

Beyond our Borders: Contextualizing Humanitarian Crisis Situations

Brian Tomaszewski, Ph.D.
Center for Multidisciplinary Studies
Rochester Institute of Technology

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3rd Annual DHS University Network Summit
Student Research In Visual Analytics for a Safer Nation



19 March 2009



R·I·T

GeoVISTA 

Outline

- Research Overview and Goals
- Implications for Visual Analytics Research
- Outreach Examples
- Implications for HLS
- Summary and Conclusions

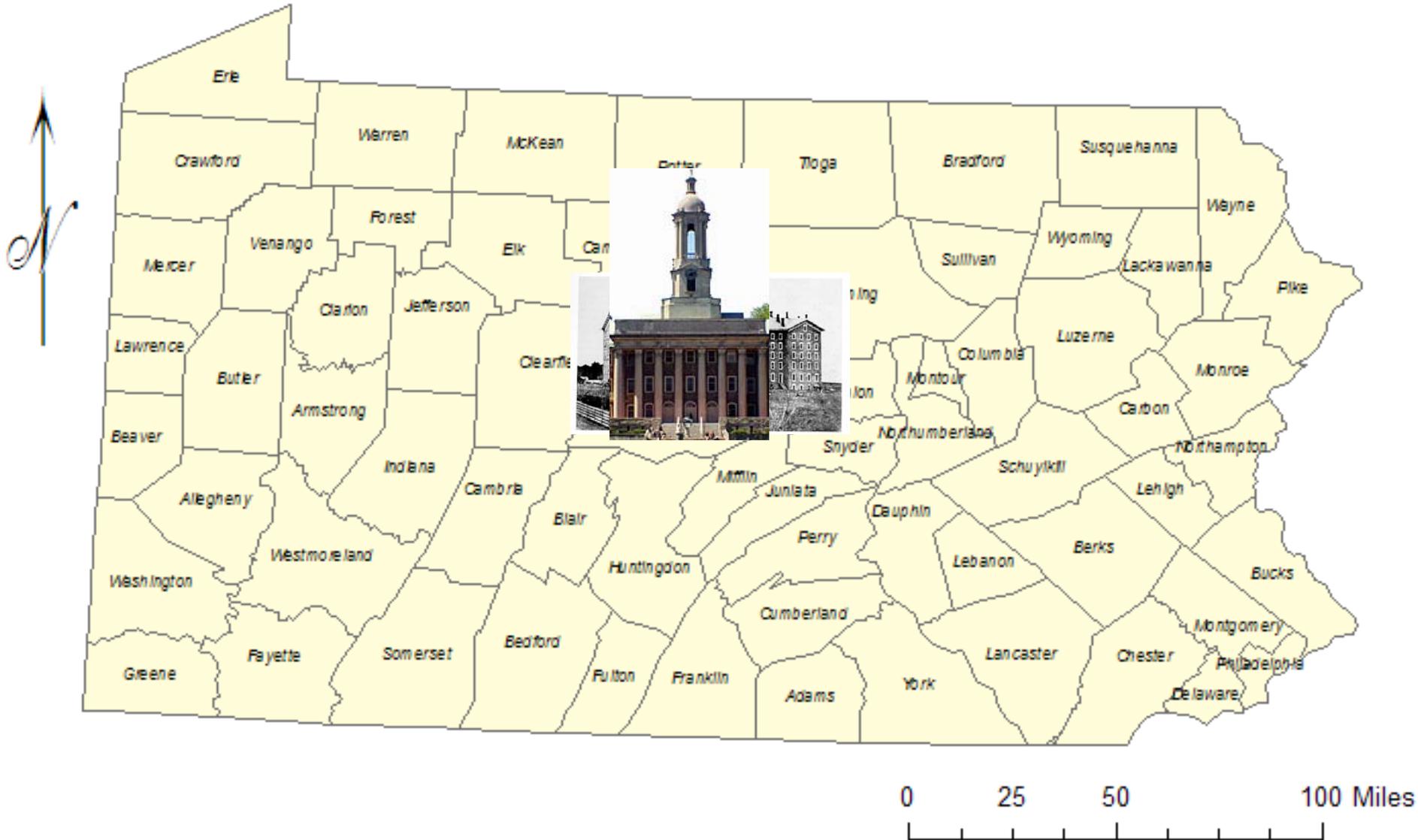
What is Context?

- **Context** - circumstances that form the setting for describing a situation
- **Context Information** - specific information needed to understand context
- **Geographical Context** - interconnectedness of phenomena, events, and place across multiple spatial scales
- **Historical Context** - interconnectedness of past situations across multiple temporal scales
- **Geo-historical Context (GHC)**— a context derived from intersection of historical and geographical contexts

Geo-historical Context

PSU in 2007?

PSU in 1876?



Problem Domain

- No approach for modeling GHC or reasoning with GHC
- Information to contextualize situations is vast and heterogeneous – implicit information
- Applied problem – use of GHC in collaborative crisis management situations

Research Goals

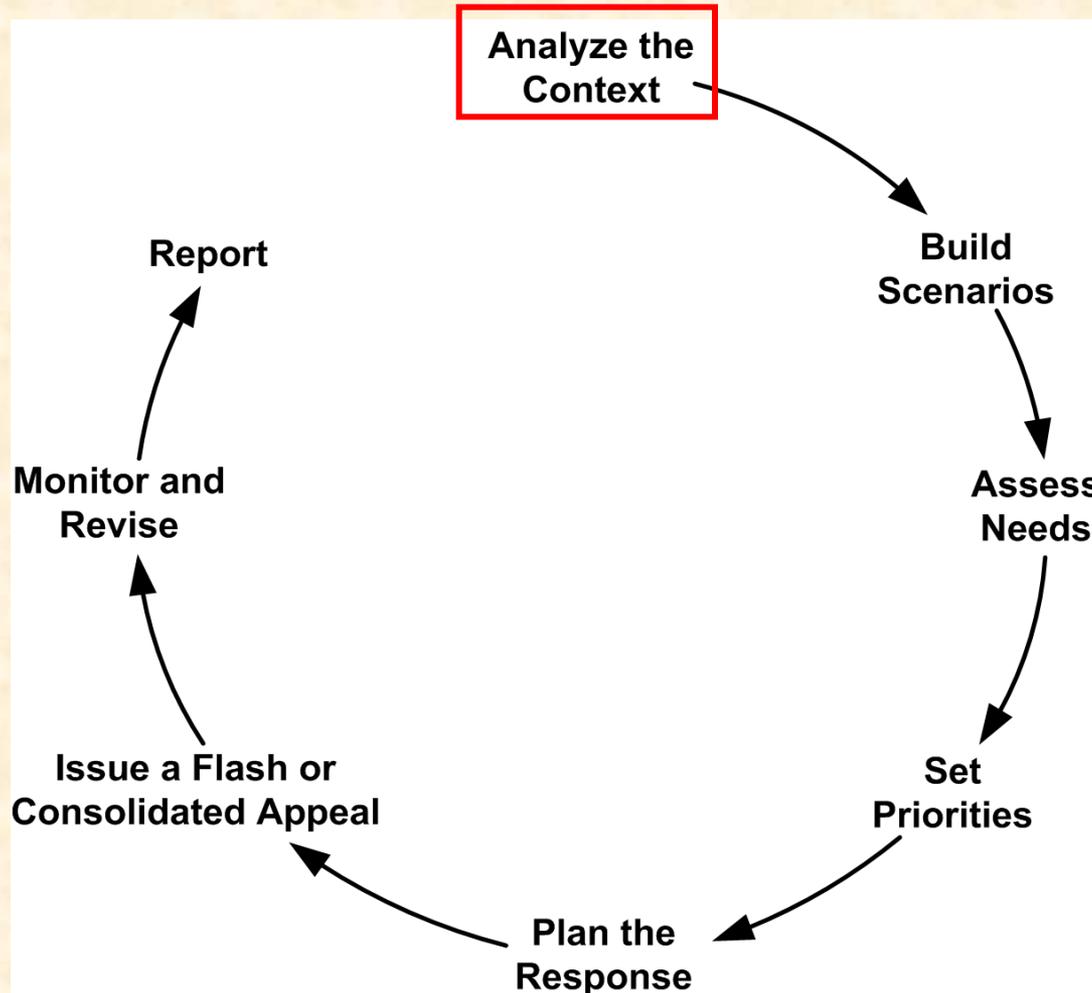
1. Develop a model of GHC
2. Implement proof-of-concept Geovisual Analytic system to produce GHC for use in collaborative crisis management
3. Evaluate approach to move proof-of-concept Geovisual Analytic system toward potential deployable system

