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**BUSINESS &
PUBLIC POLICY**

Strategies for Logistics in Case of a Natural Disaster

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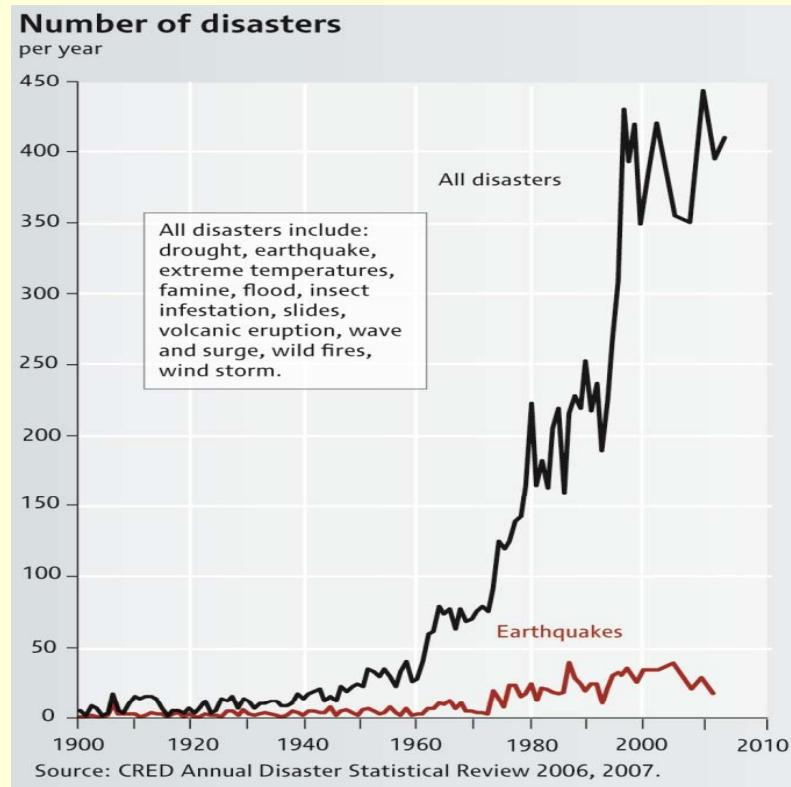
Operations and Logistics Management
Graduate School of Business and Public Policy
Naval Postgraduate School, Monterey, CA



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In 2009

- there were 335 natural disasters
- that killed 10,655 persons
- affected more than 119 million others
- caused over \$41.3 billion in economic damages





Questions of interest

- How can a state of supply preparedness be established and maintained?
- What are appropriate logistics strategies for different disaster types and during various stages of the disaster lifecycle?

