



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



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)



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.

General Instance	15 1. Generator (D. Number	2 Page 1 al	3. Emergency Response Phone	4. Manifest Trackin	Shute OCOOO
WASTE MANFEST	158388 142 01	17 BID - 125	(800)483-3718	1 0038	96230 F
5. Generator's Name and 5 Clippers Highborn (	Canada las		State State State State	15-24-27, KOHA	
7842 Progress	Way	r name and add	Tess . 70%	Manife	est number
Delta, BC V46 3	IM NOT NOT		64 CM	44.9 1	
Generator's Phone #B/G+B	139-80-0894		1.1	U.F. INCOMENT	
Nicharabet Trans	moort ing (URM)	2560	14411	CREANA	Mich sousol
7. Transante I Campany	Name		1.14	15 (2) (3) (3)	10.97
Cleand	what Earling	man stal	Seculient	Los Imp	orter EPA ID
8. Designated Pacify Nam	is and Gile Address	DUPPROTINI	Jer on Cara	UL	
Clean Harbore E	Dorado LLo Impor	ter name and ad	dress		
309 American (	Cirele	-		ARDOGS	9749192
Facility's Plane.	1130		# of containers	Containe	r type
96.U.S. 007 Bee	cription (including Proper Shipping Name.)	Hagard Class, El Hanties,	1. Containers	1.300 12.0	
Hit and Packing Group	(fang)		a 19	9 9 VL	til. Weath Code
UN1391 W	ASTE ALNALI METAL DIS	PERSIONS, 4.3, PO I			0004
	TT-	ing Taulain	001 08	D0097 P	1
waste code	waste descript	ion   racking gr	oup		
"HME2BL, M	OASTE ALKALI METAL DIS	PERSIONS, 4.4, PG1	0.05	hannel	001
x			000	2000	
-					EPA waste
1 12			Quantity		
				Quantity	unit
4					
			1 1		
the second secon	and the second sec				
14. Special Handing Instru 1. E3,CB48725 2. E1, - CE48725	ctons and Additional Information 51 IEDG#138 51 EFRG#139	1X55 5X85			
4. Epocial handing tem, 1. ET, -CB48721 2. ET, -CE48721 15. GENCHAURISON	ctons and Additional Information 51. IED 5#138 51. ERIG#139 URDPS-CORT-CALLOR: Handly dec	1X55 5X85	are fully and accusticly described i	cover by the proper stripping is	uarre, and are classified, your
14. Epocial Handing Netry 1. KTr - CB43721 2. KTr - CB43721 15. GENERAL DR SOUTH market and tabeledy Provide: Landin Auto	ctons and Additional Information 5.1. TED 5#138 5.1. EFRIG#128 UROPS-CONTREAMOR: I havely onc Distantion, and are in all magnets in proper- tion methods, and are in all magnets in proper-	1X55 5X85 white the contents of this consignment exactlines for transport according to age to the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the constraint of the cons	are fully and accustivity described in order intervational and national gen-	core by the proor shaping a strenenial regulations. If repo	ann, and sie classified, you It shipment and I an the Pier
14. Special Handling Netry 1. E3+-CB4372: 2. E3+-CB4372: 15. GENERAL DESCRIPTION marked and tabeledge Reporter. Levelly had Incently that he waste	ctors and Actilianal Information 5.1 IED (2+5.38 5.1 ER(2+1.29 IED/SY-CORTINGATION: However, and IED/SY-CORTINGATION: However, and IED (2+5.58) IED (2	1×55 5×85 sector to the construct of the consignment endities for transport assorting to again to the terms of the alternate (TFA-drives 74 //2123)((1) from a targe quarkity per 74 //2123)((1) from a targe quarkity per	are fully and accounting described in code referencience and software pro- dedgement of Conserv.	Cove by the proper shaping a emmorial regulations. If expo by generator ( is that.	une, and we cleatified, poor d obgeneric and 1 am the Pere Year
<ol> <li>Boold Handling Netry</li> <li>B 1, - CB 4197.2:</li> <li>Z - EL 4197.2:</li> <li>Z - EL 4197.2:</li> <li>Genetical Borecommunication of the boold statements of the boold</li></ol>	ctors and Additional Information 5.1 IEE/G#138 5.1 EFRO#139 URIOFS/CONTROLATION: Interdy size Document, and are in alternagenit is proper file contains of this consignment contains minimization intervent controls in 60 C Bit gast Name	1×55 5×85 south to remain of the component available for transport association again to the terms of the strated ter M-Actions F8 2012103 (11 am a targe quartity per F9	are fully and accurately described in outer international and vehicular go- independent of Concest. encody or p1(01 am a spart quent pattern	cove by the proper shaping a emmorial regulations. If expe lygenerator ( is true.	ann, and an classifiel, poor d objevent and 1 am the Pier Yestar North