Methodology

- Goal 1 – theory of context, model implementation in OWL-DL
- Goal 2 – visual interface components, geographic information retrieval (GIR) and automated reasoning
- Goal 3 – computational evaluations and user studies

Case Study - Sudan

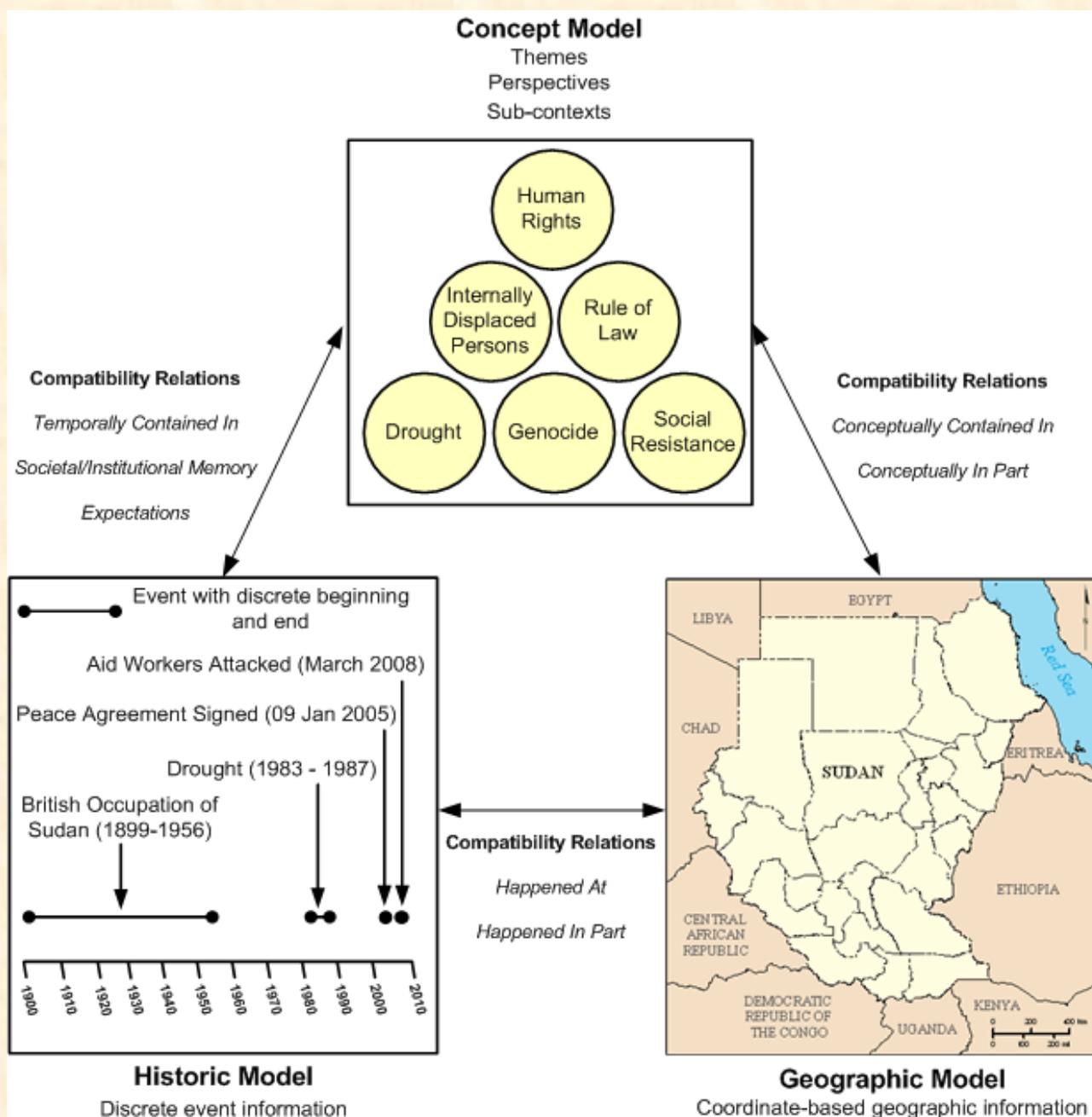
Humanitarian Context Analysis



The Consolidated Appeals Process (CAP)

Consolidated Appeals Process (CAP)

- Context analysis is meant to “outline the root cause of the crisis and its evolution, including any regional or historical dimensions” (Office for the Coordination of Humanitarian Affairs (OCHA), 2007).
 - What are the locations that have been effected by the crisis over a given time period?
 - How do locations relate to events and thematic/conceptual aspects of the mission or focus of a group developing a CAP?



B. Tomaszewski, "Producing Geo-historical Context from Implicit Sources: A Geovisual Analytics Approach," *The Cartographic Journal*, vol. 45, pp. 165-181, 2008.

Goal 2 - The Context Discovery Application (CDA)

- Visual interfaces to support analytical reasoning
- Asynchronous Geocollaboration Support
- Computational processing, geocoding and visualization of place names
- Automated reasoning for document ranking

Geovisual Analytics

- **Visual Analytics** - the science of analytical reasoning facilitated by interactive visual interfaces
- **Geovisual Analytics = Geo + Visual analytics**
 - analytical reasoning and decision-making with geospatial information

Document Review

Data Views

CAP Projects Search Results Concepts and Time GeoCollaboration

Search Results Ranked by Relevance to Query

The UN system reponse to the world food security crisis (as of 31 July 2008)
Source: Date: 31 Jul 2008 The UN system has rapidly taken note of the seriousness of the challenges to world food security by the recent dramatic escalation of the food price crisis...
<http://www.reliefweb.int/rw/rwb.nsf/db900SID/MUMA-7HB4EJ?OpenDocument&RSS20=02-P>

FEWS South Sudan Food Security Update Jul 2008
Source: Date: 31 Jul 2008 - Northern parts of the Western Flood Plains, including Aweil West, North, East and South, Gogrial and Twic Counties, and eastern parts of the Eastern...
<http://www.reliefweb.int/rw/rwb.nsf/db900SID/YSAR-7HBRZJ?OpenDocument&RSS20=02-P>

Floods in Sudan: Displaced and food crisis
Source: Date: 08 Aug 2008 Seasonal heavy rains in the Northern Bahr el-Ghazal state, in South Sudan, have caused the Kuom River to overflow in the town of Aweil, displacing at...
<http://www.reliefweb.int/rw/rwb.nsf/db900SID/LRON-7HBF2S?OpenDocument&RSS20=02-P>

Sudan: Security Council must oppose efforts to ensure impunity for Darfur
Source: Date: 30 Jul 2008 Amnesty International today called on the United Nations Security Council to reject initiatives to defer the investigation and prosecution of crimes in...
<http://www.reliefweb.int/rw/rwb.nsf/db900SID/AMMF-7H9HLP?OpenDocument&RSS20=02-P>

Humanitarian action in Southern Sudan weekly bulletin, week 30, 27 Jul - 02 Aug 2008
Source: Date: 02 Aug 2008 - 60,299 refugees returned home so far in 2008 - Security incidents hamper refugee and IDP repatriation operations (see Section III) - Localized flooding...
<http://www.reliefweb.int/rw/rwb.nsf/db900SID/LSGZ-7HBC9L?OpenDocument&RSS20=02-P>

Sudan: Hundreds of thousands in Darfur receive agricultural and veterinary assistance
Source: Date: 21 Jul 2008 The International Committee of the Red Cross (ICRC) completed a major aid

Selected Item Details: Toggle Named Entities
Concepts Found: Food Sudan Southern Food

Source: Date: 08 Aug 2008 Seasonal heavy rains in the **Northern Bahr** el-Ghazal state, in **South Sudan**, have caused the **Kuom River** to overflow in the town of **Aweil**, displacing at least 40,000. A further 1,500 people were left homeless in 14 villages of the neighbouring Warrab state. We are attempting to reach those in need as quickly as possible, working quite closely with the local government, which has set up a crisis management committee, said **David Gressly**, the **United Nations** regional coordinator for **southern Sudan**. The high water levels have raised fears of increased cases of cholera, typhoid and malaria. The semi-autonomous region of **South Sudan** is suffering the consequences of the food crisis: In **Gogrial** East alone, it is reported that 12 people have died of hunger in the last week. While the soaring food prices are worldwide, fragile states and vulnerable populations like ours who purchase food daily from an unorganised market face greater risk of starvation and poverty, said a member of parliament for the area, specifying that food prices in the south had risen by 11% between February and June. The consequences of the flooding are also affecting some 50,000 civilians that fled from the **Abyei** oil region disputed between the government of **Khartoum** and **South Sudan** authorities, theatre to violent fighting in May. Conditions continue to deteriorate because of the rains. Until the situation in **Abyei** is resolved with