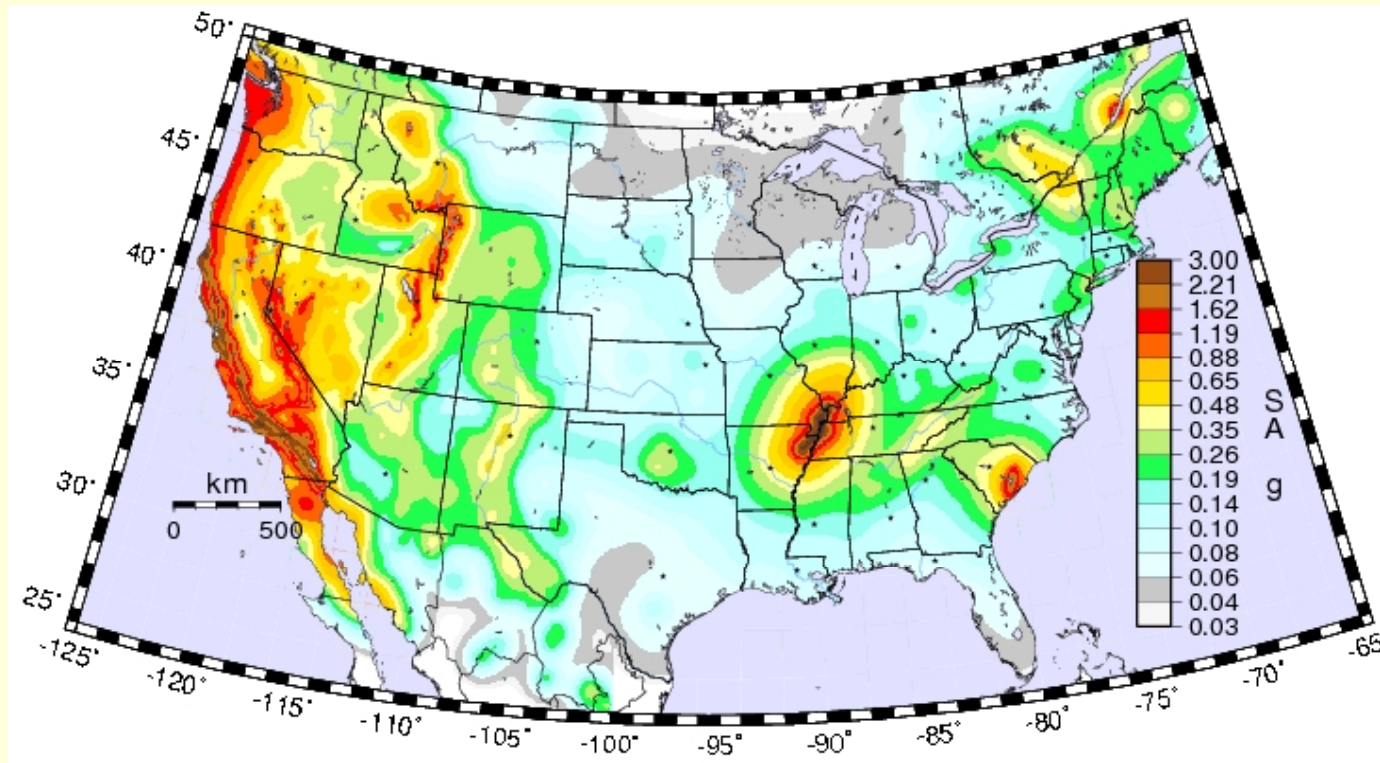
Answers depend on

- the likelihood of a disaster in the area
- the expected onset speed of the disaster
- volume and weight of supplies to be moved
- the expected magnitude of humanitarian relief required



