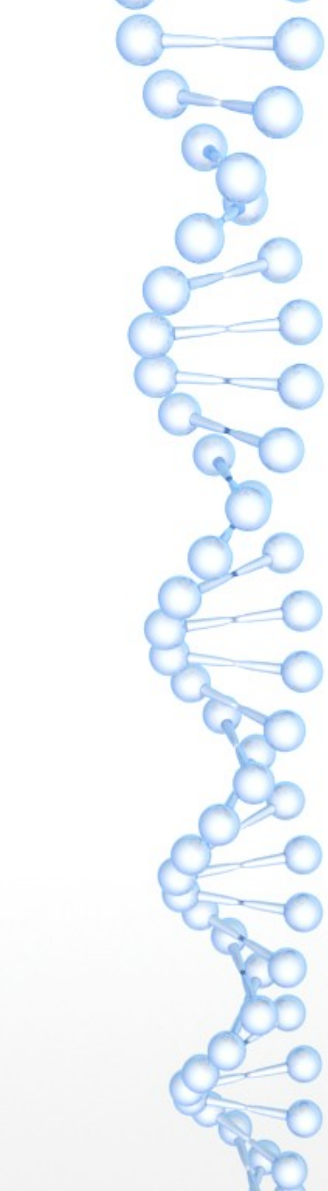
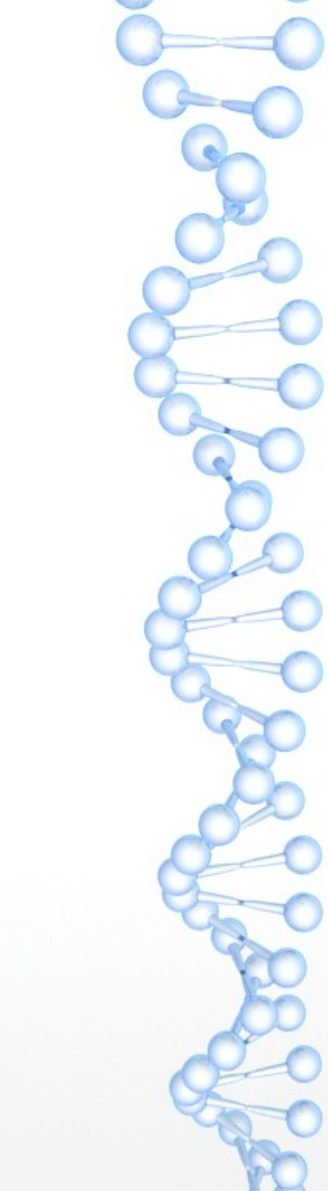


Ontology Summit 2022
Pandemics and Other Disasters



Motivation

- Disasters such as the COVID-19 pandemic and Climate Change have affected individuals and society in profound ways.
- Enormous efforts have been devoted to dealing with disasters, producing large numbers of documents and massive amounts of data
- Managing all this knowledge is itself a major problem
- Ontologies can make significant contributions

Summit Organization

- Four tracks
  - Each track has four regular sessions followed by a synthesis session
  - Each track has a theme, but speaker scheduling will cause some rearrangements
- The first track is devoted to the overall landscape of disasters
- Later tracks are concerned with three types of disasters

Summit Tracks

- Track 1: The Landscape of Disasters
  - Ontologies, Knowledge Graphs, Parameters, Rules, Metadata, Metrics
- Track 2: Pandemics
  - Ontologies for different aspects of pandemic response, especially for the COVID-19 pandemic
- Track 3: Environment Disasters
  - Wildfires, floods, climate change
- Track 4: Aerospace/Maritime Disasters

Organizing Committee

- Gary Berg-Cross
- Ken Baclawski
- Ram D. Sriram
- Ravi Sharma (Chair)
- Robert Rovetto

What is a disaster?

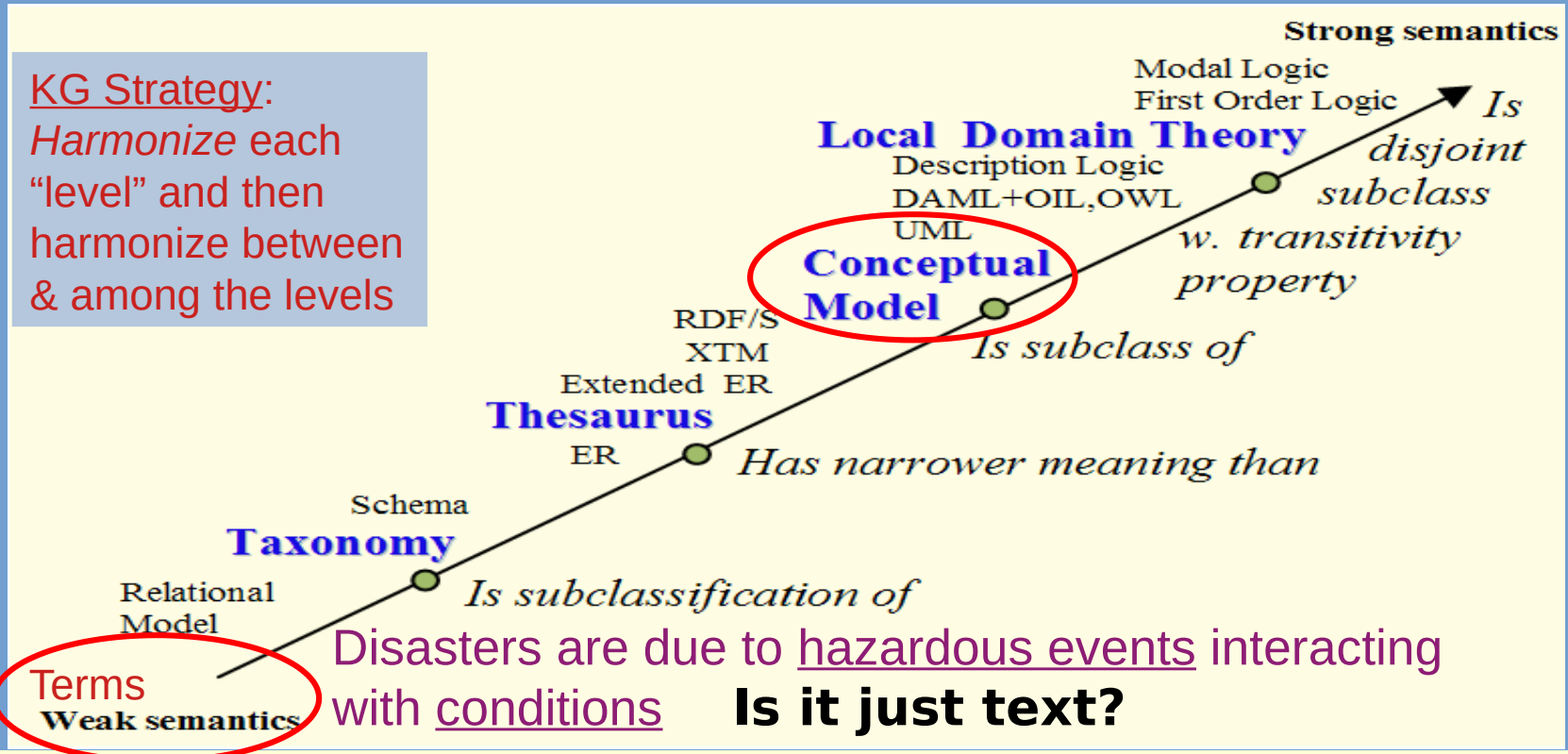
- Many definitions of disaster
  - International organizations
  - Governments and agencies
- The definition matters
  - Disaster relief depends on satisfying the definition
  - In the US, the president decides whether a situation represents a disaster
- Terminology matters
  - Attitudes are affected by the words used to describe a disaster

Lifecycle of Disasters

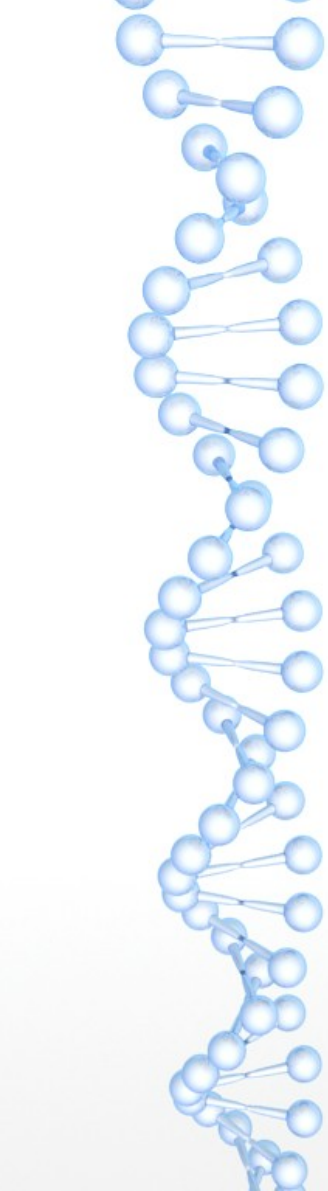
- Identifying
  - Determining potential disasters
  - Planning to deal with disasters
  - Estimating probabilities and costs
- Mitigating
  - Reducing risks
  - Analyzing costs and benefits
- Monitoring
  - Tracking a disaster as it is occurring
  - Managing knowledge
- Managing
  - Dealing with the disaster
  - Communicating among disaster relief entities
- Ontology contributions

Defined Terms are Part of a Semantic Spectrum/Gradient Context

Terms may be standardized but the conceptualized *meaning* has to be too.