Content

Select web view option:
Welcome Screen/Information Map Web Browser

ReliefWeb [log in](#) | [My ReliefWeb](#) |

this section entire site [Advanced](#)

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PROFESSIONAL RESOURCES **MAPS**

AFRICA »
AMERICAS »
ASIA »
EUROPE »
OCEANIA »

Source: [Missionary International Service News Agency \(MISNA\)](#) Print E-mail Save
Date: 08 Aug 2008

Floods in Sudan: Displaced and food crisis

Seasonal heavy rains in the Northern Bahr el-Ghazal state, in South Sudan, have caused the Kuom River to overflow in the town of Aweil, displacing at least 40,000. A further 1,500 people were left homeless in 14 villages of the neighbouring Warrab state. 'We are attempting to reach those in need as quickly as possible, working quite closely with the local government, which has set up a crisis management committee', said David Gressly, the United Nations regional coordinator for southern Sudan. The high water levels have raised fears of increased cases of cholera, typhoid and malaria. The semi-autonomous region of South Sudan is suffering the consequences of the food crisis: 'In Gogrial East alone, it is reported that 12 people have died of hunger in the last week. While the soaring food prices are worldwide, fragile states and vulnerable populations like ours who purchase food daily from an unorganised market face greater risk of starvation and poverty', said a member of parliament for the area, specifying that food prices in the south had risen by 11% between February and June. The consequences of the flooding are also affecting some 50,000 civilians that fled from the Abyei oil region disputed between the government of Khartoum and South Sudan authorities, theatre to violent fighting in May. 'Conditions continue to deteriorate because of the rains. Until the situation in Abyei is resolved with a full withdrawal of all forces, the establishment of a joint police force, an integrated unit on the military side and an interim administration, it is unlikely that there will be a major movement of people back', added the UN representative.

[See all maps](#)
[Emergency](#)

[By Emerge](#)
[Global food](#)
[Sudan: Floo](#)
[2008](#)

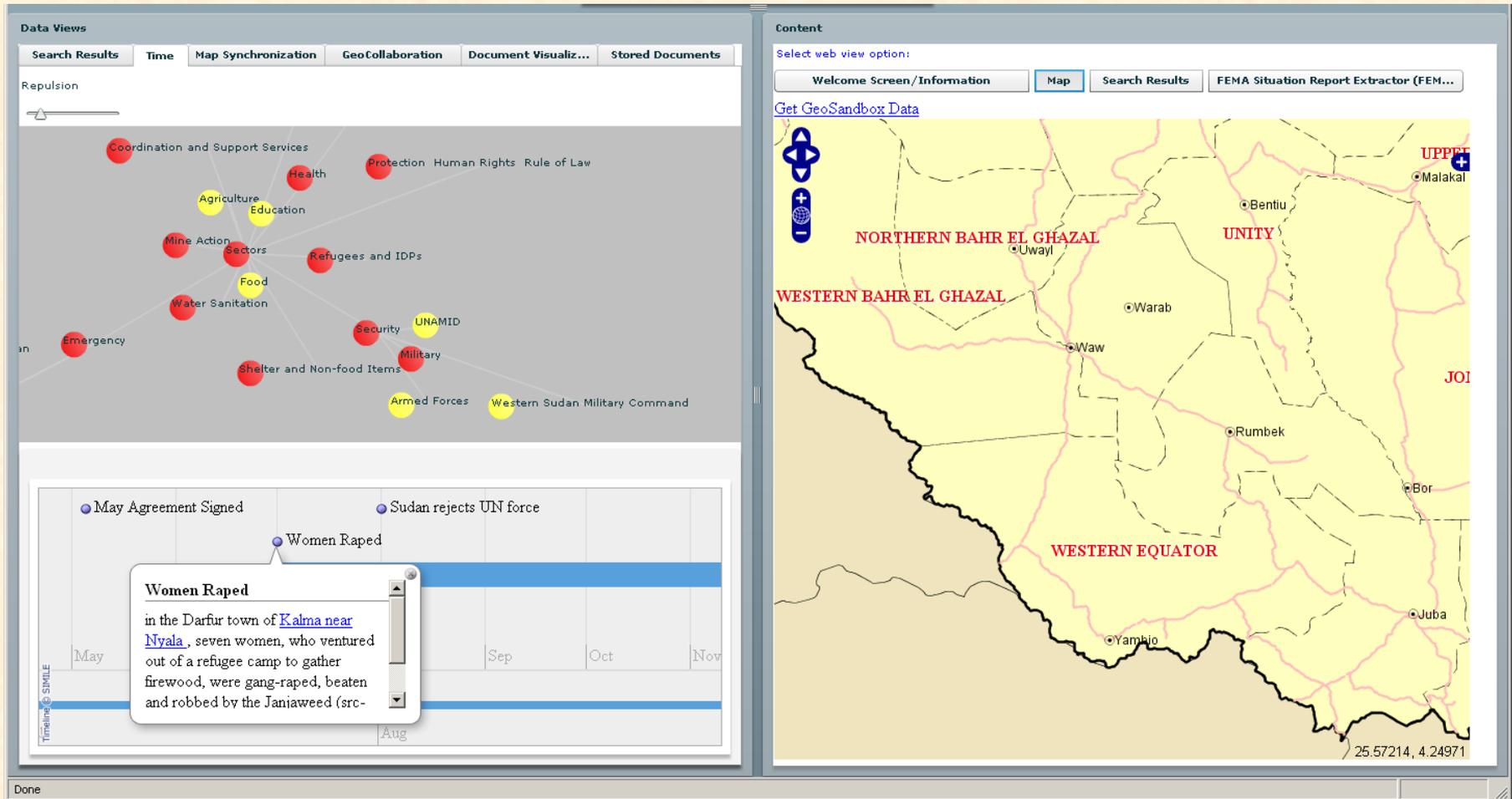
[By Country](#)
[Sudan \(the\)](#)

[By Source:](#)
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[Service Nev](#)
[\(MISNA\)](#)

[By Type:](#)
[News](#)

IR01

Space/Time/Concept Interface



Asynchronous Geocollaboration

The image displays a web application interface for asynchronous geocollaboration, divided into two main panels.