<ul> <li>R1, COMPARING States of the second sta</li></ul>	ctors and Activitial Information 51 IED GH 138 51 EFR GH 139 UNDPS-CORTIFICATION: Introduction countrel, and are in all response to proper file consignment of this consignment content minimization interment councilse is 40 C all Types Name	1255 5X85 exite the contents of this consignment resolution for transport association, a gat to the terms of the intentived UFA-denois FR 2023(1) (1) are a large quartity per To	ten fully and toosening described tools retenutions and valour go- independ of Conserv. encody or (1) (1) an a sport quest plates	Score by the proper shaping a ennormal regulations. It report by generating is true.	ares, and are clearlind, poor of objected and fair free Year of the second second second second second of the second seco
In the second seco	ctore and Actilianal Information 5.1 200.000 1.38 5.1 EERCE 1.39 URISP'S CORTECATION: Handy sec Document of the comparate in proper microscope of the comparate in proper microscope of the comparate in the CO Of Type Tables * X Input Table 3.	1X55 5X85 en foi the contents of the consequence and the for integrat some high a get to be seen of the internet IMFA-deep F4.8621(1); if i are a keep seenity per f4.8621(1); if i are a keep seenity per f4.	ten fally and bocosting described interactions and solver goo integrand of Consort, match or BJ (11 am a synt special filters	cover by the process theorem is enterinal regulations. It exper- aggenerated is true. BL/2/N2*_QVA	are, and are detailed, pool of objective law ten free Year 000 000 000 100
International Control of International     International Control of Cont	ctore and Actilianal Information 5.1 IEE/C#138 5.1 EE/C#139 IEE/C#129 IEE	1X55 5X85 souther for the consponent and the for tangent according to ago to the terms of the strender (TM-Letros 59.2012/10) (Filling a large quartity pr 10) 10) 10) 10) 10) 10) 10) 10) 10) 10)	an bily and accuracy described index meanstream and selecting po- departed of Concert, watch or Bill (1 an a signif quark policy 2.2. For of any part these barring 1.2.	oon by the proce theore a encount registries. To per- type case ( is the B4.2/W <sup>(2)</sup> , 4/A	area, and are cheatled, proc et objected and i are the Pre- Year of the Pre- off to Port of er
International Associations     International Association     Section 2014 (2012)     Reprint 2014 (2012)     Reprint 2014 (2014)     Reprint 2014     Reprint 2014 (2014)     Reprint 2014     Repri	ctors and Actived Information 5.1 IEE/C#138 5.1 EE/C#129 IEE/C#	1X55 5X85 en the toronal of the component module to targed construction of the term of the strenge (TMA deco FA 2012) (1) are a large quark, yes to be the strengt of the strenge quark, yes to be the strengt of the strenge quark yes to be the strengt of the strengt of the strengt of the str	an Uh and asserting families internet of Consert internet of Sources and the Source of Consert and the Source of Consert and the Source of Consert Data Source of Consert Data Source of Conserts Data	on by the prover the part in the prover the part of the part of th	eres, and an cheathed, poor expression and Lance Har Year 0.57 to Port of er
<ol> <li>Kin-CB44772</li> <li>Kin-CB44772</li> <li>RTr-CB4772</li> <li>RTr-CB4772</li> <li>RTr-CB4772</li> <li>Conduct Decomposition (Conduct Decomposition (Co</li></ol>	ctore and Actilianal Information 5.1 IEE/C#138 5.1 EE/C#129 IEE/C#129 IEE/C#129 IEE/C#120/IEE/CATOR: However, Souther to 40 and the content of this consignment content to 40 all type? Note: IEE/C#129	1X55 SXB5 In the two of the component module for proget sources for the source of the states of the component of Addition (1) and a large quark part of Addition (1) and a large quark part of Addition (1) and a large quark part of the source of the states of the source	an Miy and according described international and valencing on integrated of Conserv. watch of B (1) and a goal candi pattor B3. / Const enzyment Date barring 113.	on by the proce shaping a memory inguitations. The pro- type water is the Big 1/1/17 _ (1/14 57	Year Port of er