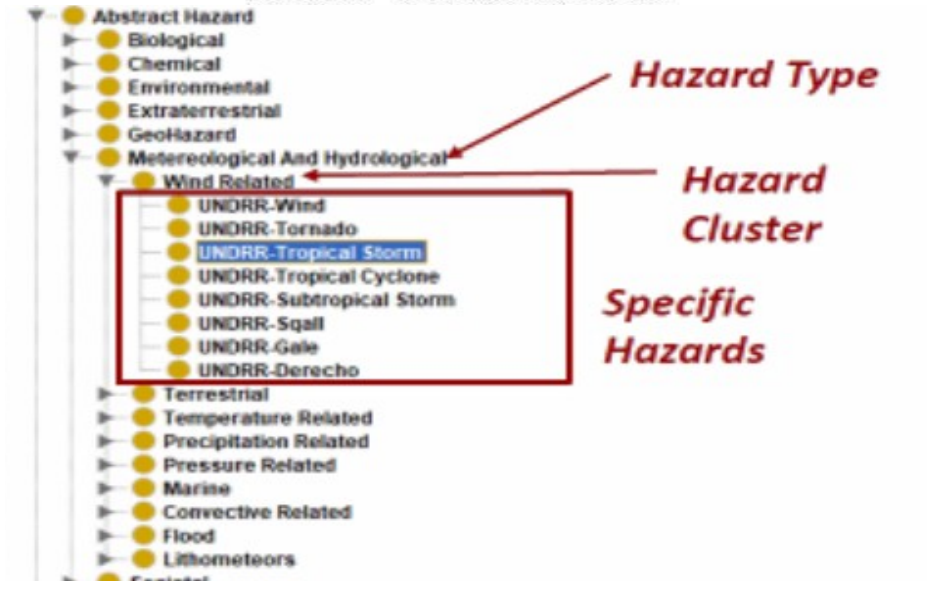
M.C. Daconta, K.T. Smith, and L.J. Obrst. The Semantic Web: A Guide to the Future of XML, Web Services, and Knowledge Management. John Wiley & Sons, Inc. New York, NY, USA, 2003.

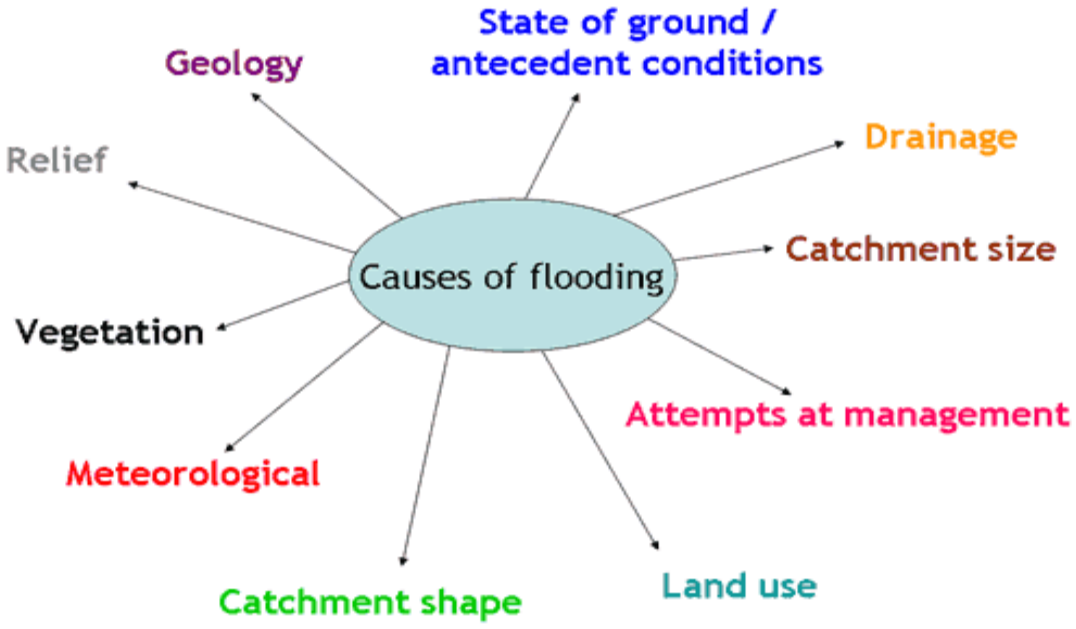


Track 1: Disaster Landscape

Gary Berg-Cross
Ravi Sharma

Overviewing Improved Semantics for Types of Disaster Situations and Events





- Gary Berg-Cross (Ontolog)

Diverse Wildfire “definitions”

- Dictionary: raging, *rapidly* spreading fire.
- n. Something that acts very quickly and *intensely*.
- n. Lightning occurring without audible thunder. (nope)

- Wikipedia: A wildfire, *bushfire, wildland fire* or rural fire is an unplanned, unwanted, uncontrolled fire in an *area* of combustible vegetation starting in rural areas and urban areas.
- Depending on the type of vegetation present, a wildfire can also be *classified* more specifically as a forest fire, brush fire, bushfire (in Australia), desert fire, grass fire, hill fire, peat fire, prairie fire, vegetation fire, or veld fire….. (Encyclopedic)

Note - Synonyms

Glossary- National Wildfire Coordinating Group

A wildland fire *originating* from an *unplanned* ignition, such as lightning, volcanos, unauthorized and accidental human caused fires, and prescribed fires that are declared wildfires.

Source: 2009 Guidance.

There are Systematic Effort Describing Disasters using Controlled Vocabularies

Disaster UNDRR is the UN focal point for disaster risk reduction

A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts.

Annotations: The effect of the disaster can be immediate and localized, but is often widespread and could last for a long period of time.

Emergency is sometimes used interchangeably with the term disaster,

Disaster damage occurs during and immediately after the disaster….

Disaster impact….

Session 1 (January 26th): Shirly Stephen Ambrose Framing Semantics for the Disaster Landscape

- Is a Data Scientist | Knowledge Engineer
- Has an MS & PhD in Spatial Information Science from U of Maine, has been a post-doc at U of Arizona and now is a post-doc at UCSB.
- Her Skills and expertise range from Ontologies spatial reasoning Automated Reasoning Spatial Science and Computational Logic

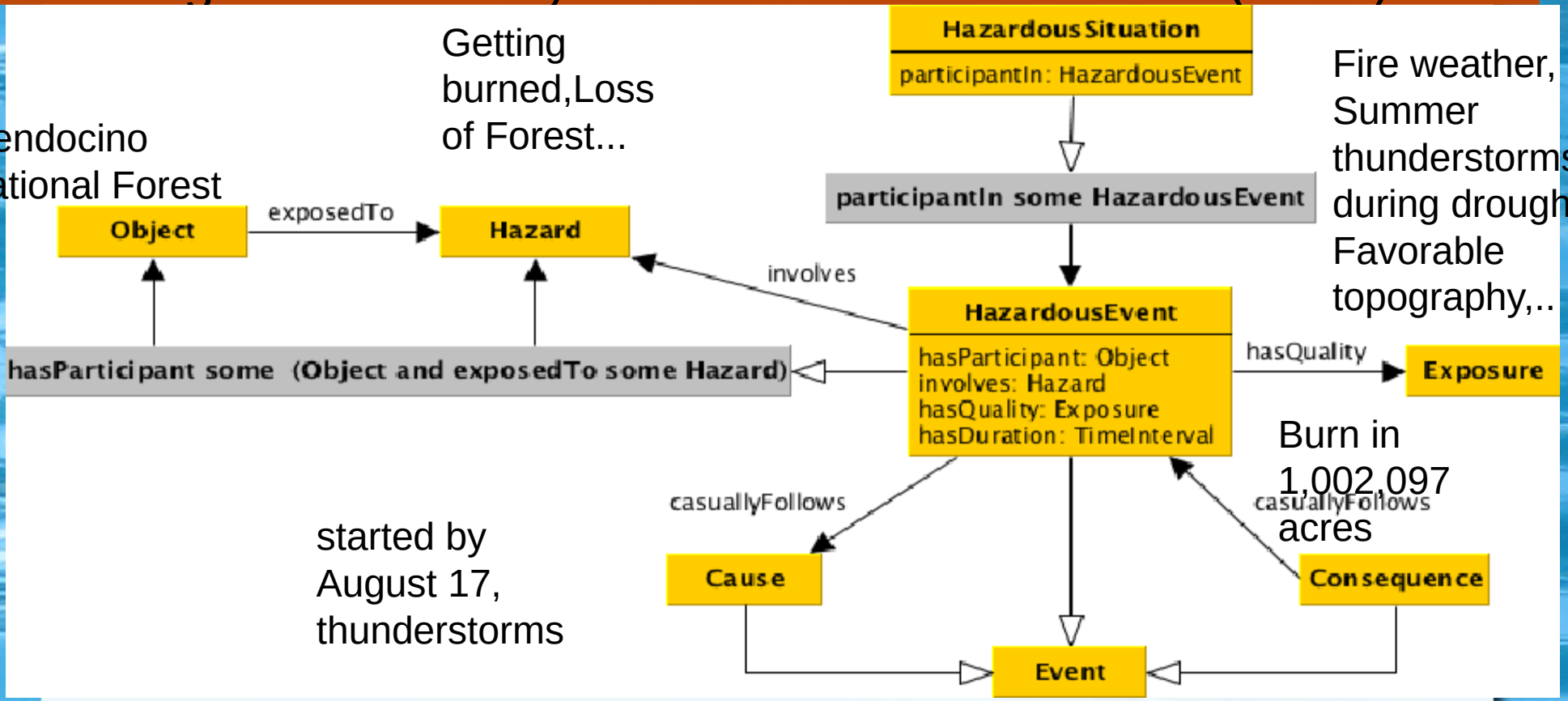
A Starting Point

Go beyond mere textual definitions to make information usable for things like knowledge graphs (KG) (Part of FAIR guidance)

Goal is a KG with competence to answer relevant questions such as: “what were the US losses in 2020 for each type of disaster?”