Left Panel: Sudan CAP Project Search

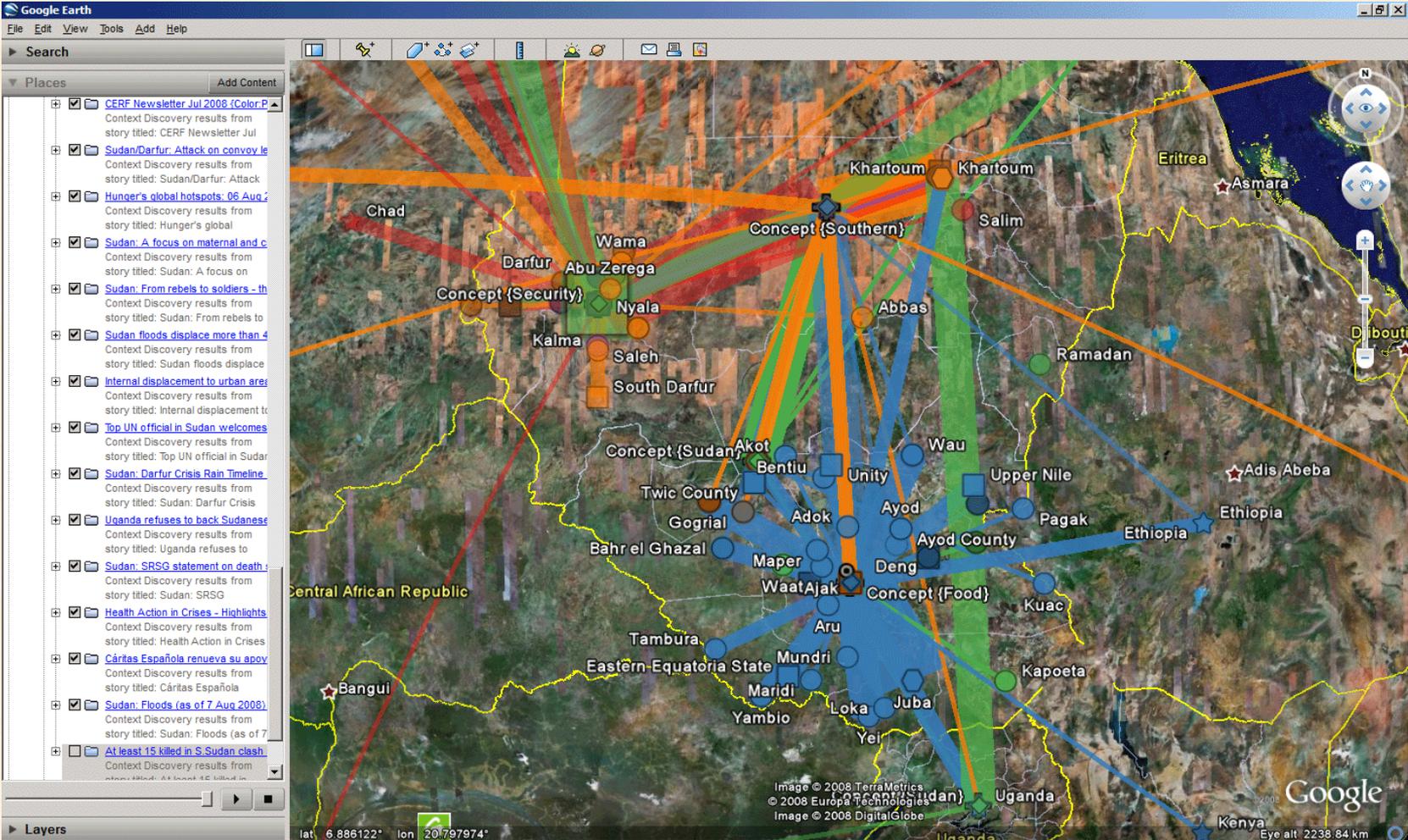
- Data Views:** Search Results, Concepts and..., Map Tools, **GeoCollabora...**, CAP Projects
- Geocollaboration Login:** Users: **Brian** (dropdown), **Login in**, **Logout**
- Currently Logged in as: Brian
- Create New GeoMessage (Modal):**
 - From: Brian
 - To: **Everyone** (dropdown)
 - Subject: Security Situation
 - Message: Raids near Al Fashir and in Southern Darfur region
 - Include Current WMS
 - Include Selected Annotation
 - Send Message**, **Cancel**
- GeoMessages Received:** Message From: Everyone, Brian, Lauren
- Message Body: [Empty text area]
- View GeoMessage on Map**, **Compose GeoMessage**

Right Panel: Content

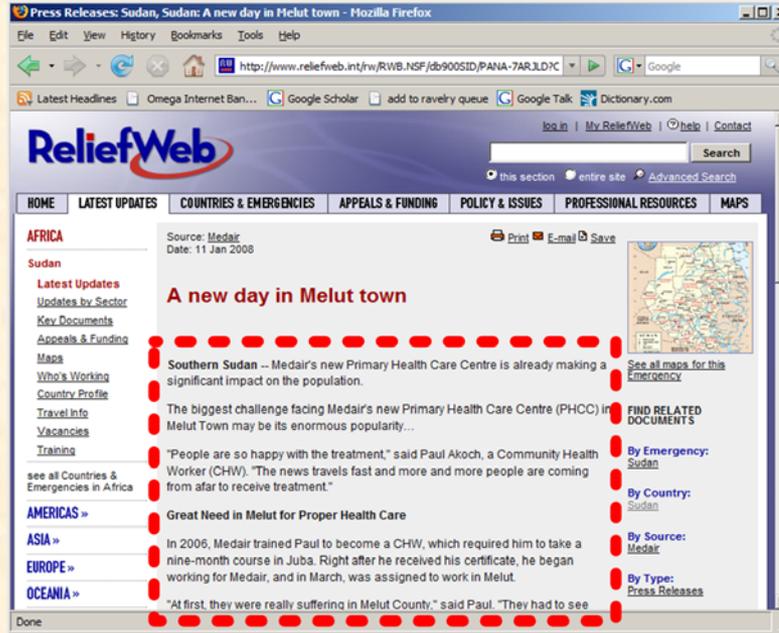
- Select web view option: **Welcome Screen/Information**, **Map**, Search Results
- Drawing Controls:** Navigate, Draw Line, Select Line
- Map Tools:** [Get GeoSandbox Data](#) (Empty), Synchronize My Map with Google Earth
- Map:** A map of Sudan with regional labels: NORTHERN DARFUR, WESTERN DARFUR, SOUTHERN DARFUR, WESTERN BAHR EL GHAZAL, NORTHERN KORDOFAN, SOUTHERN KORDOFAN, and UNITY. A blue circle highlights the Al Fashir area. Other locations marked include Abéché, An Nahud, and Al Ubayyic.

Done

Google Earth Visualization



Geographic Information Retrieval



Relevant content section from a web page is extracted by identifying HTML tags (<p>, <TD> etc.)

Prevents gathering outlying page information that can create false/irrelevant information.

Southern Sudan -- Medair's new Primary Health Care Centre is already making a significant impact on the population.

The biggest challenge facing Medair's new Primary Health Care Centre (PHCC) in Melut Town may be its enormous popularity...

"People are so happy with the treatment," said Paul Akoch, a Community Health Worker (CHW). "The news travels fast and more and more people are coming from afar to receive treatment."

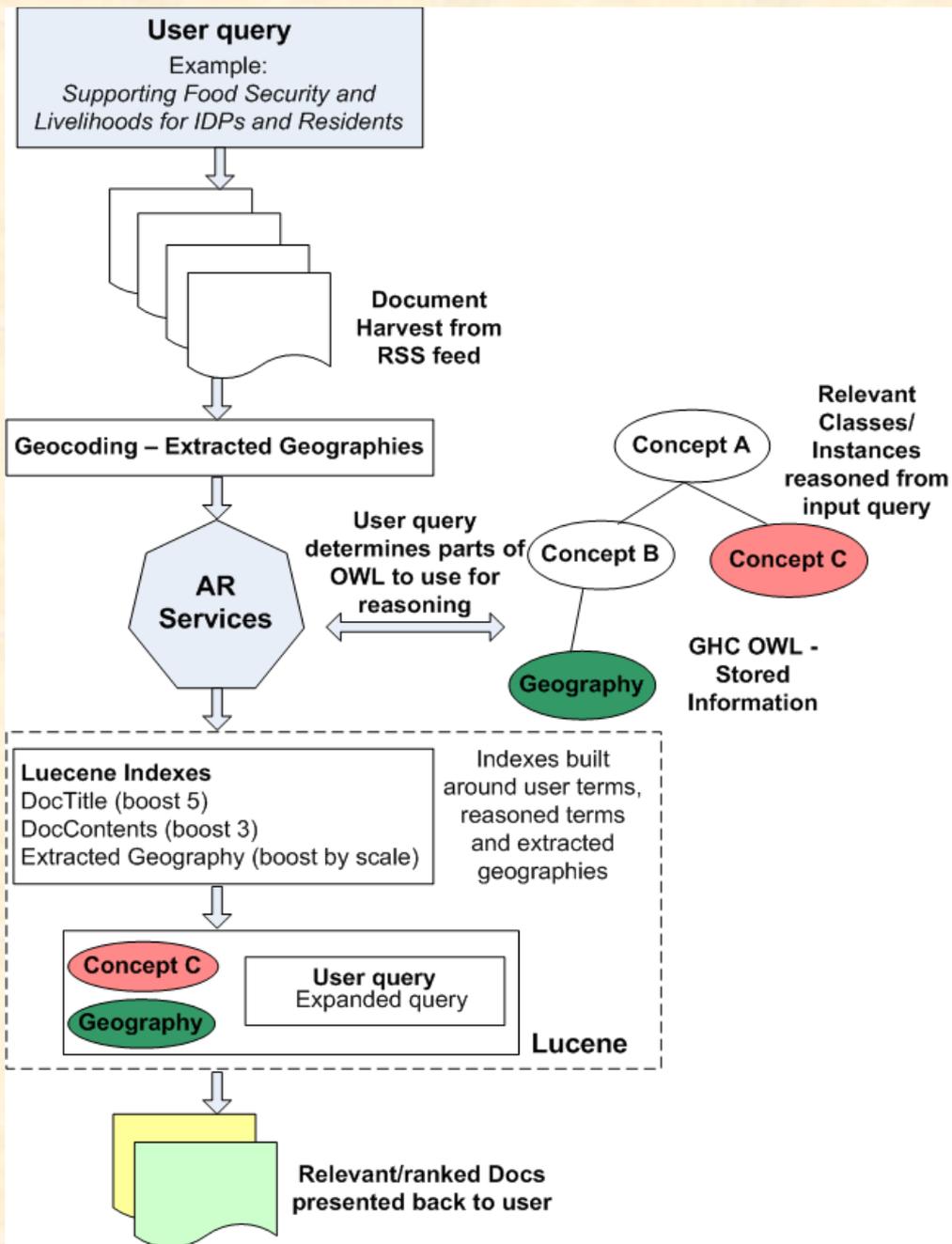
Great Need in Melut for Proper Health Care

In 2006, Medair trained Paul to become a CHW, which required him to take a nine-month course in Juba. Right after he received his certificate, he began working for Medair, and in March, was assigned to work in Melut.