Likelihood of disaster

Earthquake – United States

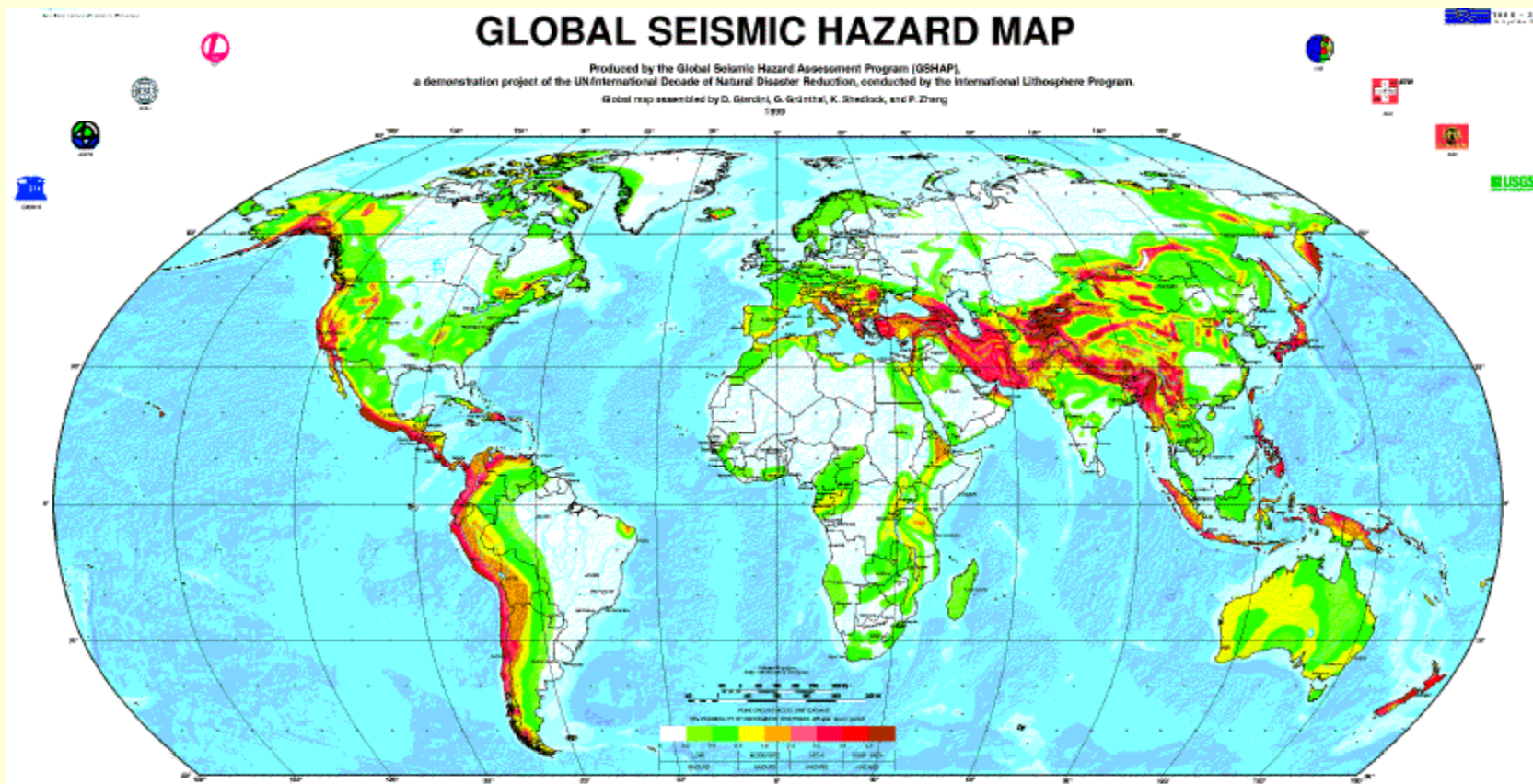


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Likelihood of disaster

Earthquake – World





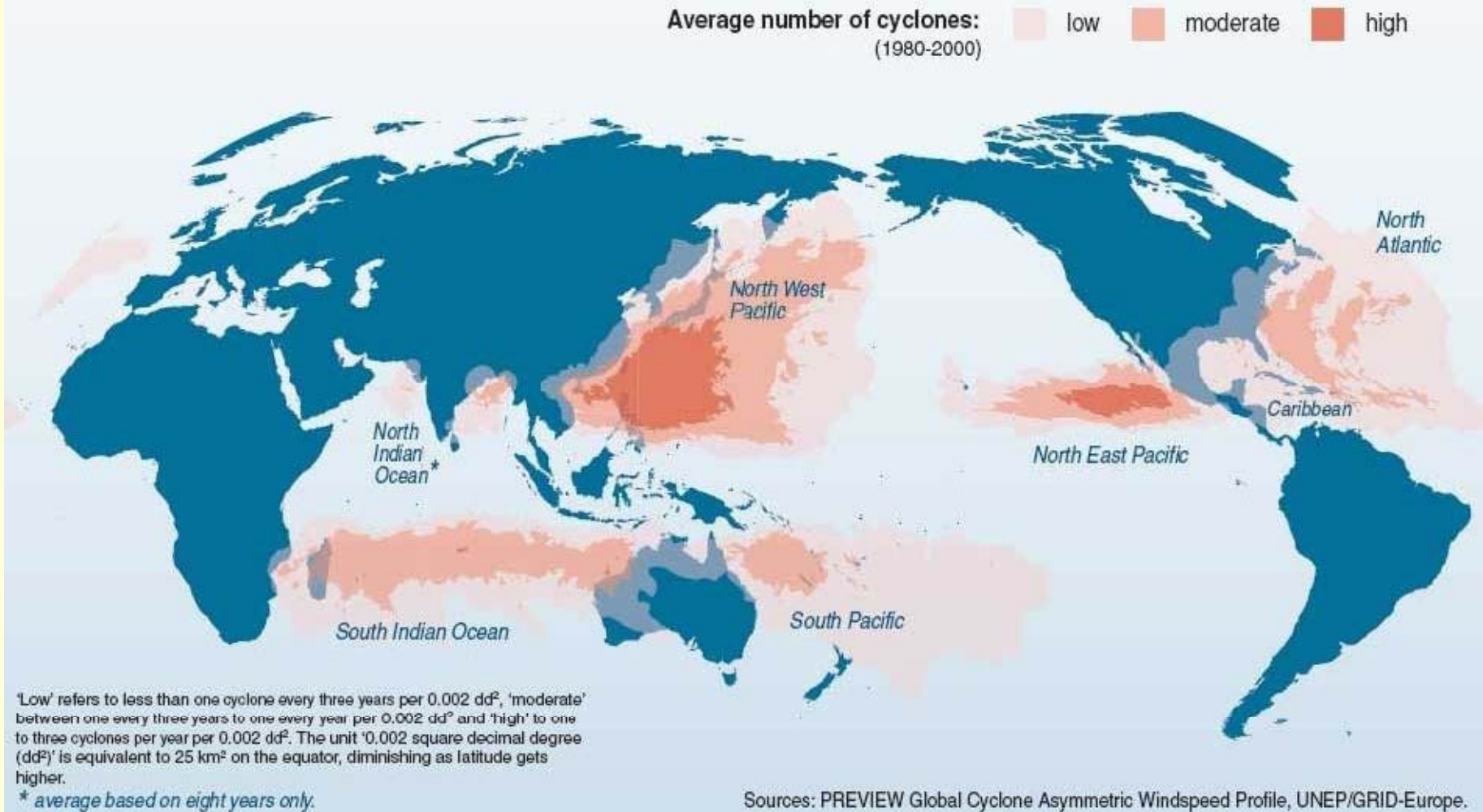
Likelihood of disaster





Likelihood of disaster

