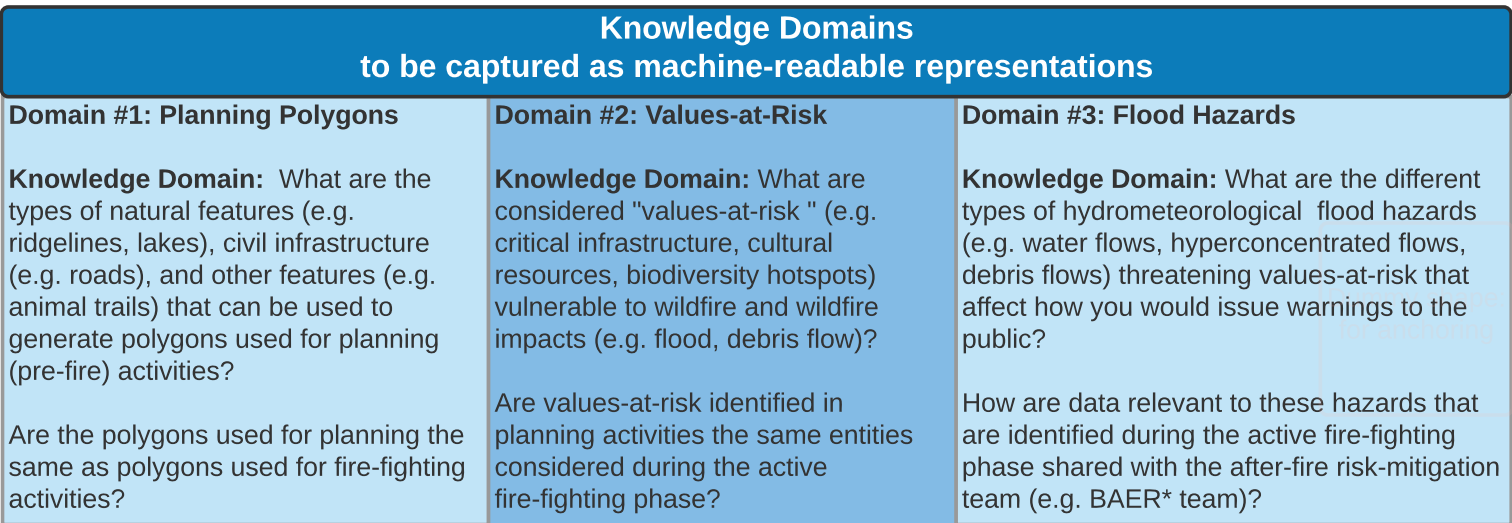# Wildfire data and information interoperability across fire management phases