Model will include Spatial and Temporal aspects in a common framework with consistent scope & detail.

Consider the Hazardous Situation Ontology Design Pattern Agnieszka Lawrynowicz & Ilona Lawniczak (2015)



Mendocino National Forest

Getting burned,Loss of Forest...

Fire weather, Summer thunderstorms during drought, Favorable topography,..

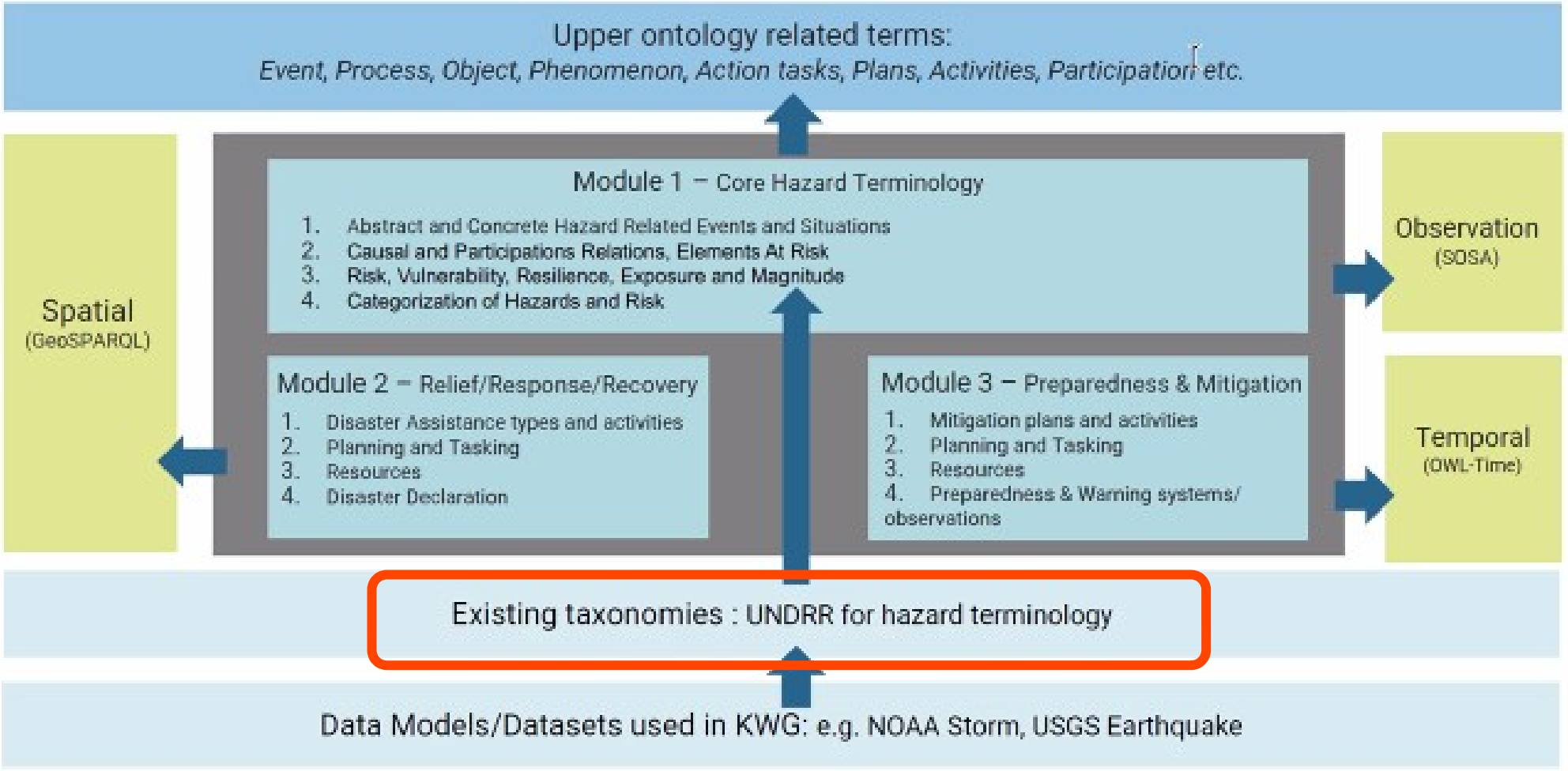
started by August 17, thunderstorms

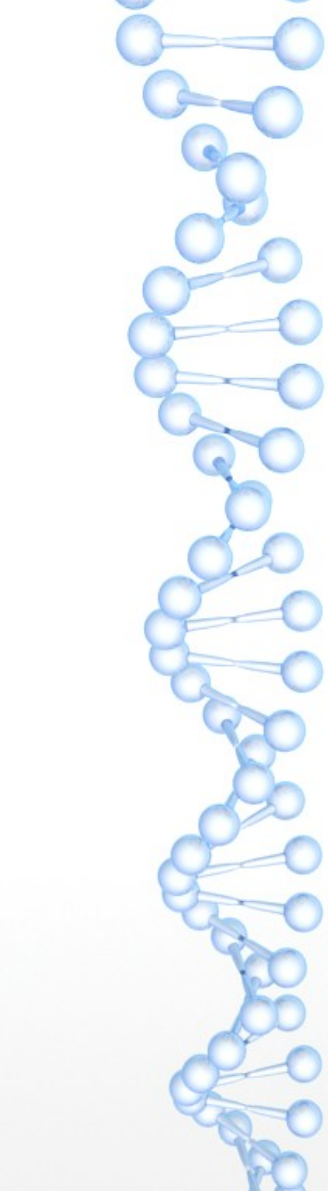
Burn in 1,002,097 acres

August Complex Fire 2020

Ontology Design

(Update from Shirley Ambrose)





Track 2: Pandemics

Ram D. Sriram
Ken Baclawski
Gary Berg-Cross

Background

- A pandemic is an epidemic of an infectious disease that has spread across a large region.
- Pandemics of the past:

Pandemic	Fatalities
Bubonic Plague	100M-200M
Smallpox	300M
H1N1	100M

- Ongoing pandemics include:

Pandemic	Fatalities	Period
Tuberculosis	1.5M/year	Over 6000 years
HIV/AIDS	32.7M	40 years
COVID-19	5.5M	2 years