"At first, they were really suffering in Melut County," said Paul. "They had to see

Items of interest can then be found in the raw text using computational procedures. In this example, concepts of interest are in pink, geographic entities of interest are in green.

Automated Reasoning and Document Ranking



Goal 3 - Evaluation

- User studies with GeoVISTA and United Nations (UN) ReliefWeb
 - Usability: identify usability issues with the CDA
 - Utility: use the CDA to accomplish tasks
- Computational Evaluations of geocoding and search engine functions

What is ReliefWeb?

- United Nations (UN) funded organization
- Office for the Coordination of Humanitarian Affairs (OCHA)
- Collection, maintenance, development and dissemination of humanitarian information to the humanitarian community
- Offices in New York City; Geneva, Switzerland; and Kobe, Japan

ReliefWeb » Home Page - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://www.reliefweb.int/rw/dbc.nsf/doc100?OpenForm

Getting Started Latest Headlines

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Advanced Search

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SERVING THE INFORMATION NEEDS OF THE HUMANITARIAN RELIEF COMMUNITY 18 Mar 2009

MAP CENTRE »

Somalia Humanitarian Snapshot (as of 11 Mar 2009) [See all Maps](#)

ABOUT RELIEFWEB

ReliefWeb is the global hub for time-critical humanitarian information on Complex Emergencies and Natural Disasters [more »](#)

United Nations Office for the

COUNTRIES & EMERGENCIES »

Sudan »
DR Congo »
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Peru: Landslides - Mar 2009 »
Colombia: Galeras Volcano - Feb 2009 »
Bolivia: Floods - Feb 2009 » [more »](#)

APPEALS & FUNDING »

CAP: 2009 Humanitarian Appeals »
CAP: 2008 Humanitarian Appeals »
Current Funding Status of Humanitarian Appeals »
By Country/Emergency »

HEADLINES

How to send us information »

Myanmar: Aid agencies look at how to expand presence outside cyclone-stricken delta »

Madagascar: Starting to count the humanitarian cost »

Kenya: Food insecurity set to escalate due to late and insufficient rains »

Namibia: President declares floods emergency »

New US law bans nearly all cluster bomb exports by US »

Sudan: US increases pressure on Bashir after NGO expulsions »

Afghanistan: Humanitarian work has never been so difficult - ICRC »

[click to save](#) go to [Latest Updates](#)

DISASTER WATCH (From GDACS)

Orange earthquake alert Indonesia(M=6.3) potentially affecting 218000 people. 2 days ago

Done

www.reliefweb.int

User Studies - Usability

Question	Mean	Median	Mode
The software interface was easy to understand.	3.6	3.5	2
The software responded to actions in expected ways.	4.2	4.5	6
The visual appearance of interface components is consistent.	4.4	5	5
The interface controls work in a consistent way	4.1	4.5	5
Visual displays of information were easy to understand.	4	4	4
System response times were acceptable.	5	5.5	6
Please rate the overall usability of the software.	4.2	4.5	3

Color key

Negative response

Neutral Response

Positive response

User Studies - Utility

- Contextualize CAP project – the Sudan
- Use the CDA to create reports



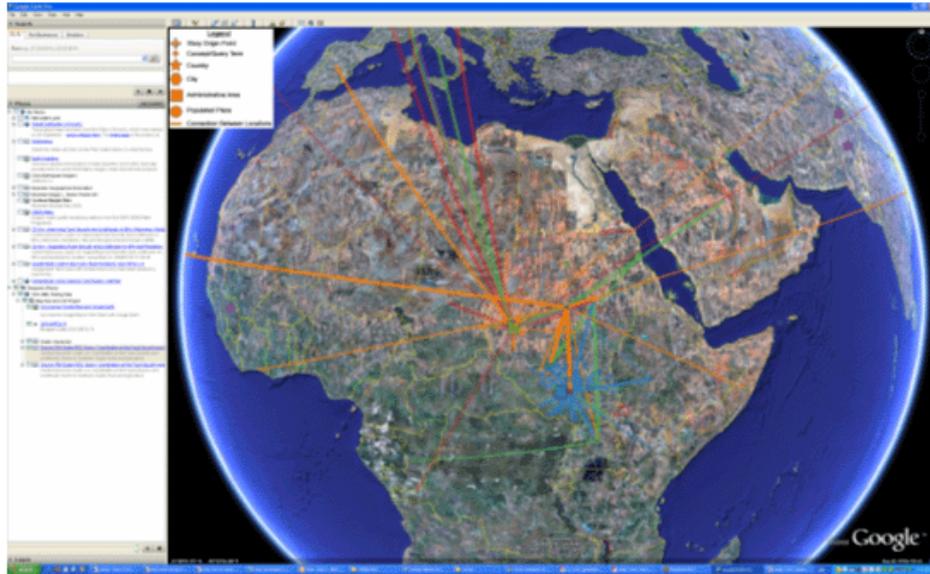
OCHA financial decision makers want an executive summary report on the evolving context of a select CAP project in the Sudan. They want to know how food security at local, regional, and international scales is playing out in the Sudan and how this may or may not relate to the efforts of the CAP project.

User Studies - Utility



- 4 participants from ReliefWeb
- Analyst reports
- Focus group

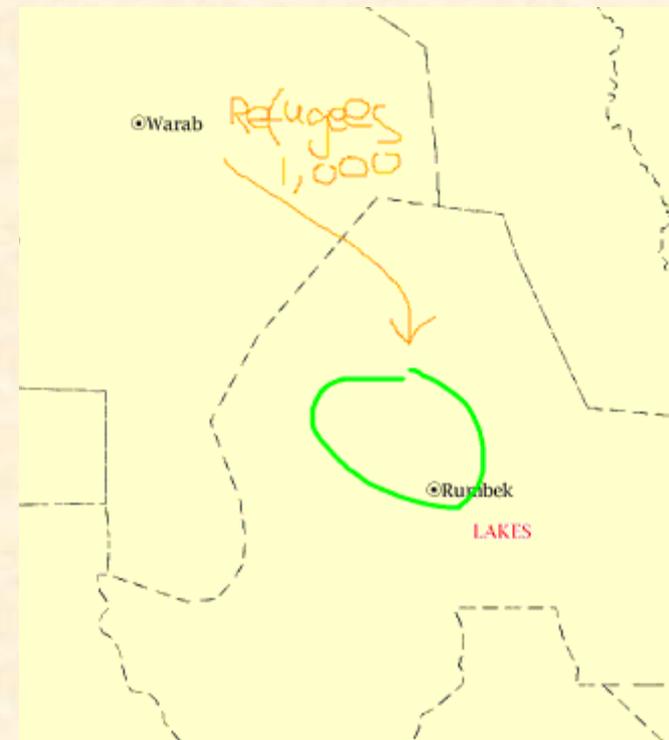
Utility Study - Results



Lots of linkages with neighboring countries, similar (food security) problems likely; most links shown are to donor countries.

Many of the found topics are referring to Darfur.

Lots of sudan (Khartoum) to South Sudan links, but no clear links between Darfur and South...



Utility Study - Results

when you get the information,
you have to literally go through
every little document, to really
pick out the information. It's not
clearly usable and in order to get
geography you have to keep
moving from your web application to
Google Earth to...

Utility Study - Results

I love even the concept and the principal.. looking at these connection across countries on issues that are being discussed in those documents..