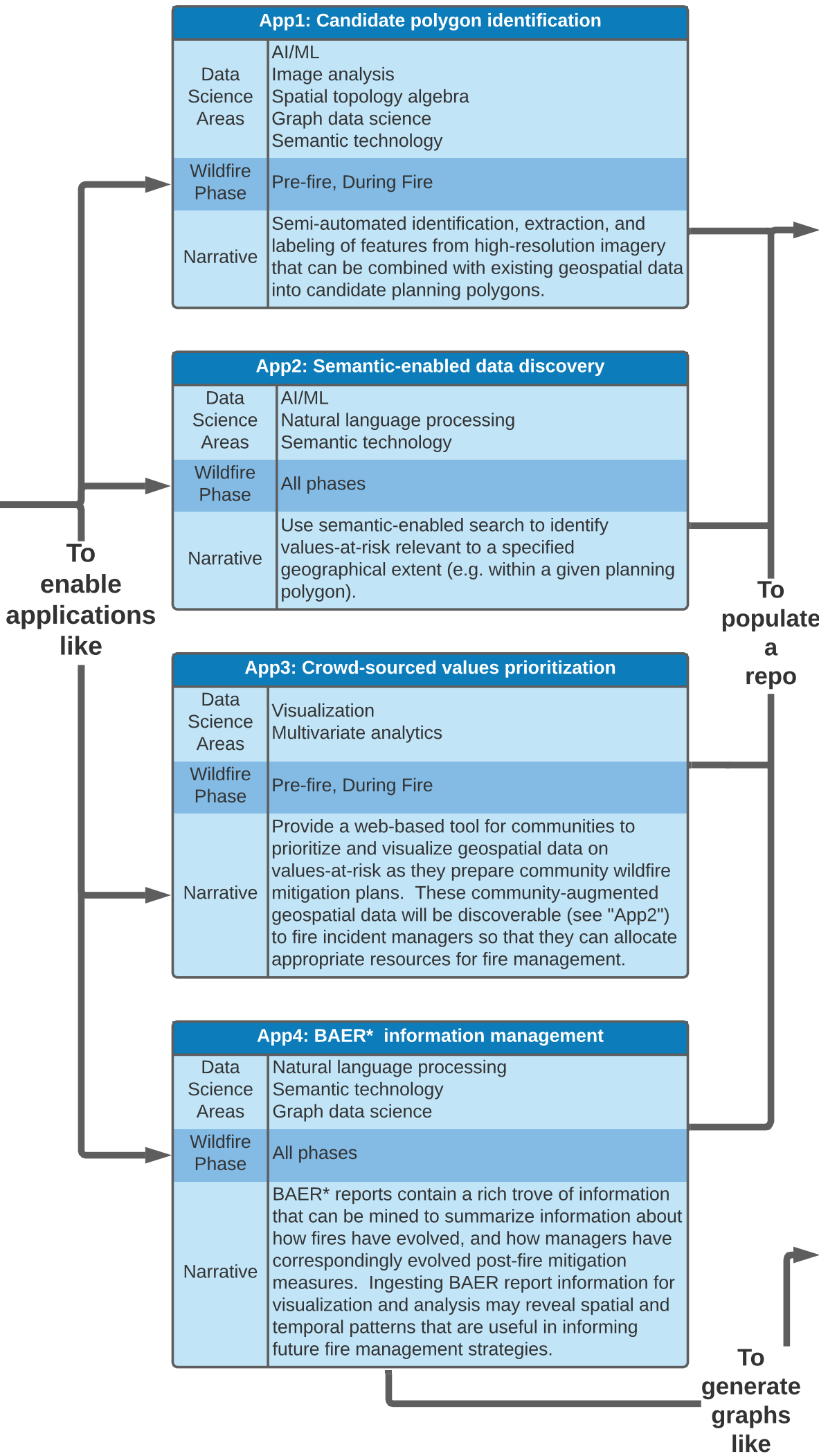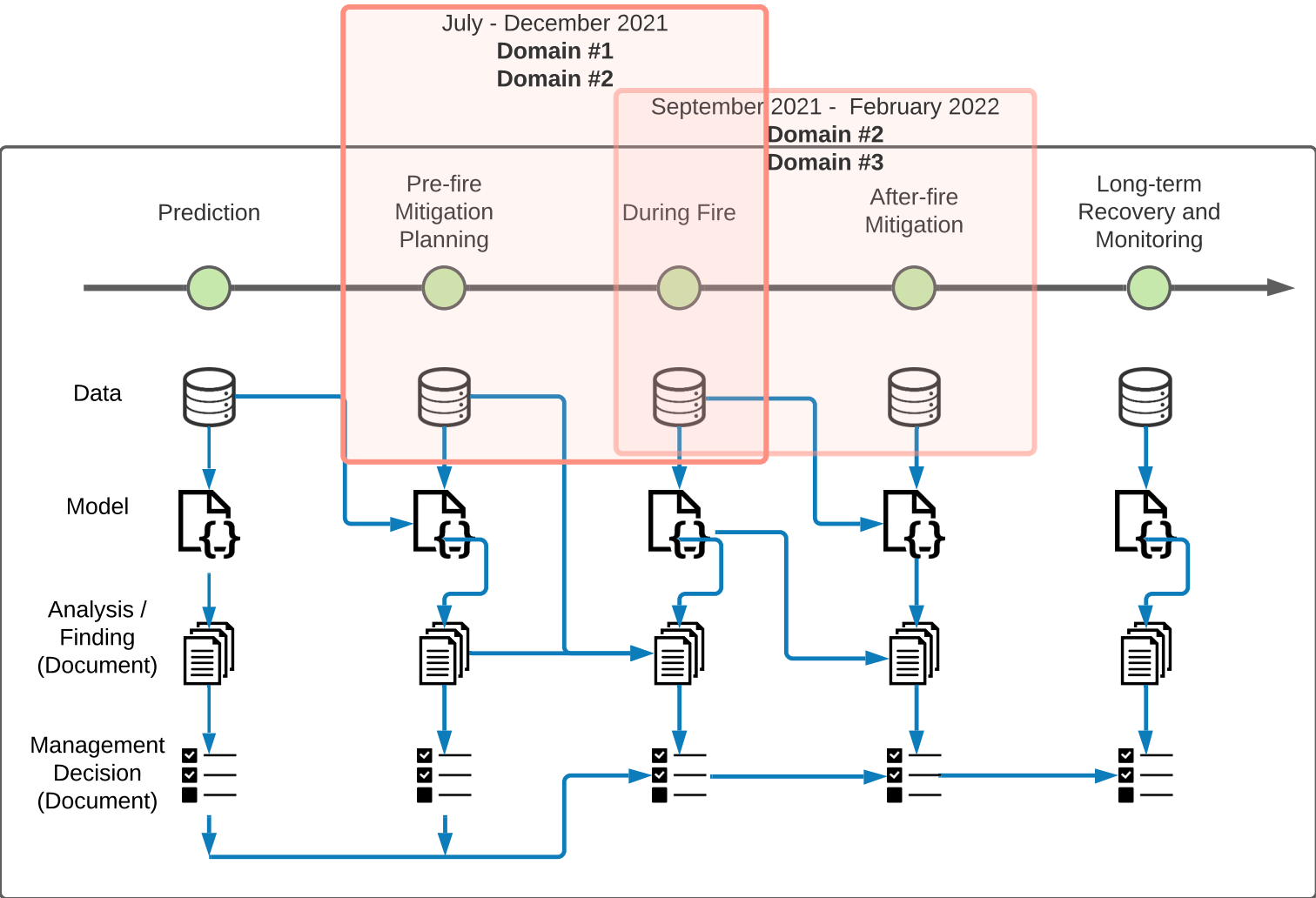Brian Wee[1], William Teng[2], Dave Zader[3]