<ol> <li>Bit-CH48722</li> <li>Bit-CH48722</li> <li>Bit-CH48723</li> <li>Bit-CH48</li></ol>	ctore and Actived Information 5.1 IEEE 5.28 5.1 EEEE 5.28 IEEE/CF 129 IEEE/CF 1	1X55 SXB5	In May and accounting described in the interactional and values of integrated of QC areas. with the interaction of QC areas into a goal of the interaction of the integration of the interaction of the Date barring 12.5.	on by the prover shaping a memory in particulations. The per- trained and the second second second second second second second s	Year Port of er
<ol> <li>Brand Austring Inco.</li> <li>BTL-CEL481722</li> <li>BTL-CEL481722</li> <li>BTL-CEL48721</li> <li>GENERATE Comments of the second seco</li></ol>	ctore and Activate Information 51 2010 # 1.38 51 EFROP 1.39 URSPS CORTECUTOR: Handy sec Document of the comparement on proper interception internationarial in early the comman of the comparement on proper interception internationarial in early (X) heper to U.S. report of Docupier of Materials (Name 4	1X55 5X85 and that the consents of this consequence and the for transport association, as give to be sent of the statestic IFM-detects FR-BELIFUS (F) and a large qualify per liquid tion in Equal tion 30	In May and socurinity described index international and valorari go integrated of Conserv. International (Conserv. International Conserv.) International Conservation Data barring II.8. International Conservation Data barring II.8.	oon by the procest imports ennormal regulations. It report typenarities ( is rea. B4.17/N <sup>27</sup> , 42/A S	Port of er
A lipson Accession and a lipson accession and a lipson accession access	ctors and Activate Information 5.1 IEE/C#138 5.1 IEE/C#139 IEE/C#139 IEE/C#129 IEE/	1X55 5X85 and that the consent of this consequence and the for transport according to ago to the terms of the instructure (TM-Activos 54 2012)(1) if it are a large quantify per graduated of the conservation for the constraint of the conservation for the constraint of the conservation for the constraint of the constraint of the format of the constraint of the constraint of the constraint of the format of the constraint of the constraint of the constraint of the format of the constraint of the constraint of the constraint of the constraint of the format of the constraint of the constra	In the art country builded and country of the second secon	oon by the proce theore is encount repartment. To pro- try processor is to a. B4.27/W <sup>(2)</sup> , 47/A S2	Port of er
<ul> <li>1. Kin-CB441722</li> <li>2. Kin-CB441722</li> <li>2. Kin-CB441722</li> <li>2. Kin-CB44722</li> <li>3. GB404104 Sectors and a set of a set of the local sectors and a sector sectors and a sector sectors and a set of the local sectors and a sector sector sectors and a sector sectors and a sector sectors and a sector sector sectors and a sectors and a sector</li></ul>	ctore and Actived Information 5.1 IEE/C#138 5.1 IEE/C#139 IEE/C#15/EA/ION: Hendy fact	1X55 5X85 excitot the consents of the conservation exolution for transport excenting on any in the terms of the strender (TML denois \$9.20121(1)) (If i are a large quartity per line in the strender (TML denois \$9.20121(1)) (If i are a large quartity per line in the strender (TML denois \$9.20121(1)) 10.2012 (International International International Strends International International International Strends International International Strends International International Strends International International International Strends International International International International Strends International International International International International International Strends International I	an University of Society Marcine Society Marcine Society Socie	oni hyte prov Rapes energia spaties Top ygenesis a na. BLZ/NS, <u>eVA</u>	Port of er
A general function term 1. Kin-CB441722     Z. RTr-CB44772     Z. RTr-CB44772     Second State State     Second State     S	ctors and Actilianal Information 5.1 IEE/C#138 5.1 EE/C#139 IEE/C#139 IEE/C#139 IEE/C#129 IEE	1X55 5X85 excite the converte of the consponent resolute for transport according to app in the term of the stretched (TRACetero F8 201211); (F1 or a large quality pr F8 201211); (F1 or	In My and according described oblighter allowed and belowing on helpseen of Connex, worked on 19 (7) and a good candi patter 12. / for cit any wait candi patter 13. / for cit any wait 14. / for cit any wait	on by the proce theory of encodinguistics. To po- systemized is not. St.L.//W.5°, 4//A S2 Diffusion Reportson	Port of er D222 Box Port of er Box D222 Box D222 Box Box Box Box Box Box Box Box