Research Activity

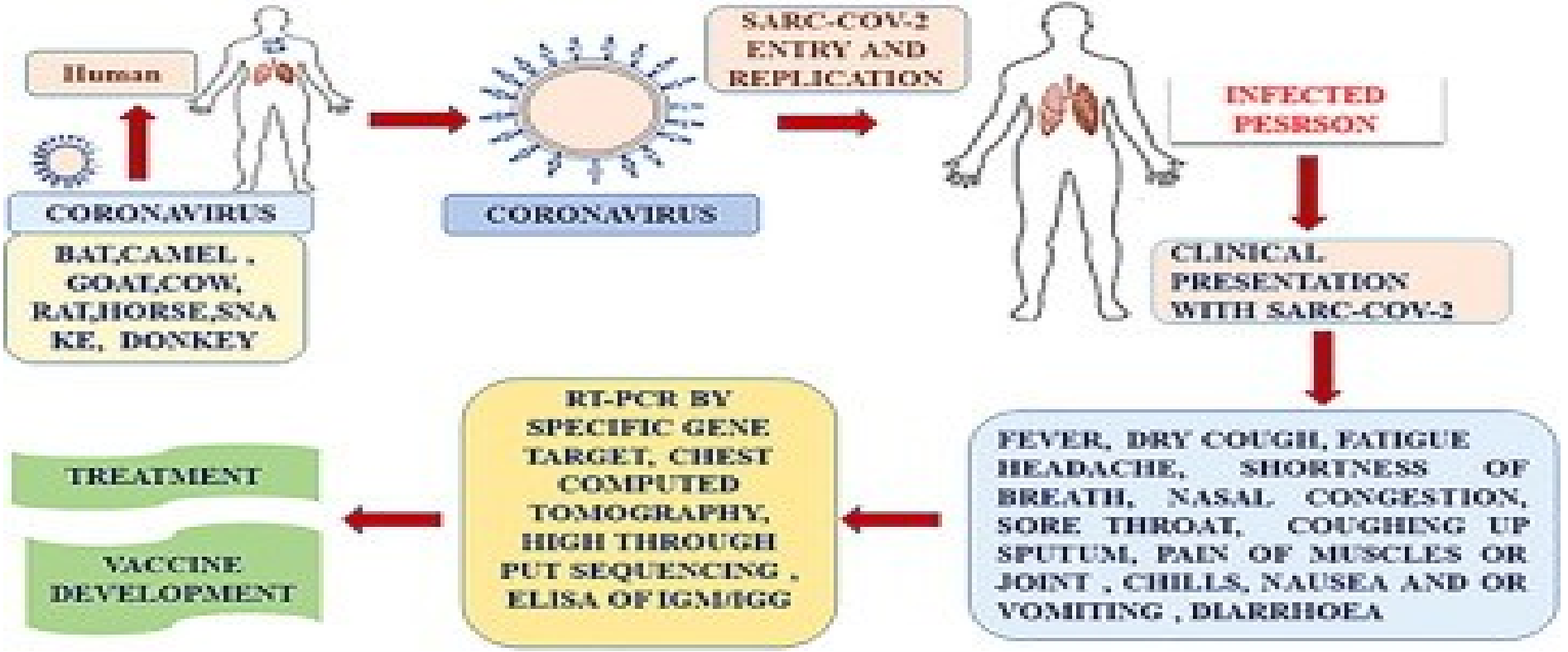
- HIV/AIDS
  - Around 260K papers over the past 40 years.
- COVID-19
  - Reached 280K by October of 2021, a period of less than 2 years.
  - Hundreds of clinical trials
  - Large amounts of data have also been produced.
- Understanding the vast knowledge base of pandemics is a monumental task.

Pandemics

Session 2 (Feb 9th): Chris Mungall & Justin Reese Covid-19 Knowledge Graphs

Many semantic resources are available for Disease & Pandemics, but they are scattered, often hastily done and thus somewhat inconsistent.

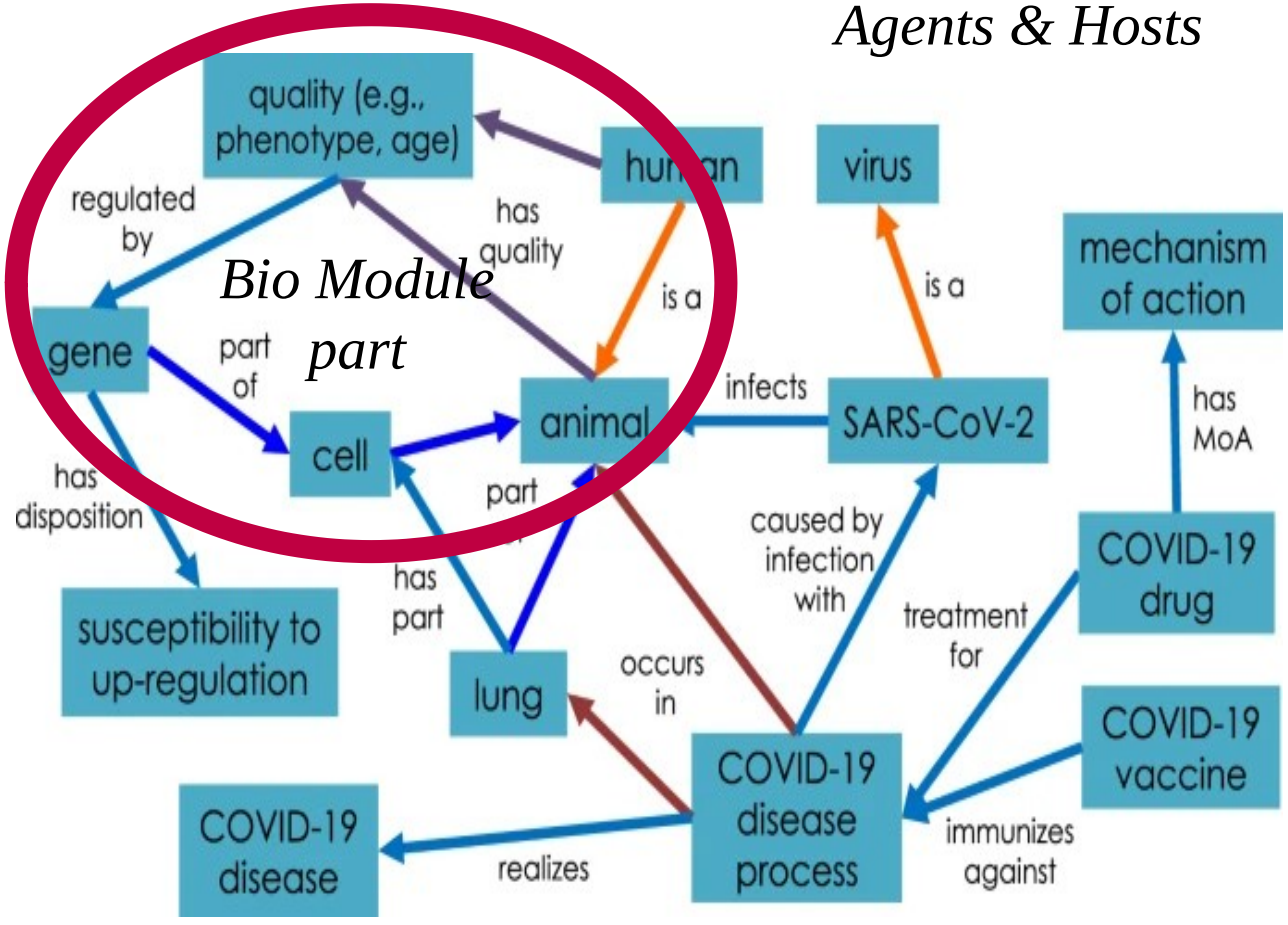
We can find best sources, explain why these are good & provide ideas on improvements



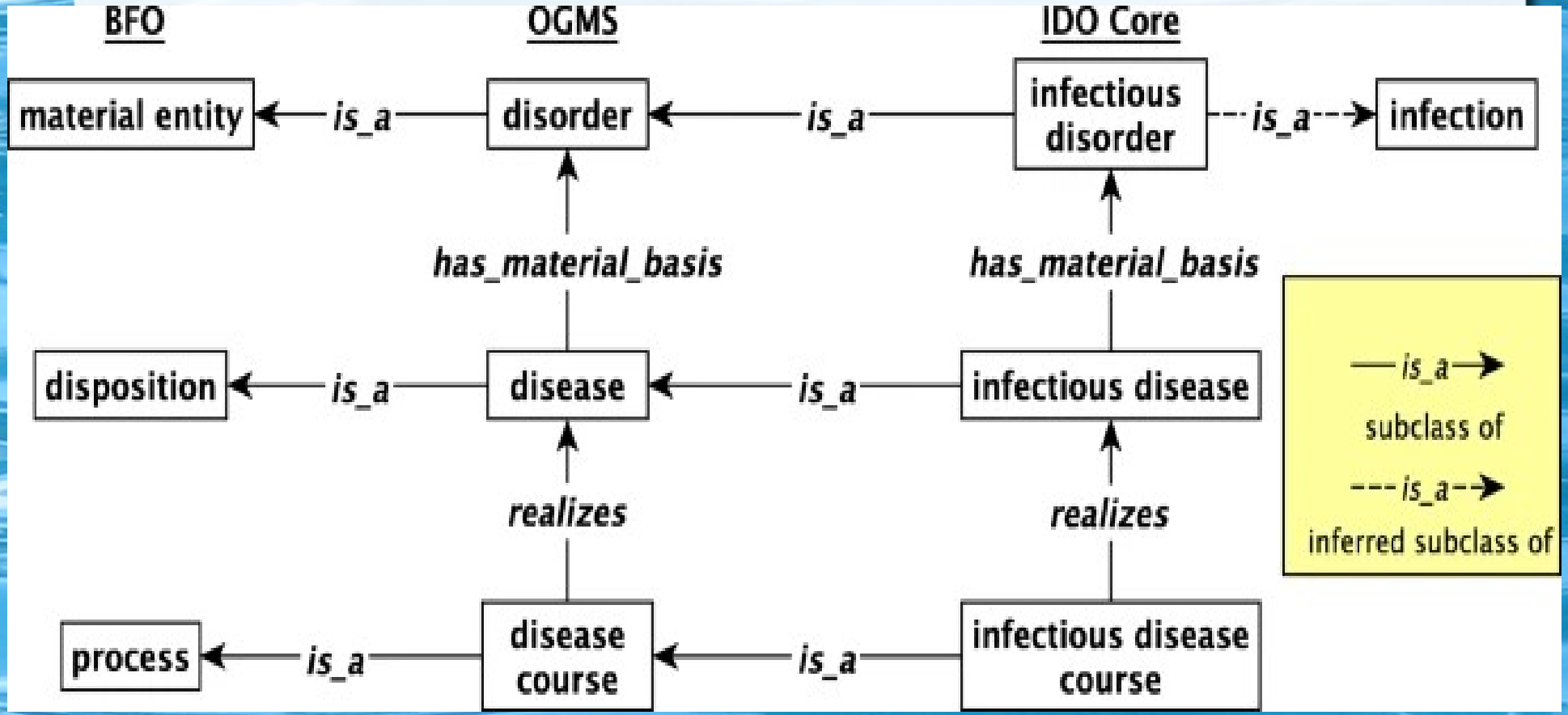
Covid Ontologies & Spectrum of Semantic Resources

The COVID-19 Ontology representing major novel coronavirus (SARS-CoV-2) entities & chemical entities suited for drug for therapeutic development (Variants?).