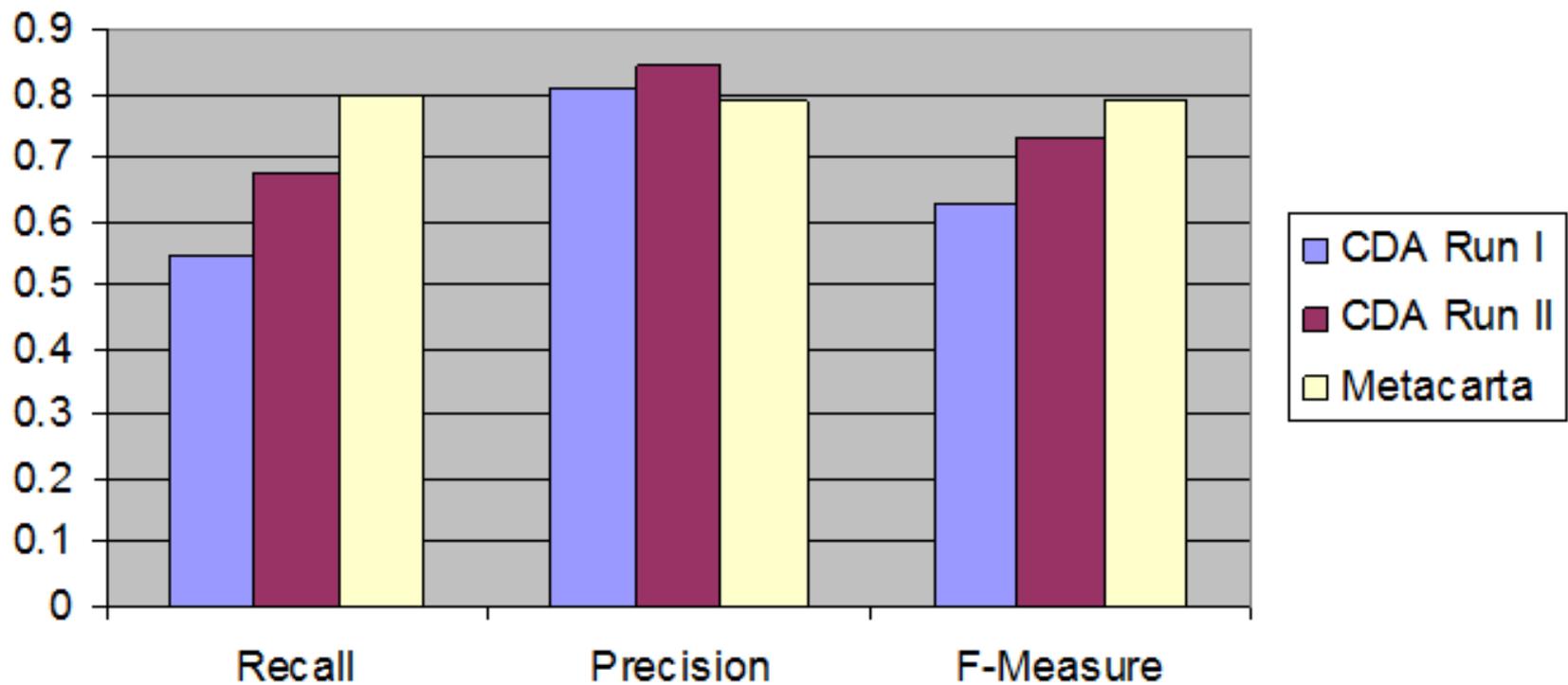
it's kinda the future

Computational Evaluations

- Geocoding - “gold standard”
 - 856 place names from 55 documents
 - F-measure
- Document Ranking Dataset
 - 200 documents captured from 4 month time period
 - Ranked by relevance (examined top 30)
 - Average Precision and Normalized Discounted Cumulative Gain