<ol> <li>Bond Harding House 1. ET<sub>2</sub> - CE 48 722</li> <li>ET<sub>2</sub> - CE 48 722</li> <li>ET<sub>2</sub> - CE 48 722</li> <li>Constant of Constant on Experience Constant on Experience Constant on Constant of Constant on Theorem Const</li></ol>	ctore and Activated Information 51 2010 (#138) 51 EFAIC#139 URDPS-CORTINGATION: Interdep ded Toccarbies, and are is at magnets is proper the content of this companies or proper this company of the company of company of the company	1X55 5X85 an fail the consent of the consentence and the for integer isometry per section for integer isometry per section of the section of the consentence of the section of the integer isometry per section of the section of the consentence of the section of the section of the section of the section of the section of the consentence of the section	In May and accounting described independent and valencing on integrated of Conserv. with Conserve. III. / Conserve. Date baseling III. Part of Conserve. III. / Conserve. Date baseling III. Part of Conserve. Date baseling III. Part of Conserve. Date baseling III. Part of Conserve. Date baseling III. Part of Conserve. Date baseling III.	over by the procer integral of momental inguitations. The pro- systematic of a true. Bit 27/W2* (2/A S2 Device Reportson Control Reportson Control Reportson	Port of er 0000 100 0000 1000 0000 100 0000 1000 0000 1000 00000 0000 1000 0000 1000 0000 1000 0000 1000 0000 1000 0000 1000 0000 1000 0000 0000 1000 0000 1000 0000 1000 0000 0000 0000 0000 0000 0000 0000 0000 0000 00000 0000 0000 0000 00000 0000 0000 00000
<ol> <li>Ignoral Accine Intellig 1. ET - CE448 722</li> <li>ET - CE448 722</li> <li>ET - CE448 722</li> <li>ET - CE448 722</li> <li>Schollwitze CE448 722</li> <li>Sch</li></ol>	ctore and Addisonal Information 51 EERCE 138 51 EERCE 139 URDPS CORTECATOR: I transport counted, and are in all magnets in proper free contents of the consignment council at the GC Cartiguet Notae (X) Insper to ULS, majorit conformation (Rame Figure 0 Cartiguet States) (Rame 1 Space 0 Country (County) (Rame (County) (County) (County) (County) (County) (County) (County) (County) (County) (County) (County) (County)	1X55 5X85 are that the consents of this consequence another for transport association, as get in the terms of the instructed IFM-dences FR-dELIF(s) (F ) are a large quantify per liquid term liquid term 19 10 10 10 10 10 10 10 10 10 10 10 10 10	In May and accounting described in the international and validating on integrated of Conserve. wanted on B (CT and a goal quark pattern a goal quark	Core by the procest imports enternal regulations. If exper- sion and the process imports generators is true. B4.17/W <sup>20</sup> 4VA S Design Reports UK EPN ID Norther UK EPN ID Norther	Port of er
<ul> <li>14. Ignuel Austrice Inc.</li> <li>15. ET CEL481721</li> <li>26. ET CEL48721721</li> <li>27. ET CEL48721721</li> <li>28. CELATOR CONTENT AND A CONTENT AN</li></ul>	ctore and Actilianal Information           51         200.000 ± 3.00           51         200.000 ± 3.00           1000000         200.000           1000000         1000000           1000000         1000000           1000000         1000000           1000000         1000000           1000000         1000000           1000000         00000000           1000000         00000000           1000000         00000000           1000000         00000000           1000000         00000000	1X55 5X85 are that the consents of this consequence another for transport association, as go in the terms of the instructed IFMA-decore FR 26210(1) (1) are a target quantify per line target association of the terms of the instructed IFMA-decore FR 26210(1) (1) are a target quantify per line targ	In bit and sociality deathed into international and industry po- deather international and industry po- deather international and po- marked in the social candi- date barring 123.	oon by the proce theore a encount registries. It ease hyperator ( is the BLZ/W <sup>(2)</sup> ( U/A ) Denial Rejector U.S. (PNIO Norder	erer, and are clearlied, pact to depend and 1 are free Year Ve