Tropical cyclone frequency





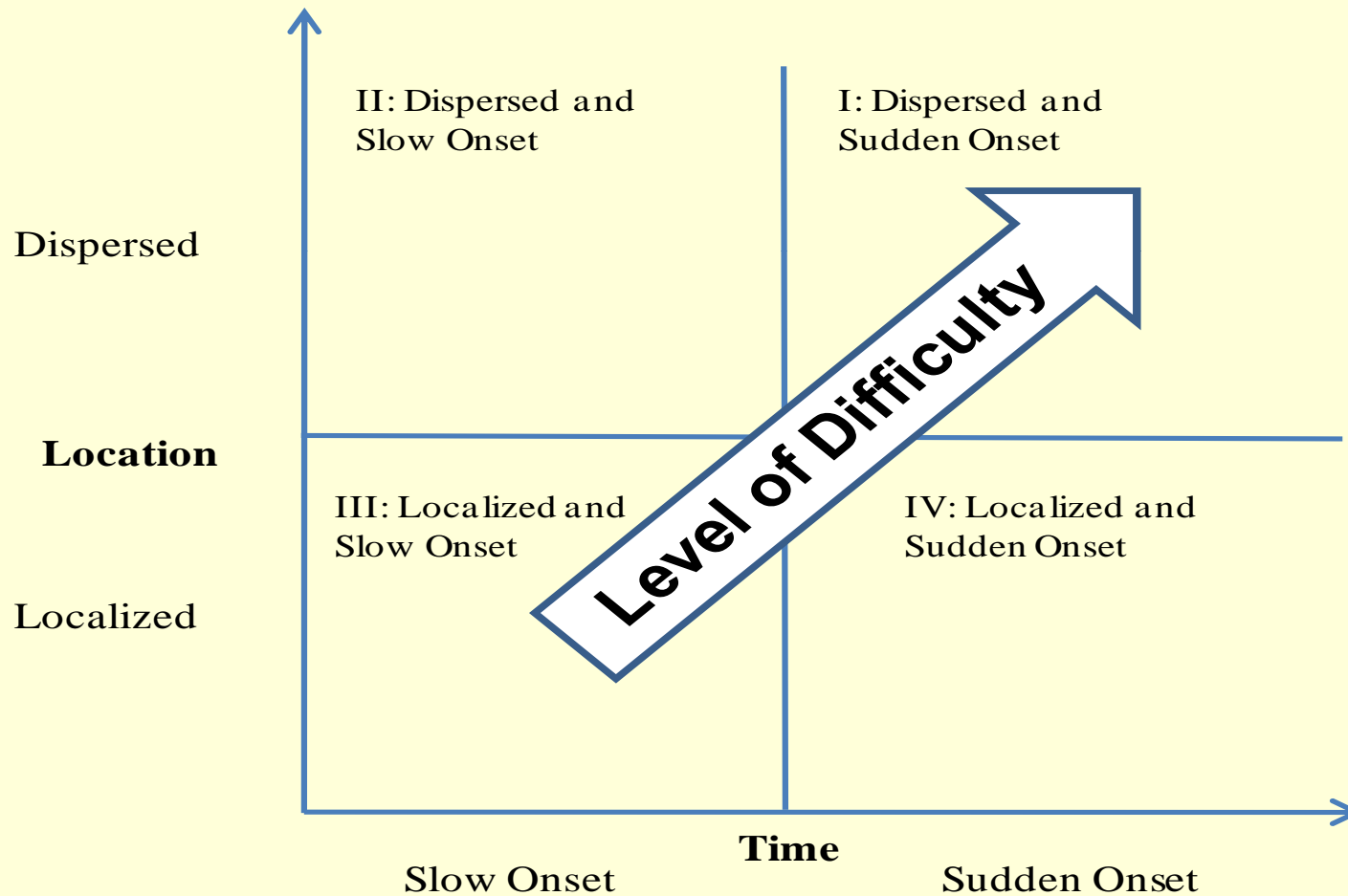
Our research focuses on four disaster scenarios:

1. dispersed, sudden-onset disasters
2. dispersed, slow-onset disasters
3. localized, slow-onset disasters
4. localized, sudden-onset disasters