Geocoding

Recall, Precision, and F-Measure Comparisons

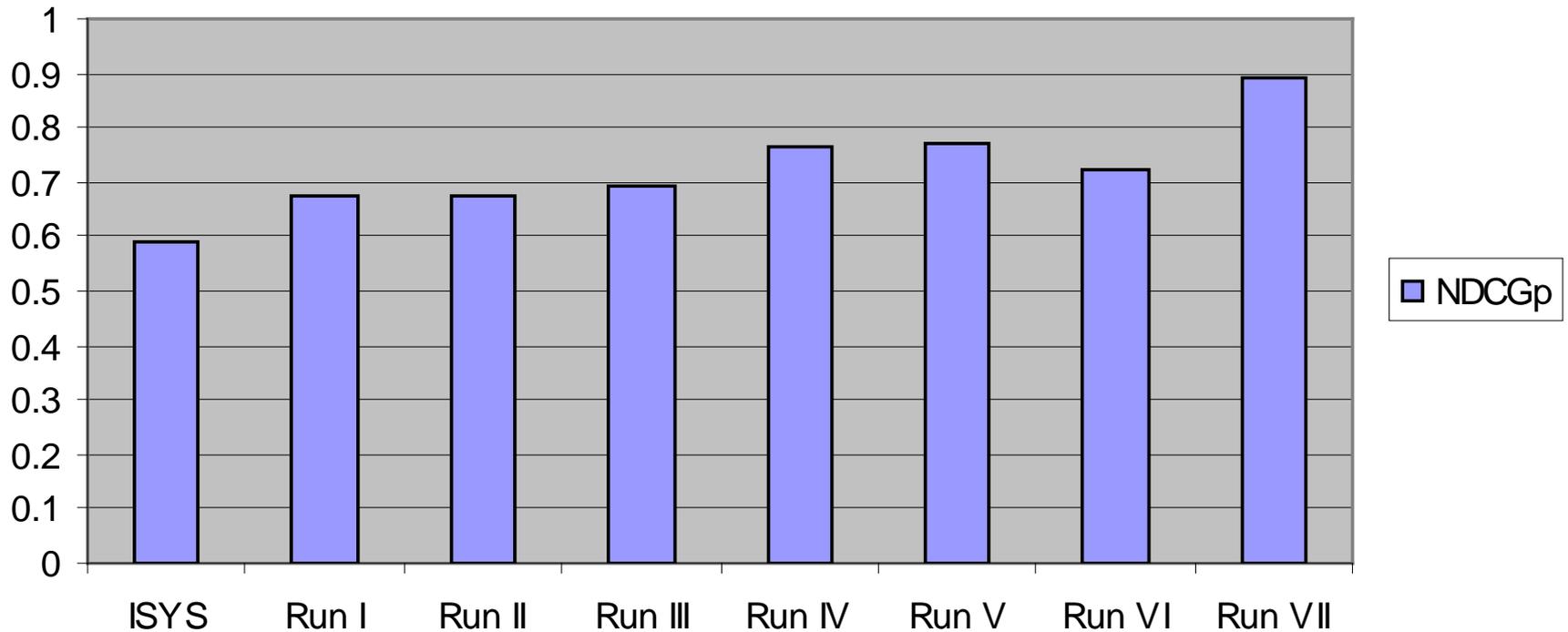


Document Ranking

Human Ranks		Run VII
Women play central role in rebuilding South Sudan		FEWS South Sudan Food Security Update Aug 2008 - Flooding and conflict in north and east
South Sudan: More than 2000 homes submerged by flash floods		Humanitarian action in Southern Sudan weekly bulletin, week 33, 17 - 23 Aug 2008
Humanitarian action in Southern Sudan weekly bulletin, week 24, 15 - 21 Jun 2008		East Africa Region Special Report 11 Aug 2008 - PPR threatens regional food security
FEWS South Sudan Food Security Update Aug 2008 - Flooding and conflict in north and east		Women play central role in rebuilding South Sudan
Ahead of donor conference, Sudanese women express grave concerns about women's situation and lack of funding		Sudan: ACF Nutrition survey - Preliminary results report, Rub Kona County, Unity State
Southern Sudan: Floods OCHA Situation Report Issue #1 30 Aug - 05 Sep 2008		Southern Sudan: Floods OCHA Situation Report Issue #1 30 Aug - 05 Sep 2008
Humanitarian action in Southern Sudan weekly bulletin, week 33, 17 - 23 Aug 2008		Eastern Africa HIV Programme (2008-2010) of the Red Cross and Red Crescent Global Alliance on HIV
Targeting in complex emergencies: South Sudan country case study		Ahead of donor conference, Sudanese women express grave concerns about women's situation and lack of funding
WFP-contracted driver killed after delivering food assistance in South Sudan		Hunger's global hotspots: 01 Jul 2008
RCA to begin airlifting supplies to South Sudan		Hundred displaced in Upper Nile due to floods
Sudan to ask donors for \$6 bln at Oslo meeting		Crop prospects and food situation - No. 3, Jul 2008
Ethiopia: Two camps close after successful repatriation to South Sudan		Hunger's global hotspots: 29 Jul 2008
Sudan: ACF Nutrition survey - Preliminary results report, Rub Kona County, Unity State		Humanitarian action in Southern Sudan weekly bulletin, week 24, 15 - 21 Jun 2008
At least 15 killed in S.Sudan clash over cattle		WFP-contracted driver killed after delivering food assistance in South Sudan
Eastern Africa HIV Programme (2008-2010) of the Red Cross and Red Crescent Global Alliance on HIV		Ethiopia: Two camps close after successful repatriation to South Sudan
Findings of a multi-indicator nutrition, health, watsan and mortality survey		Winnipeg's refugee rapper with a mission
Female deminers can do it!		South Sudan: More than 2000 homes submerged by flash floods
Case study: A victim of UXO in Wau		At least 15 killed in S.Sudan clash over cattle
Bush asks Congress to approve \$770 million more in food aid		RCA to begin airlifting supplies to South Sudan
Crop prospects and food situation - No. 3, Jul 2008		Sudan: Joint deployment to pave way for IDP returns
Sudan: Acute watery diarrhoea epidemic DREF Operation No MDRSD005		Bush asks Congress to approve \$770 million more in food aid
East Africa regional report on market prices April/May 2008		Nutrition information in crisis situations - Report number 16
WFP's Operational Priorities - Aug 2008		Olympic spirit helps bring peace to southern Sudan
Sudan: Center For Early Warning And Emergency Information(EWEF) - Flood watch update no. 10		Targeting in complex emergencies: South Sudan country case study
Sudan: Center For Early Warning And Emergency Information(EWEF) - Flood watch update no. 9		Uganda says LRA rebels fought south Sudan forces
Center For Early Warning And Emergency Information (EWEF) - Flood watch update no. 11		Emergency latrines and health & hygiene promotion for the "green village"
Sudan: Center For Early Warning And Emergency Information (EWEF) - Flood watch update no. 18		Findings of a multi-indicator nutrition, health, watsan and mortality survey
Center For Early Warning And Emergency Information (EWEF) - Flood watch update no. 19		CERF Newsletter Jun 2008
Hundred displaced in Upper Nile due to floods		Double your impact on World Refugee Day
Olympic spirit helps bring peace to southern Sudan		Case study: A victim of UXO in Wau

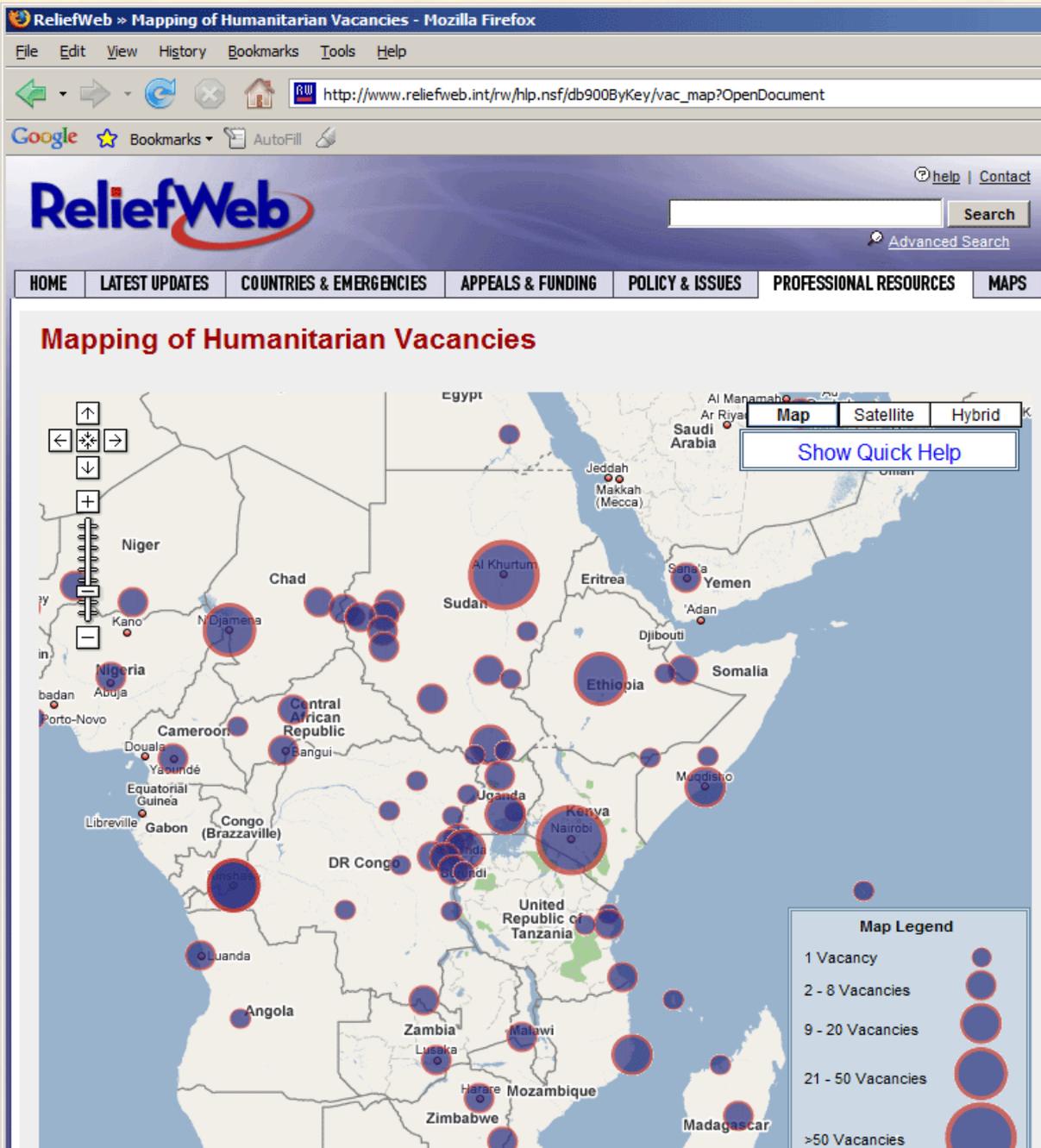
Normalized Discounted Cumulative Gain

Normalized Discounted Cumulative Gain Score Comparisons



Implications for Visual Analytics Research

- Visual Analytic tools evaluated by practitioners
- Positive response and interest – new ways of thinking
- Feedback for improvements to create production systems
- Outreach and dissemination of research parts to “real world” users