<ul> <li>1. EXCBAILTY E.</li> <li>1. EXCBAILTY E.</li> <li>2. EXCBAILTY E.</li> <li>3. EXCBAILTY E.</li> <li>3. GENCIAL DESCRIPTION TO THE STATE AND DESC</li></ul>	ctors and Actived Information S1 IEE/C#138 S1 EF/C#139 UE095-20215/CATOX: Handy fac IEE/C#150/CATOX: H	1X55 5X85 are that the consent of the conservation and the for transport according to ago to the terms of the instructure (TM-Activos 54.262310) (F) are a large quantity pr G G G G G G G G G G G G G G G G G G G	In the action of the second se	oni hy thi provi Proping energial registries, Tope typescale (a tra. 84,27/N) <sup>27</sup> , <u>47/A</u> 20 Desial Rejector U.E. DNLO Kenter	eres, and are cheatled, poor d objected and i an the Per- Year lo ? to Port of er Boot D222 Work Dr 0.9 127 □ Autro
<ol> <li>Josef Austrie, Inc.</li> <li>Kin-CEL48 (72)</li> <li>Kin-CEL48 (72)</li> <li>Kin-CEL48 (72)</li> <li>Status (1990)</li> </ol>	ctors and Actiliand Information           51         IED C # 5.38           52         IED C # 5.38           53         IED C # 5.38           54         IED C # 5.38           55         IED C # 5.38           56         IED C # 5.38           57         IED C # 5.38           58         IED C # 5.38           58         IED C # 5.38           59         IED C # 5.38           50         IED C # 5.38           51         IED C # 5.38           52         IED C # 5.38           53         IED C # 5.38           54         IED C # 5.38           55         IED C # 5.38	1X55 5X85 excitot the consense of the consequence excitot the transport excenting on age to the sense of the strender (TM-Aderos 59.2012)() () or a large quarkly pr line transport 2012) () Expand team 59. () Type	an Miy and according described and international and belowing po- helpseer of Connect. and Connect. Biology of the angular canding the bearing 12. Data bearing 12. Problem Describe Machine Technology Startion	on by the prove theorem executed registries. To po- sygnetized is the BLL/WP (VA D) Design Reports UK EN ID familie UK EN ID familie	ere, and an cheated, poor chapment and it an the free Year of the Port of er Boot 55 D292 Mach 56 D292 Mach 56 D202 Mach 56 D202 Mach 56 D202 Mach 50 D202 Mach 50 Mach 50 Mac
<ul> <li>1. Enc 284-817.21</li> <li>2. ETC - CE 4817.21</li> <li>3. ETC - CE 4817.21</li> <li>4. Encoded a Department of the second department of th</li></ul>	ctors and Activated Information 51 20.000 + 1.38 51 EFACE + 1.39 URDPS-CORTENCATION: Intrody size Cocarted, and are is all magnets is proper information materiant conclusion of the content of the companies of cocarted, information and are in all magnets in an are information and are in all magnets in a content of the cocarted of the companies o	1X55 5X85 as that he constrained the consponent and the for integer isomethyle and the term of the strends IPA dates F4.2423(s) (f i set a logg paidly pe logger ison logger ison logger ison logger ison logger ison	an Mily and accounting described independent and subject particular independent of concer. with the subject particular particular of the subject particular Data baseling 11.5. Particular particular	Cont by the procer Property of environd inspections. To po- sygnetized is the BLL//W <sup>2+</sup> _QVA 22 Differential Rejection U.S. ETN ID Namber	erre, and are desided, paol d objected and 1 are the free Year and Port of err Boot D22 D23 D4 D4 D5 D5 D5 D5 D5 D5 D5 D5 D5 D5
<ul> <li>14. Ignoral Accelling International Control of the International</li></ul>	ctors and Activate Information 51 2010 # 1.38 51 EFAIC# 1.39 URDPS/DORTPONTON: Handy sec Decarded, and are is at magent is proper free content of the consignment or proper free content of the consignment of t	1X55 5X85 are that the constrained that consequence another for transport association, as get in the terms of the instrated IFM-detects FR-dELET(s) (F) are a large quantify per liquid term prime terms of the second second second second prime per terms of the second second second second per terms of the second second second second second per terms of the second sec	In bij and soosnie deuriked inde menuteral eel sekon ge deuriken word of pi (11 an a syst sunt biller IS. Fond emploie Deuriken Deuriken Merikel Merike Sunt Sekon Sunto Sekon Sunto	Core by the procest Papers enternal registries. It early generated is to a. BLZ/W2 _ gVA 	erre, and are detailed, pool of objected and are the free Year Port of err Note: Top 0,9,27 Units: Top 0,9,27 Units: Top 0,9,27 0,9