Classification of Disasters

(Adapted from Apte 2009)





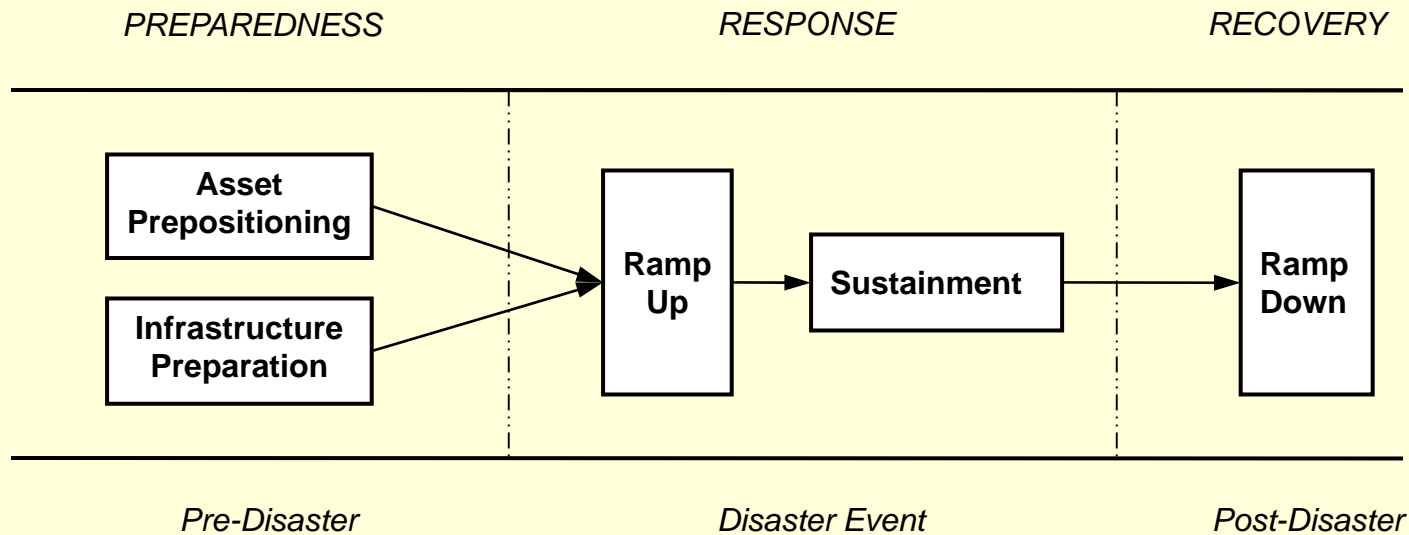
We divide the life cycle of a disaster into three stages:

1. being prepared in the pre-disaster stage
2. response as the disaster strikes
3. recovery in post-disaster



Life Cycle of Disaster Response

(Source: Apte 2009)





The classification suggests

- logistics execution is less onerous in the case of localized, slow-onset disasters because there may be adequate lead time to prepare for the response
- dispersed, slow-onset disasters may take substantial planning, resource allocation and coordination
- sudden-onset disasters, even if localized, create problems in all three stages of the lifecycle of the disaster



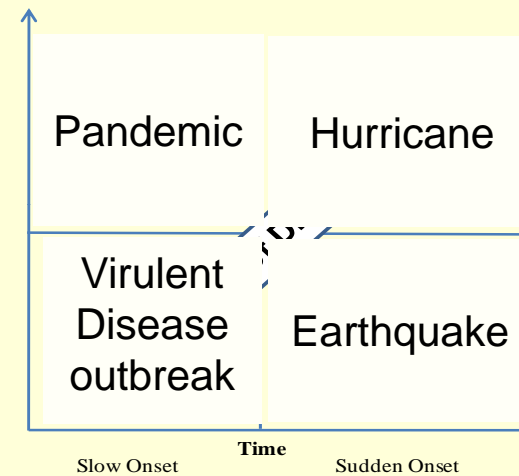
Methodology

Review of the relevant
logistics literature

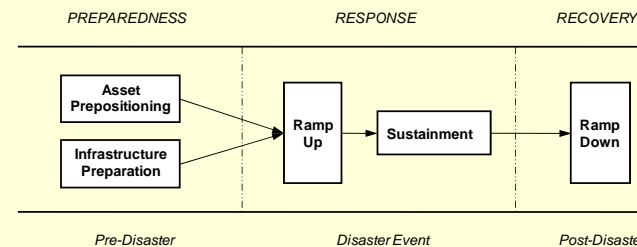


Dispersed
Location
Localized

Examination of
disaster *exemplars*



Consideration of
disaster lifecycle



Identified logistics strategies
associated with each disaster
type and associated lifecycle



Some relevant logistics literature

- Coordinating activities and inventories over a spectrum of stages in the supply chain (Schoenmeyr and Graves 2009).
- Strategic inventory placement under evolving or pre-determined forecasts (Schoenmeyr and Graves 2008, Simpson 1958) and under uncertain and non-stationary demand Graves and Willems (2002).
- Managing humanitarian operations is similar to the management of response supply chains however there is a much higher level of uncertainty in an adverse environment.