Wildfire data and information should ideally be reusable and repurposable across different fire management phases.

For example, infrastructure that is vulnerable to wildfire-induced floods identified during the active-fire fighting phase should be easily discoverable to city managers weeks or even months later, when heavy rains on burn areas may trigger catastrophic debris-flows that threaten lives.

The Agriculture and Climate Cluster and the Semantic Harmonization Cluster are examining how formally encoded knowledge about disasters like wildfires can be used to enable applications that result in wildfire data and information interoperability across fire management phases.

Knowledge Domains
to be captured as machine-readable representations

Domain #1: Planning Polygons

Knowledge Domain: What are the types of natural features (e.g. ridgelines, lakes), civil infrastructure (e.g. roads), and other features (e.g. animal trails) that can be used to generate polygons used for planning (pre-fire) activities?

Are the polygons used for planning the same as polygons used for fire-fighting activities?

Domain #2: Values-at-Risk

Knowledge Domain: What are considered "values-at-risk " (e.g. critical infrastructure, cultural resources, biodiversity hotspots) vulnerable to wildfire and wildfire impacts (e.g. flood, debris flow)?

Are values-at-risk identified in planning activities the same entities considered during the active wildfire fire-fighting phase?

Domain #3: Flood Hazards

Knowledge Domain: What are the different types of hydrometeorological flood hazards (e.g. water flows, hyperconcentrated flows, debris flows) threatening values-at-risk that affect how you would issue warnings to the public?

How are data relevant to these hazards that are identified during the active fire-fighting phase shared with the after-fire risk-mitigation team (e.g. BAER* team)?

* BAER stands for "Burned Area Emergency Response"

To enable applications like

App1: Candidate polygon identification

Data Science Areas	AI/ML Image analysis Spatial topology algebra Graph data science Semantic technology
Wildfire Phase	Pre-fire, During Fire
Narrative	Semi-automated identification, extraction, and labeling of features from high-resolution imagery that can be combined with existing geospatial data into candidate planning polygons.

App2: Semantic-enabled data discovery

Data Science Areas	AI/ML Natural language processing Semantic technology
Wildfire Phase	All phases
Narrative	Use semantic-enabled search to identify values-at-risk relevant to a specified geographical extent (e.g. within a given planning polygon).

App3: Crowd-sourced values prioritization

Data Science Areas	Visualization Multivariate analytics
Wildfire Phase	Pre-fire, During Fire
Narrative	Provide a web-based tool for communities to prioritize and visualize geospatial data on values-at-risk as they prepare community wildfire mitigation plans. These community-augmented geospatial data will be discoverable (see "App2") to fire incident managers so that they can allocate appropriate resources for fire management.

App4: BAER* information management

Data Science Areas	Natural language processing Semantic technology Graph data science
Wildfire Phase	All phases
Narrative	BAER* reports contain a rich trove of information that can be mined to summarize information about how fires have evolved, and how managers have correspondingly evolved post-fire mitigation measures. Ingesting BAER report information for visualization and analysis may reveal spatial and temporal patterns that are useful in informing future fire management strategies.

To populate a repo

A "Prototype Needs Repository" can be used to:

- Foster project ideas for ESIP FUNding Friday, ESIP Lab, USGS Community for Data Integration, etc. by connecting stakeholders to parties interested in developing experimental prototypes.

- Enable the visualization of how informatics capabilities may help fulfill stakeholder needs via experimental prototypes.

To generate graphs like