<ul> <li>1. ET-CB48721</li> <li>2. ET-CB48721</li> <li>2. ET-CB48721</li> <li>3. ET-CB48721</li> <li>3. ET-CB48721</li> <li>3. ET-CB48721</li> <li>3. ET-CB48721</li> <li>3. ET-CB48721</li> <li>4. ET-CB</li></ul>	ctore and Actived Information 51 EERC#138 51 EERC#139 URSPS-DERTFICATION: Handy sec Decarded, and are is all magnets is proper in elements on adversarial second and and and and and and and and and a	1X55 5X85 are that the common of the component readilies for transport associations and in the terms of the instructed IFM-denses FR JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target quantify per line strape transport fr JREIT(1); (f) are a target q	In bij and sooning deutlood ade meeting ee deutlood ade sooning of the soon ade to be a soon and address and a soon a soon and address and a soon a soon a soon address and a soon	one by the proce theore a encount registries. To per- systematic la tras.	erer, and are clearlied, pack to depend and 1 are free Year 1 o ? to Port of ere 1 o ? to 0 29,22 Work Dry 0 9 27 □ not he more Dry 0 0 100
A general function later A (2014) (2014) A (2014) (2014) A (2014) (2014) A (2014) (2014) (2014) (2014) A (2014) (2014) (2014) (2014) A (2014) (2014) (2014) (2014) A (2014) (2014) (2014) (2014) (2014) (2014) A (2014) (2014) (2014) (2014) (2014) (2014) A (2014)	close and Actived Information     S1 IEEE S138     S	1X55 5X85 sector te conerci of the component reading for intervention of the component reading for intervention of the component reading for intervention of the component reading of the intervention of the intervention of the intervention reading of the intervention of the intervention of the intervention reading of the intervention of the inte	In the and sounds in device your sector of the sector of t	oni hy tri prov Paper energia reputition, Topo ygenerati la tras. BLZ/NI <sup>-5</sup> <u>(VA</u> Destai figlector UE EPA D fuerter L	eres, and are clearlied, poor of object and 1 an the Per- Veran 1 o \$ ₹0 Port of er 1000 50 1000 50 100
<ul> <li>1. Etc CB48 722</li> <li>2. Etc CB48 722</li> <li>2. Etc CB48 722</li> <li>3. Etc CB48 722</li> <li>3. Etc CB48 722</li> <li>3. Constant De South Expose 1 senses Expose 1 senses Expose 1 senses</li> <li>4. Introduct Segments Transporter (phase 1 senses</li> <li>4. Storagency Holeson</li> <li>5. Storagency Holeson</li> <li>4. Storagency Holeson</li> <li>5. Storagency Holeson</li> <li>5. Storagency Holeson</li> <li>5. Storagency Holeson</li> </ul>	ctors and Activated Information 51 20.000 + 1.38 51 EFACE 1.39 URDPS-CORTINGATION: Transle and Content of the company of a progen information manematic conclusion of a progen informatic conclusion of the informatic conclusion of a progeneric conclusion of the informatic conclusion of a progeneric conclusion of a prog	1X55 5X85 an that the constrained that consignment and the for integrat isomethy by the term of the internet IPA-date of the internet	an Mily and accounting described outer international and subscription integrated of Connect. autorical of (1) and a goal cause processing of (1) and a goal cause the barring 12. Data barring 12. Processing of the subscription of and mayoling systems) And oncept as used in laws The goaler	on by the prove thoppes eccentral registries. To po- sygnetized is true.	erre, and are cheatled, poor e objected and are the Per- son  o?  €0 Port of err BOR 56 D222 Mach 50  o?  27 □nuffer North 5a

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) dicking 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 El-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



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 grown 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