- Overview & understanding the accumulation of resources (vocabularies, taxonomies, KGs, linked data) across the disease domain(s) and provide a <u>general context for the Covid-19 pandemic topic.</u>
- .



We Have Some Relevant, Formal Semantic Resources



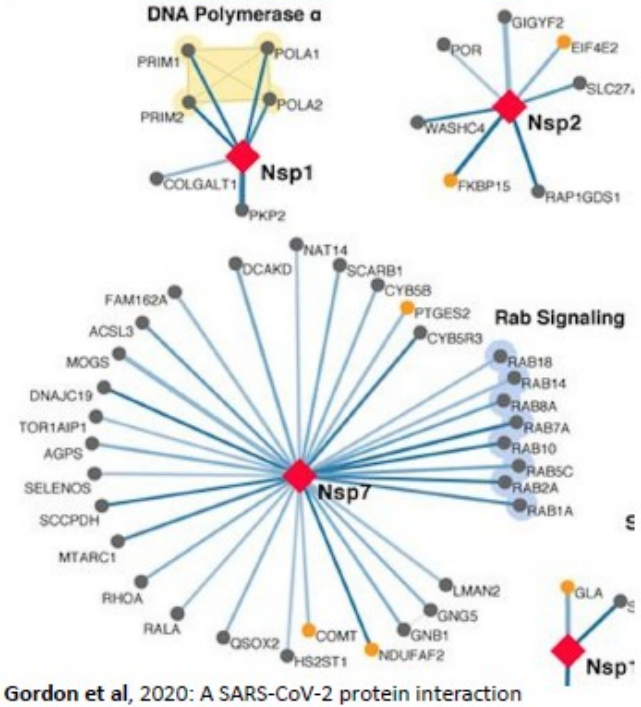
Christopher J Mungall has a PhD from University of Edinburgh School of Biological Sciences and is Staff Scientist in the Environmental Genomics and Systems Biology Division at LBNL, where he heads the Biosystems Data Science department at Lawrence Berkeley National Laboratory where he leads a group working on the application of computational techniques to problems life sciences of relevance to the health of humans and the health of the planet.
He describes his main interest as:
" the application of artificial intelligence, knowledge-based methods, and bio-curation to advance our understanding of the interconnected role of genes and genetic mechanisms in key biological processes. "

Justin Reese is a Computer Research Scientist working on Environmental Genomics and Systems Biology at the Lawrence Berkeley National Lab.
He broadly interested in using computational methods to extract actionable knowledge from biomedical and biological data. I am particularly interested in using these methods to address

- Chris Mungall and Justin Reese's work on Covid-19 Knowledge Graphs

KG-COVID-19 Knowledge Graph for COVID-19 Response

BioSciences



Gordon et al, 2020: A SARS-CoV-2 protein interaction map reveals targets for drug repurposing

Goal:

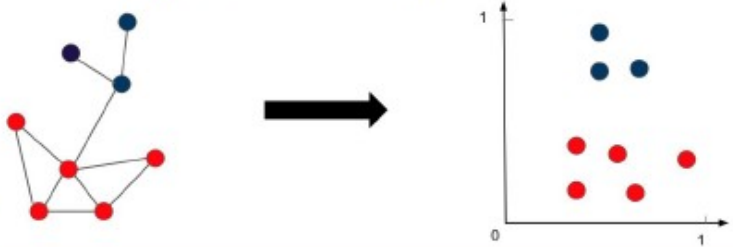
- Use Machine Learning (ML) to make useful COVID related predictions
  - e.g. drug repositioning

Challenge:

- Data is siloed
- Traditional ML methods don't take into account interconnectedness

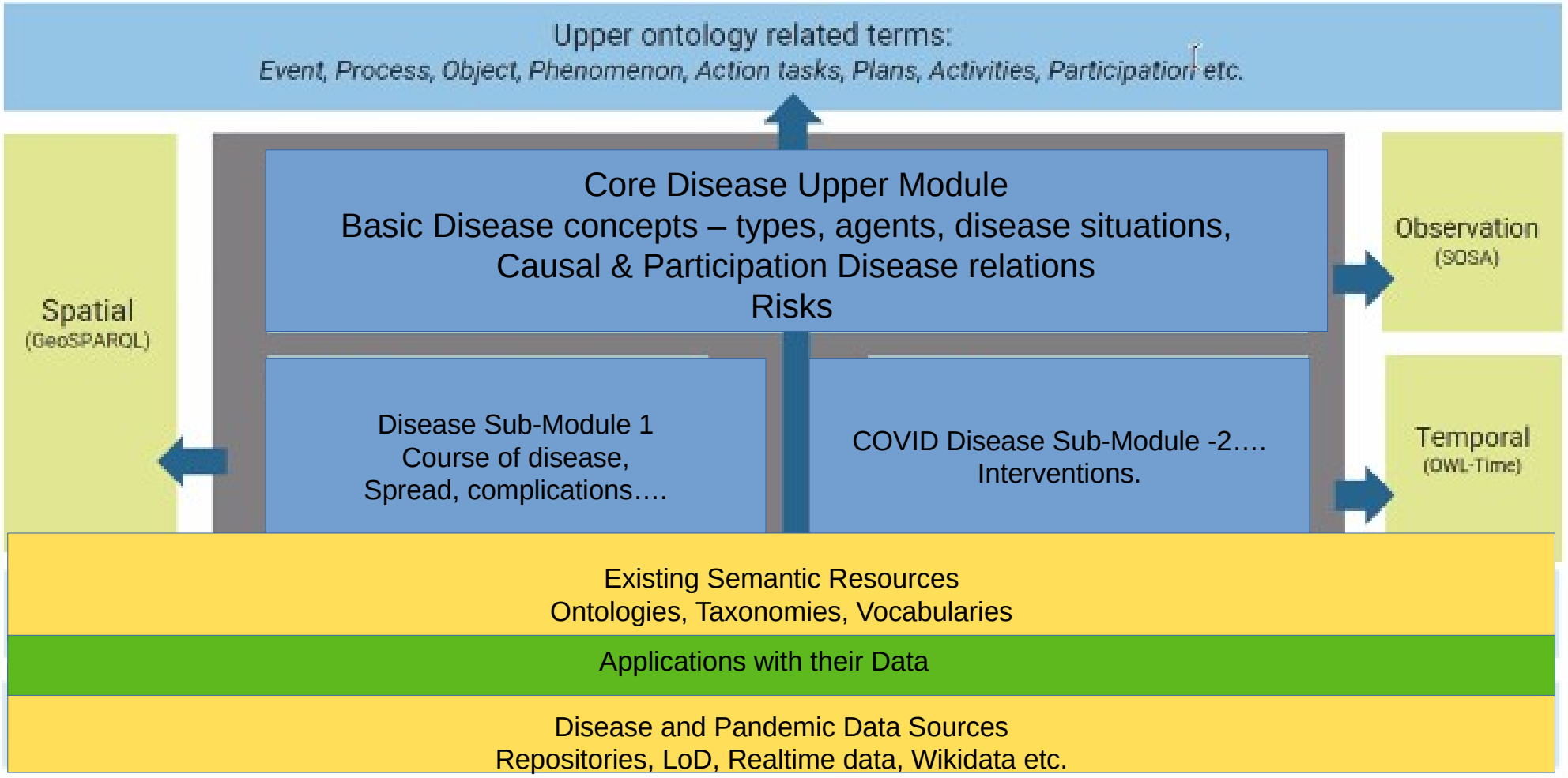
Approach:

- Create a COVID-19 *Knowledge Graph (KG)*
- Develop graph *embeddings*



BERKELEY LAB ENERGY

Disease/Pandemic Design(s)



Session 1

- John Beverly,
  - PhD graduate student at Northwestern University working in Logic, Social Epistemology, Ethics, and Applied Ontology. (from johnbeverly.com)
- Co-author of “Coordinating Coronavirus Research: The COVID-19 Infectious Disease Ontology”, September, 2020.
  - Preprint is available on ResearchGate
  - DOI: 10.31219/osf.io/5bx8c
- He will be speaking on Pandemics and Ontologies