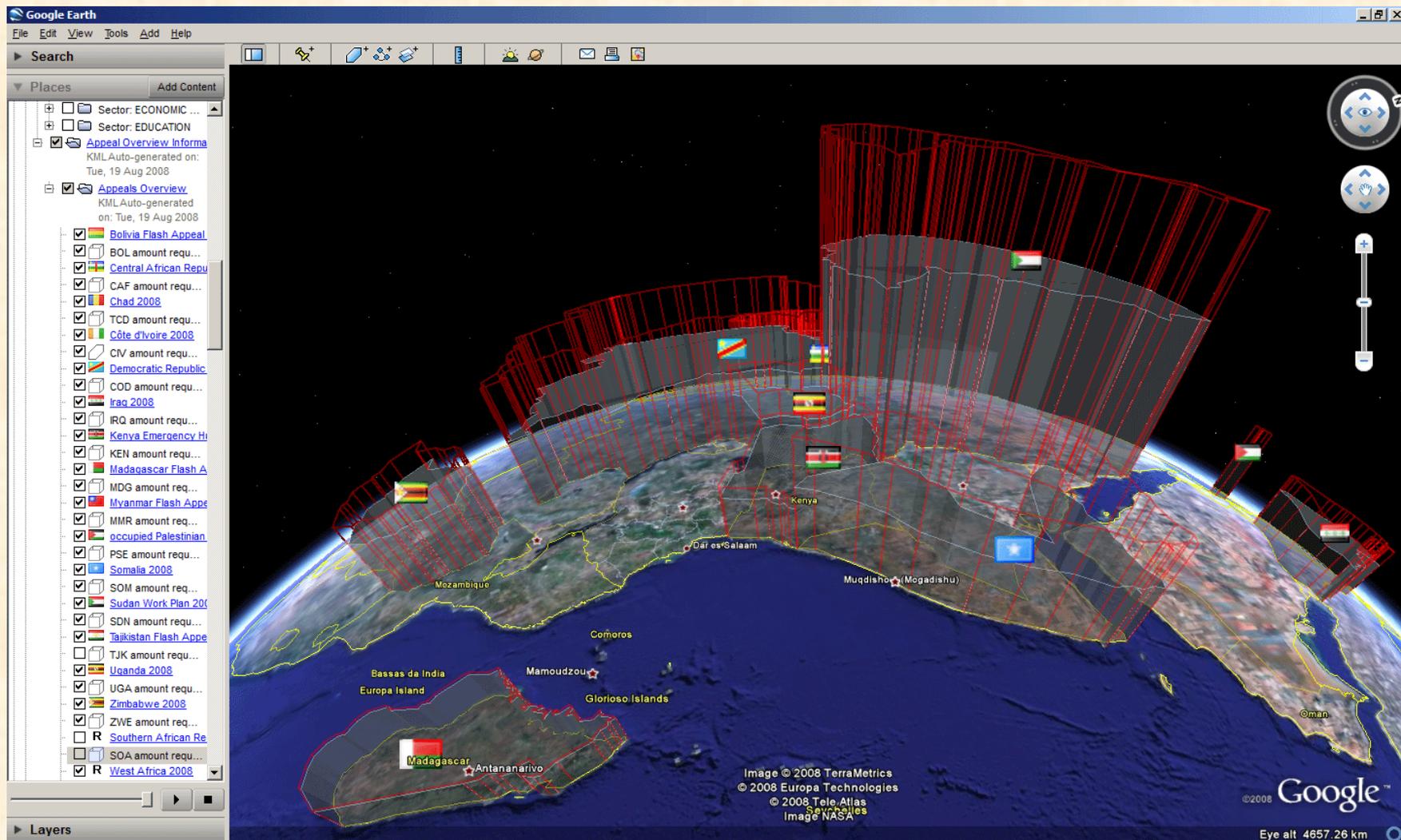
Outreach

Knowledge and
Technology
Transfer

Example -
Vacancies
Mapping
Application

Outreach

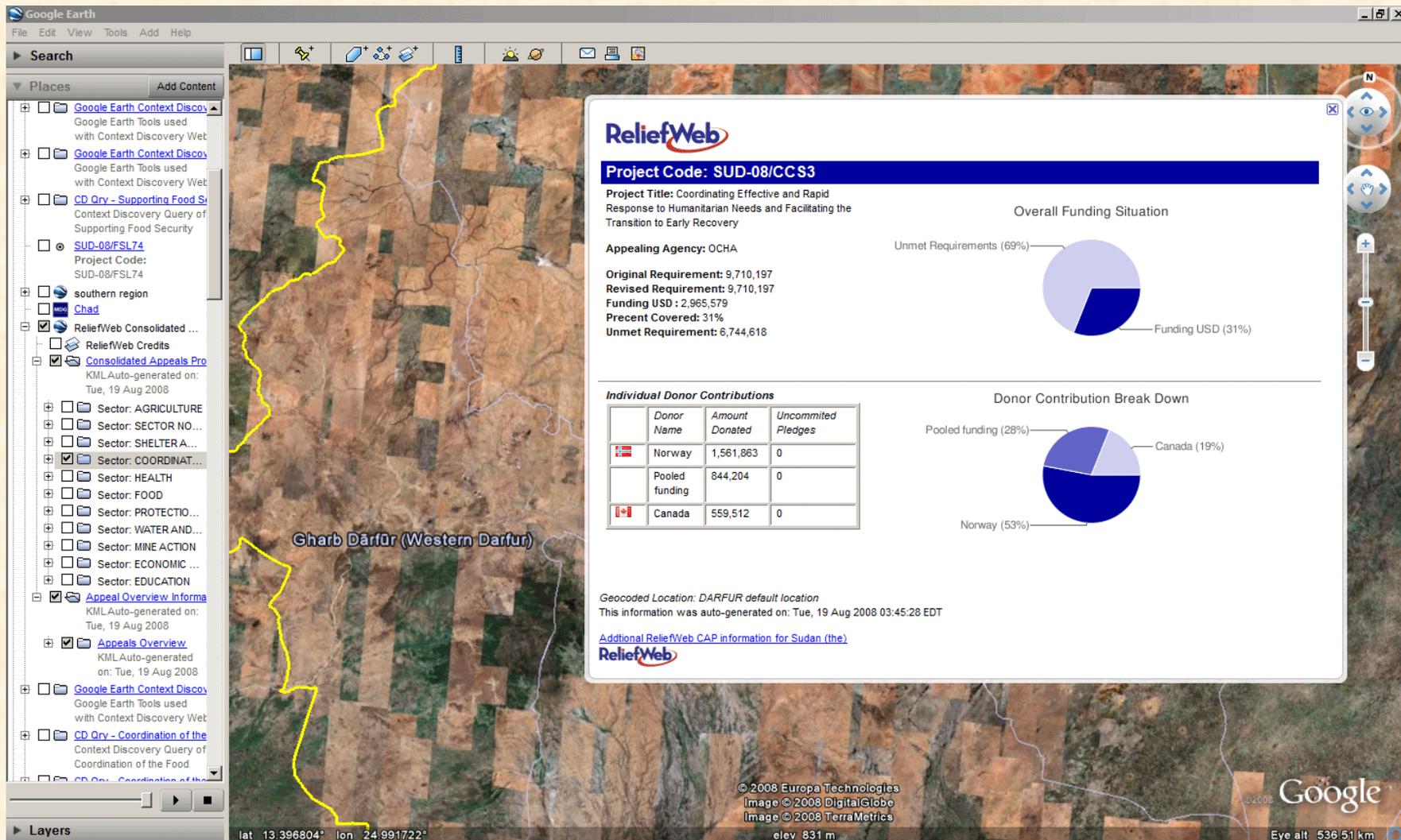
CAP financial information – improved decision making



B. Tomaszewski and L. Czárán, "Geographically Visualizing Consolidated Appeal Process (CAP) Information," Proceedings of the 6th International ISCRAM Conference, Gothenburg, Sweden, 2009.

Outreach

CAP financial information – improved decision making



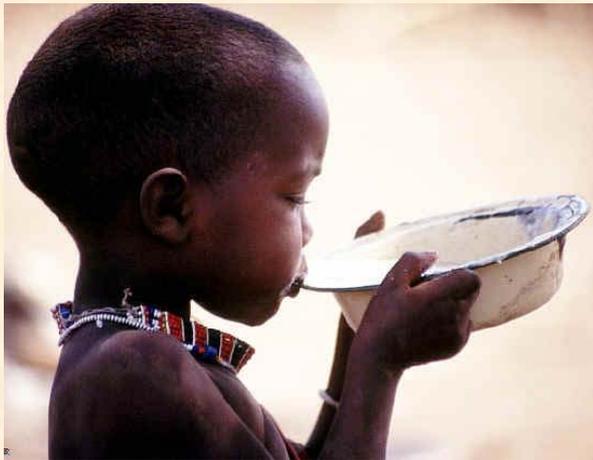
B. Tomaszewski and L. Czárán, "Geographically Visualizing Consolidated Appeal Process (CAP) Information," Proceedings of the 6th International ISCRAM Conference, Gothenburg, Sweden, 2009.

Implications for HLS

- Position Visual Analytics research to address international problems - global warming, food security, economic crisis
- Indirect HLS threats – political instability, extremism
- Ideally, improve lives of people effected by crisis around the world
- Diminish motivations to attack the US homeland, better cooperation

Future Work

- ‘Situatenedness’ of concepts within the GHC model
- Repurposing the Geocoding Algorithms
- *“aid workers were attacked on Monday”*
- Applications - Slow onset disasters



http://www.countdown.org/end/pix/famine_2.jpg

Famine



<http://www.southlandusa.com/tbflib/spaw2/uploads/images/Drought%20Pix.jpg>

Drought

Summary and Conclusion

- Geovisual Analytic concepts and tools developed represent viable proofs-of-concepts to produce GHC in social settings
- Research evaluated by and select components transferred to real world use
- Further research and development-analyze situations “beyond our borders” to indentify indirect HLS threat

Questions?

Thank you!

bmtski@rit.edu