Examination of disaster *exemplars*

- Dispersed Sudden
 - 2004 Indian Ocean Tsunami
- Dispersed Slow
 - 2009 Avian Flu Epidemic
- Localized Slow
 - 2005 Hurricane Katrina
- Localized Sudden
 - 2010 Haiti Earthquake



Examination of policies

- We investigate four policy options based upon strategies that have been effective in the military and private sector:
 - prepositioning supplemental resources in or near the incident location;
 - proactive deployment of assets in advance of a local request;
 - phased deployment of assets, analogous to the “just in time” inventory control philosophy;
 - “surge” deployment of manpower and equipment from locations outside the disaster area.



Prepositioning

- **Pre-positioning in the private sector**
 - spare parts in post-sales product support
 - location and timing of requests is not known exactly and can be uncertain
 - seasonal inventories
 - typically moved closer to retail during the peak season, then moved back into distribution centers in the off-season
- **Prepositioning in the military**
 - Prepositioned stocks on land or at sea
 - in or near anticipated contingency areas
 - In a hardened or protected “safe haven”



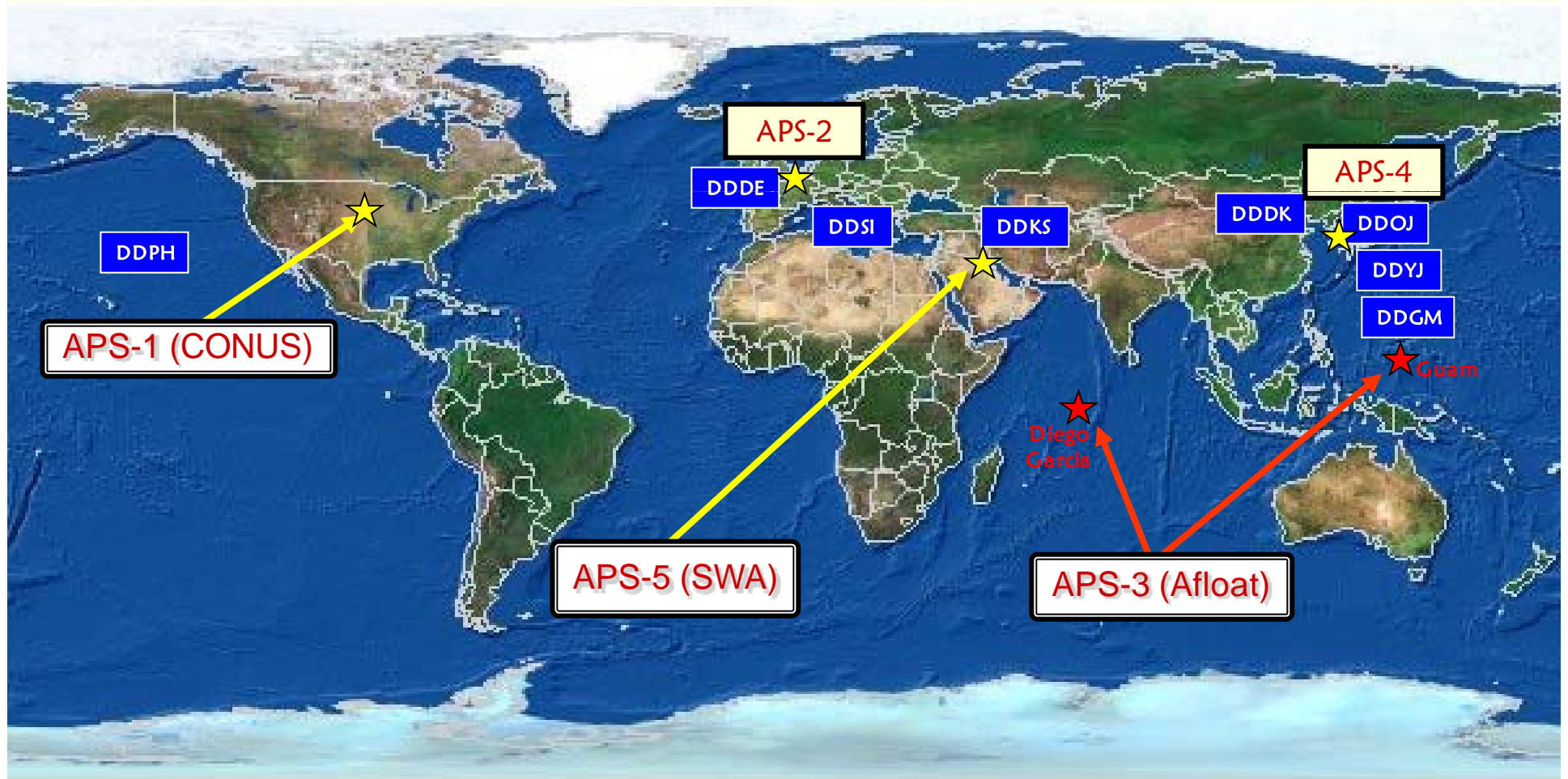
Prepositioning

- Is prepositioning the best strategy for all types of disasters?
- How should adequate prepositioned disaster relief inventory be established and sustained over time to include the rotation of perishable stocks?
- How can information regarding the location, quantity, and condition of prepositioned inventory be shared and what effect would this information sharing have on the total investment of prepositioned stocks?
- How reliable are the potential supply lines if it is determined that supplies should be virtually stockpiled?
- Should supplies be sourced locally or from outside the disaster zone?



Army Prepositioned Stocks (APS) and DLA Distribution

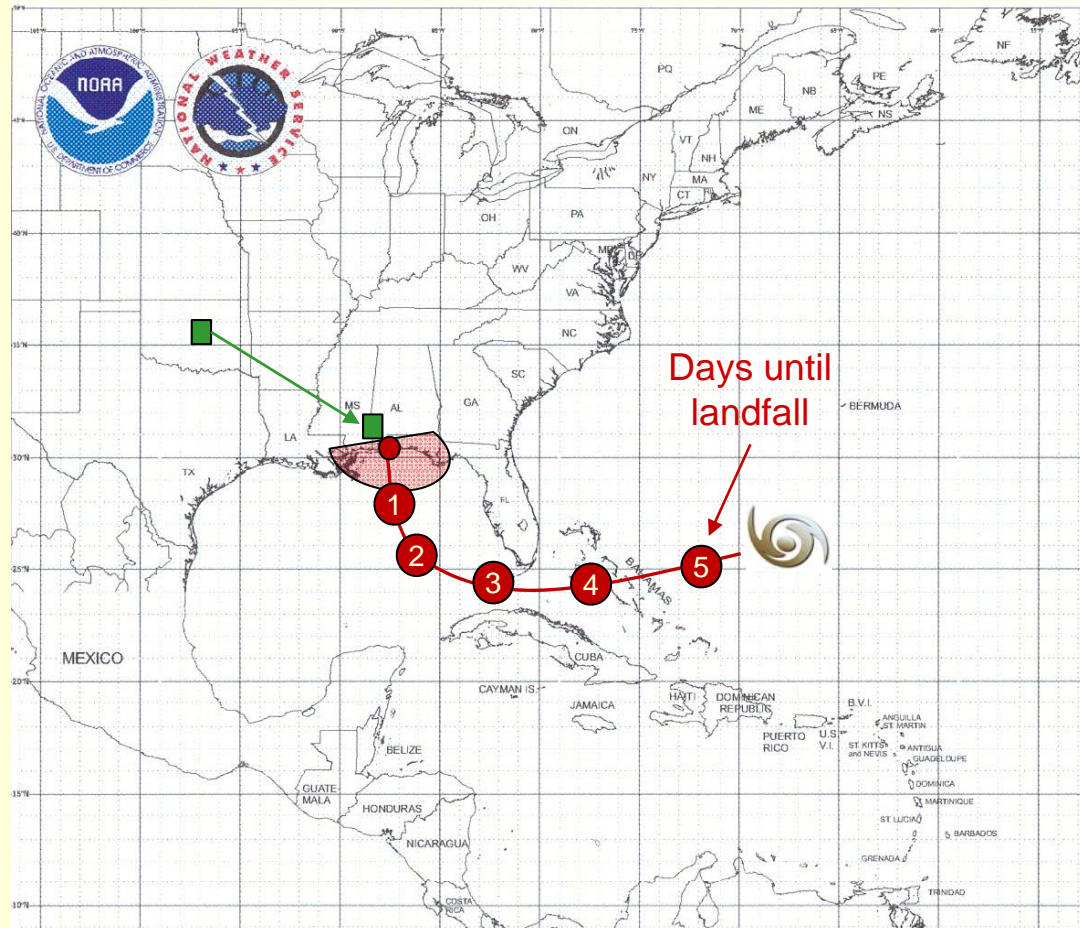
Example of military prepositioning and forward distribution





Proactive deployment

Refers to moving supplies into an area in advance of a local request





Phased deployment

Refers to pushing inventory into a dis...
and in the quantity in which it is ne...