Session 2

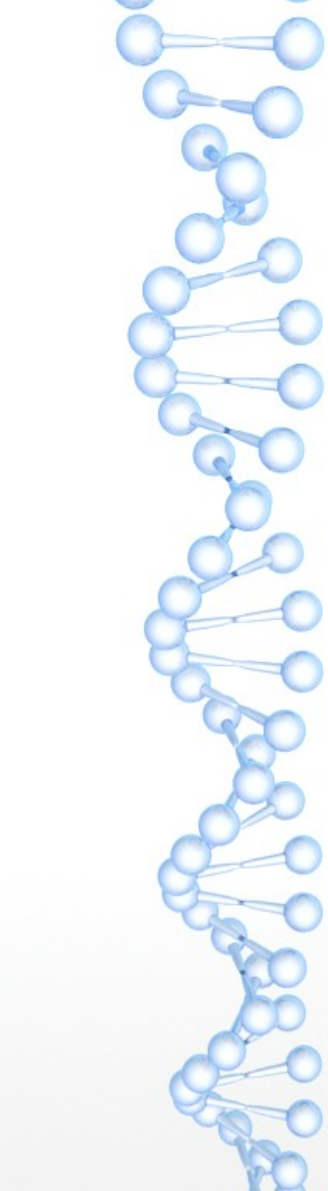
- Michael DeBellis and Biswanath Dutta
- Michael is a frequent contributor on the Ontolog Forum
- They will be speaking about the COviD-19 Ontology for cases and patient information (CODO)
  - B. Dutta, M. DeBellis, CODO: An Ontology for Collection and Analysis of Covid-19 Data, available on arXiv.org
- They have also written on how Semantic Web technology was used to combat the COVID-19 pandemic
  - This should be published in March or April.

Session 3

- Asiyah Yu Lin
  - Postdoctoral Research Fellow, He Group, University of Michigan Medical School
  - Primary developer of 7 medical ontologies
  - Participated in the development of 7 other medical ontologies
- She will be giving a post-workshop report of WCO-2020: Workshop on COVID-19 Ontologies

Session 4

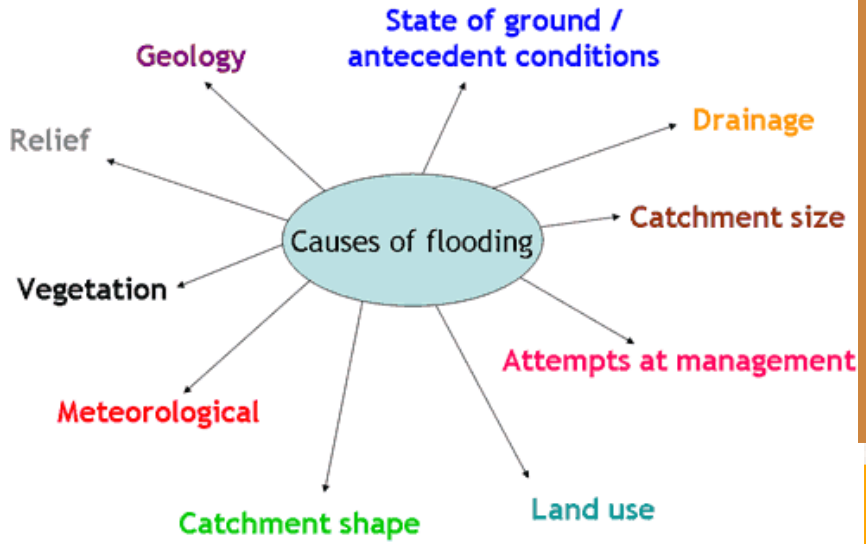
- Alpha Tom Kodamullil
  - Group leader Applied Semantics
  - Deputy Head of Business Area Bioinformatics
  - Fraunhofer Institute for Algorithms and Scientific Computing SCAI
- Co-author of “The COVID-19 Ontology”. Bioinformatics, 36(24), 5703-5705.
- She will be speaking on COVID-19 Multilingual Ontologies



Track 3: Environment Disasters

Gary Berg-Cross
Ravi Sharma

Overviewing Environmental Disaster Situations and Events



+ fluid astronomical body part
  + liquid astronomical body part
    + body of liquid
      + water mass
        + water body
          + estuary
          + underground water body
          - plunge pool
          + lentic water body
          + lotic water body
          - puddle of water
          + saline water body
          + fresh water body
          + brackish water body
          + melt pond
          - flood
            + coastal flood
            - riverine flood
            - flash flood

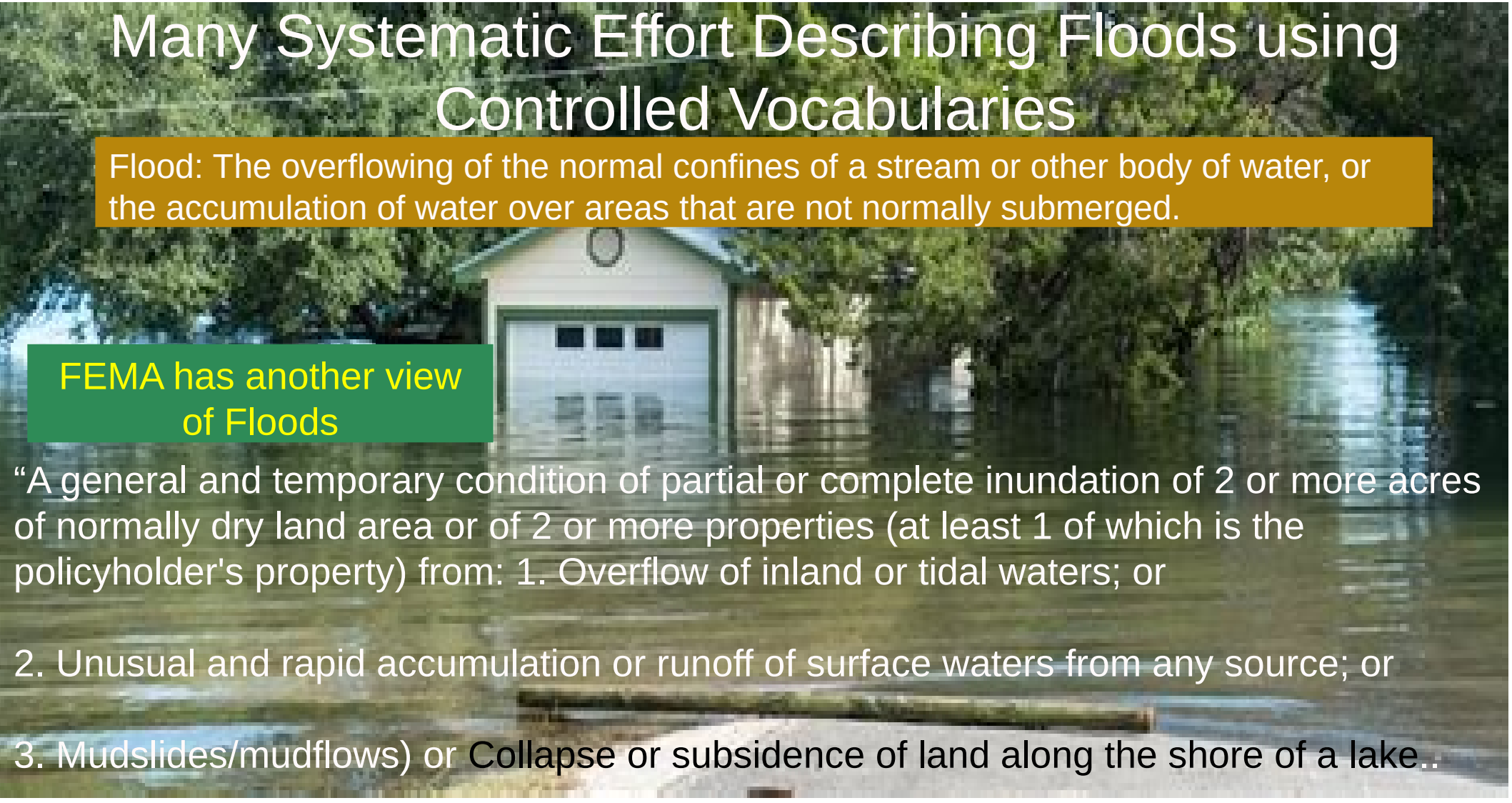
ENVO

Flood An unusual accumulation of water above the ground caused by high tide, heavy rain, melting snow or rapid runoff from paved areas. [database_cross_reference: GEMET:http://www.eionet.europa.eu/gemet/concept/3298]

- Gary Berg-Cross (Ontolog Board)

Many Systematic Effort Describing Floods using Controlled Vocabularies

Flood: The overflowing of the normal confines of a stream or other body of water, or the accumulation of water over areas that are not normally submerged.



FEMA has another view of Floods

“A general and temporary condition of partial or complete inundation of 2 or more acres of normally dry land area or of 2 or more properties (at least 1 of which is the policyholder's property) from: 1. Overflow of inland or tidal waters; or

2. Unusual and rapid accumulation or runoff of surface waters from any source; or

3. Mudslides/mudflows) or Collapse or subsidence of land along the shore of a lake..

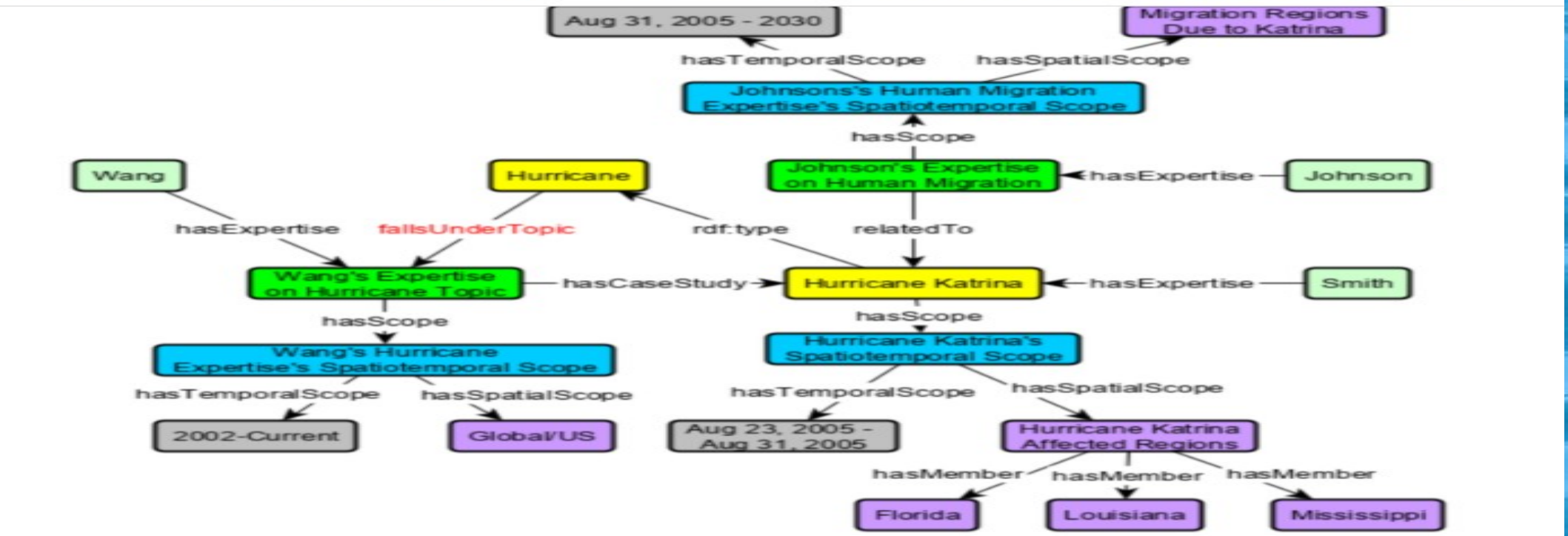
April 6th Session - tentative) Krzysztof Janowicz Wildfires and Knowledge Graphs

- Krzysztof Janowicz is a professor for Geographic Information Science and Geoinformatics at the Geography Department and the director of the Center for Spatial Studies.
- At UCSB, he runs the STKO Lab which investigates the role of space and time for knowledge organization.
- Before, joining UCSB he was an Assistant Professor at the GeoVISTA Center, Department of Geography at the Penn State University.

Jano is also one of two Editors-in-Chief of the *Semantic Web journal.*

He has been a frequent speaker at the Ontology Summits.

The KnowWhereGraph ("KWG"), an enabling application for various domains, is empowered by the convergence of linked data with environmental intelligence in the form of geo-enrichment or area briefings. It fills gap between identifying a potential disaster and finding experts on the ground.



Climate Change Session (TBD Julia Barrott has been invited)

PLAtform for Climate Adaptation and Risk reDuction

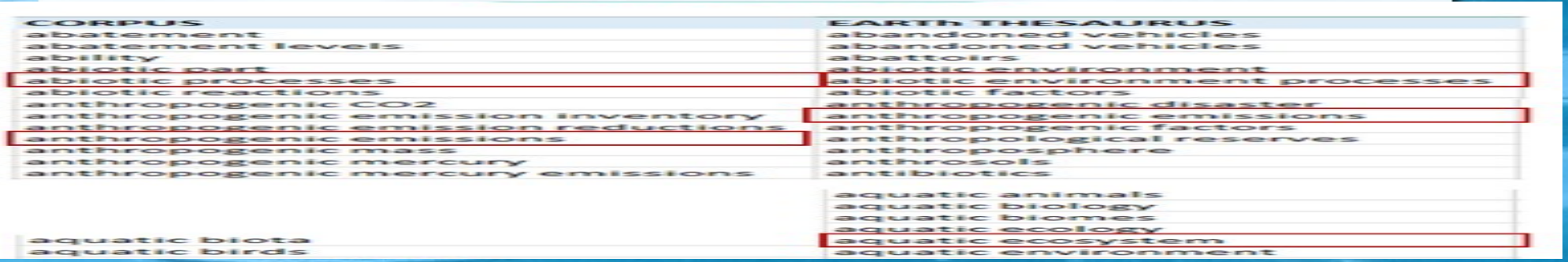
PLACARD's approach: establish a comprehensive coordination and knowledge exchange platform for Climate Change Adaptation (CCA) and Disaster Risk Reduction (DRR).

Fostered dialogue and consultation among stakeholders (e.g. researchers, research funders,policymakers, practitioners) to address gaps and fragmentation challenges in current CCA and DRR research, policymaking and practice, and support the development and implementation of an evidence base for research and innovation policies.

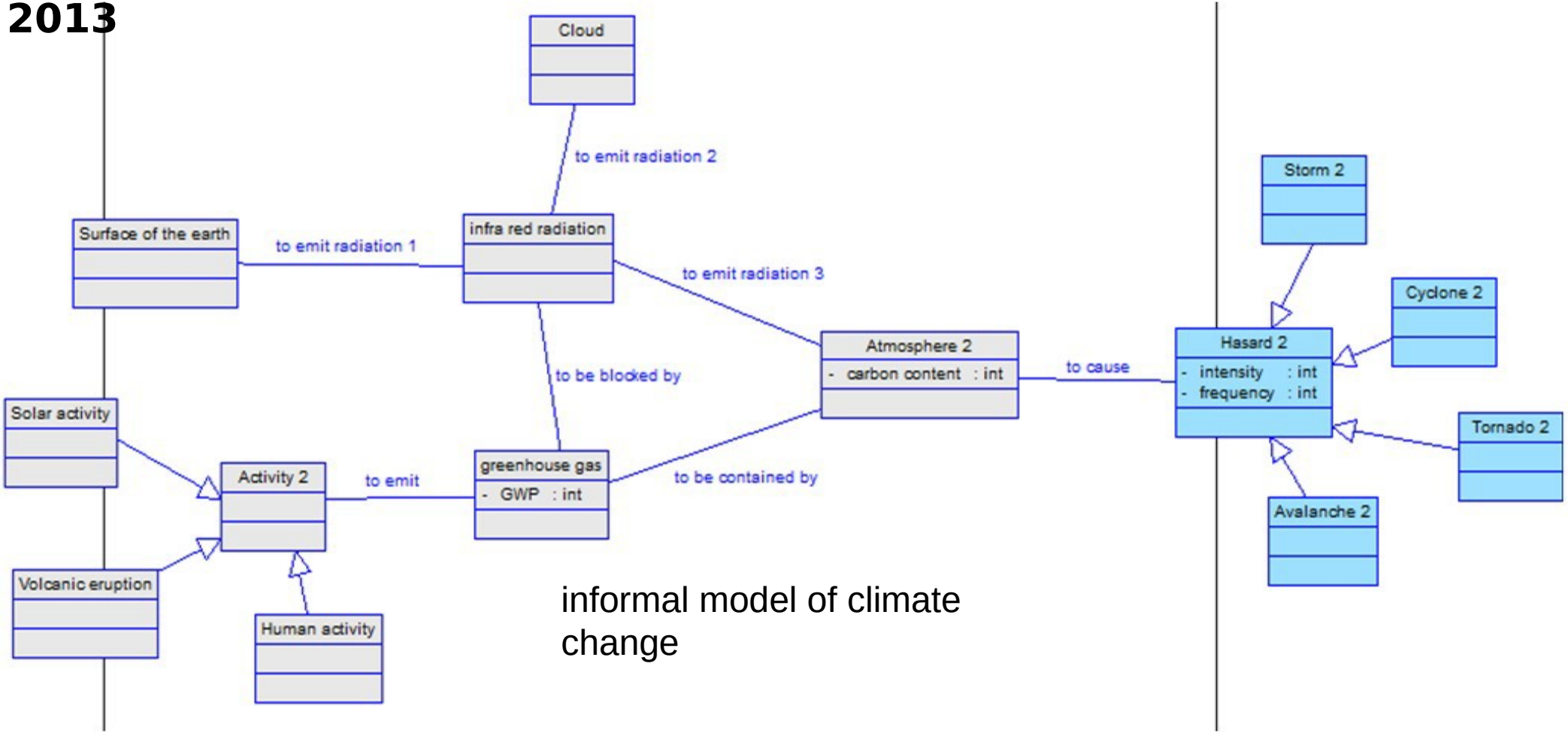
Shared terminology is critical to improving communication, coordination and collaboration. Much data is fragmented and unstructured so information has limited use which partially explains the large gap between research and action.

An Ontological Model for Semantic Interoperability Within an Earth Observation Knowledge Base

Mapped terminological resources (thesauri) related to the Environment such as the General Multilingual Environmental Thesaurus (GEMET), the EARTh Thesaurus (14,000 terms extracted), the AGROVOC Thesaurus, along with the INSPIRE Feature Concept Dictionary/Glossary (& ENVO) https://www.ergon-verlag.de/isko_ko/downloads aiko_vol_17_2020_03.pdf.



"An Ontology Design Pattern of the Multidisciplinary and Complex Field of Climate Change", **Ibrahima Diop and Moussa Lo, ACSIJ Advances in Computer Science: an Inter Journal, Vol. 2, Issue 5, No.6 , November 2013**



informal model of climate change

Climate Change TimeLine (CCTL) Ontology

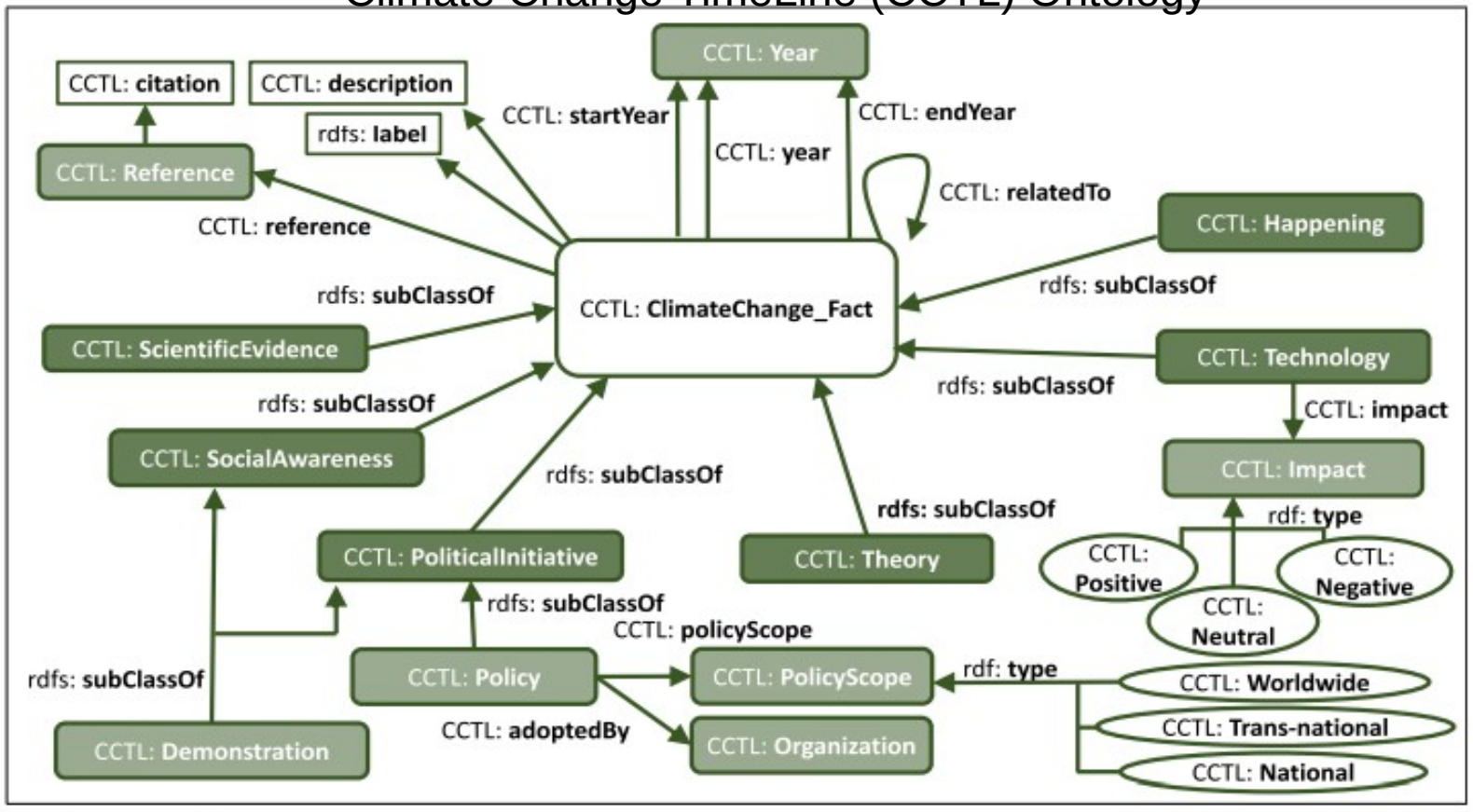


FIGURE 1. CCTL ontology overview.

S. F. Pileggi and S. A. Lamia, "Climate Change TimeLine: An Ontology to Tell the Story so Far," in IEEE Access, vol. 8, pp. 65294-65312, 2020, doi: 10.1109/ACCESS.2020.2985112.

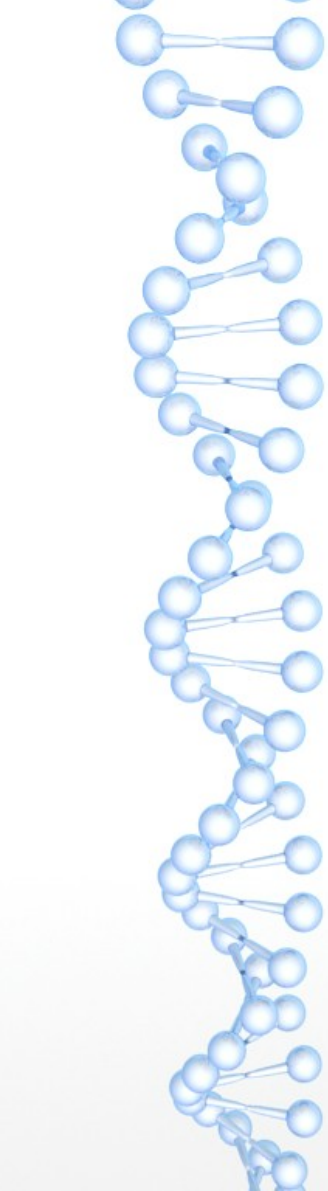
Climate Related Classes in SWEET Ontology

- climate
- climate anomaly
- climate change
- climate phenomena
- drought
- global change
- global climate
- global warming

greenhouse effect

- heat island
- local climate
- mesoclimate
- microclimate
- moisture climate
- nuclear winter
- paleoclimate
- regional climate
- thermal climate

Amounts to just an early and small start on climate



Track 4: Aerospace/Maritime Disasters

Robert Rovetto
Ravi Sharma

Track 4 Roadmap: Aerospace/Maritime

Champions: Ravi Sharma, Robert Rovetto

Topics:

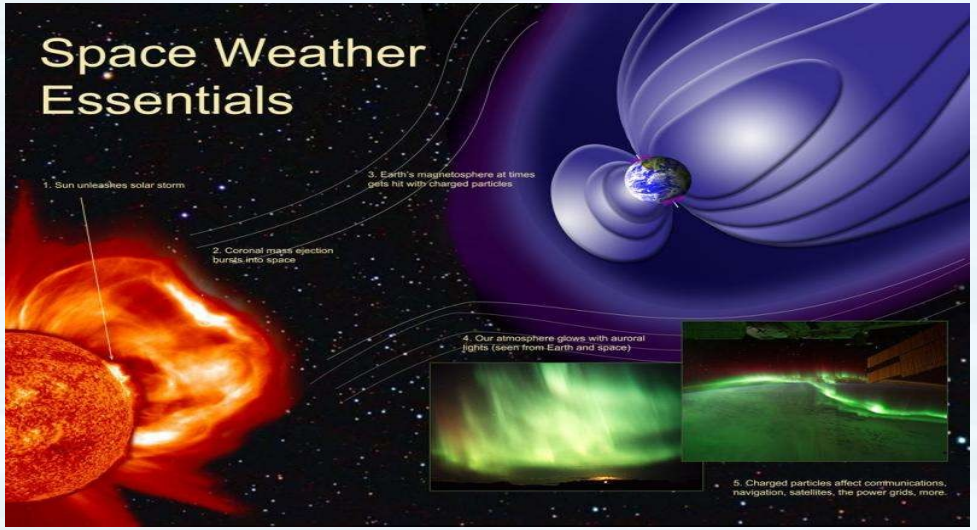
- Unmanned Aerial Vehicles
- Situational Awareness
- Disasters in & from exoatmospheric space
- Hazards in & from […] space

- Tentatively 2-4 speakers
- May-June

A Larger, Recurring Question

1) How can we leverage the best of various approaches to achieving both detailed models & applications like KGs within a specific disaster type and sub-type, but also

2) General models across disaster types to support interoperability?



Geomagnetic Storms

A geomagnetic storm is a temporary disturbance of Earth's magnetic field typically associated with enhancements in the solar wind. These storms are created when the solar wind and its magnetic field interacts with Earth's magnetic field. The primary source of geomagnetic storms is CMEs which stretch the magnetosphere on the nightside causing it to release energy through magnetic reconnection. Disturbances in the ionosphere (a region of Earth's upper atomosphere) are usually associated with geomagnetic storms.

Open Discussion