Utilize surge capacity

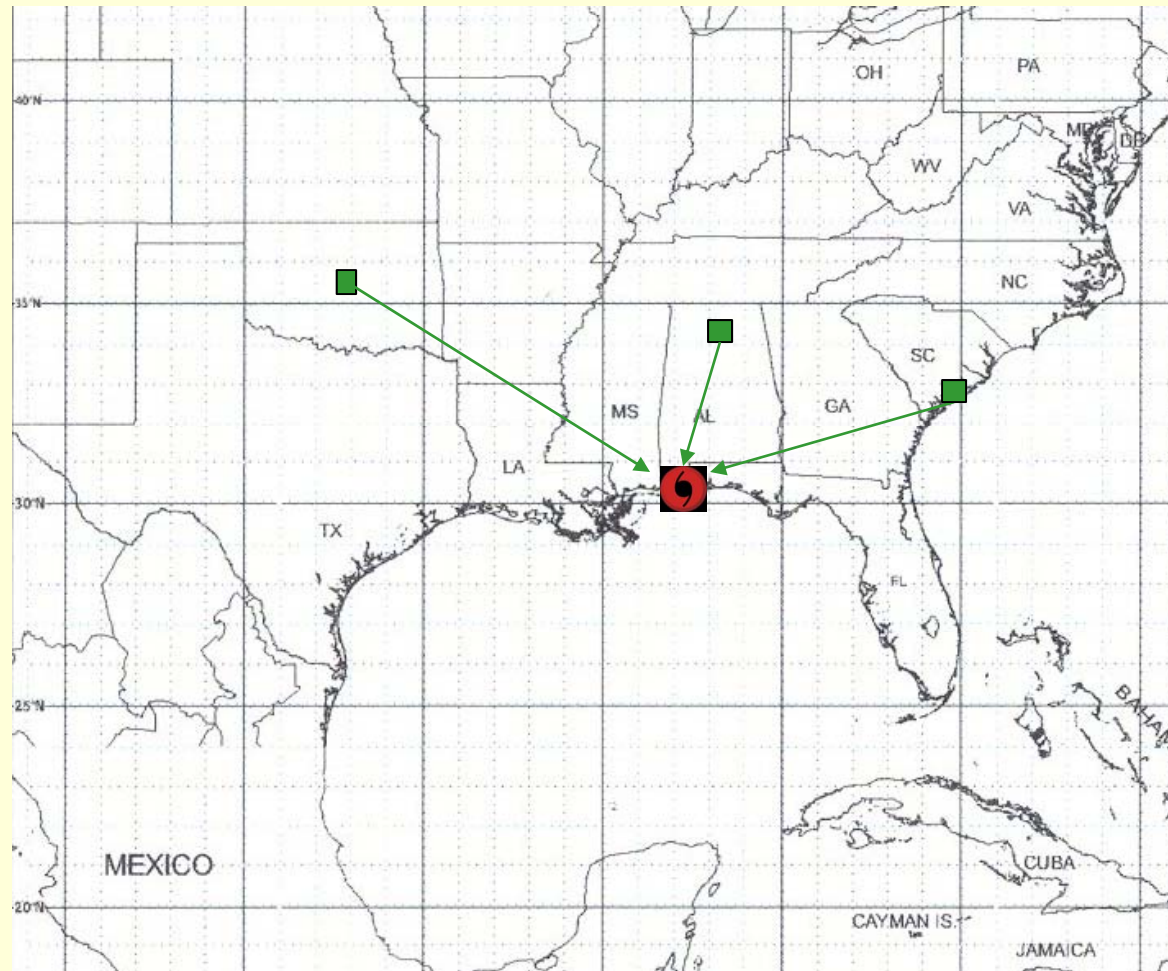
A surge in the deployment of manpower and equipment from locations outside the disaster area is an alternative that, rather than relying on prepositioned physical inventory, plans for excess capacity to deliver personnel and materiel in case of an emergency.

In the case of a surge strategy, the “prepositioning” is with respect to capacity rather than inventory.



Surge

Refers to the deployment of large quantities of supplies to the affected area

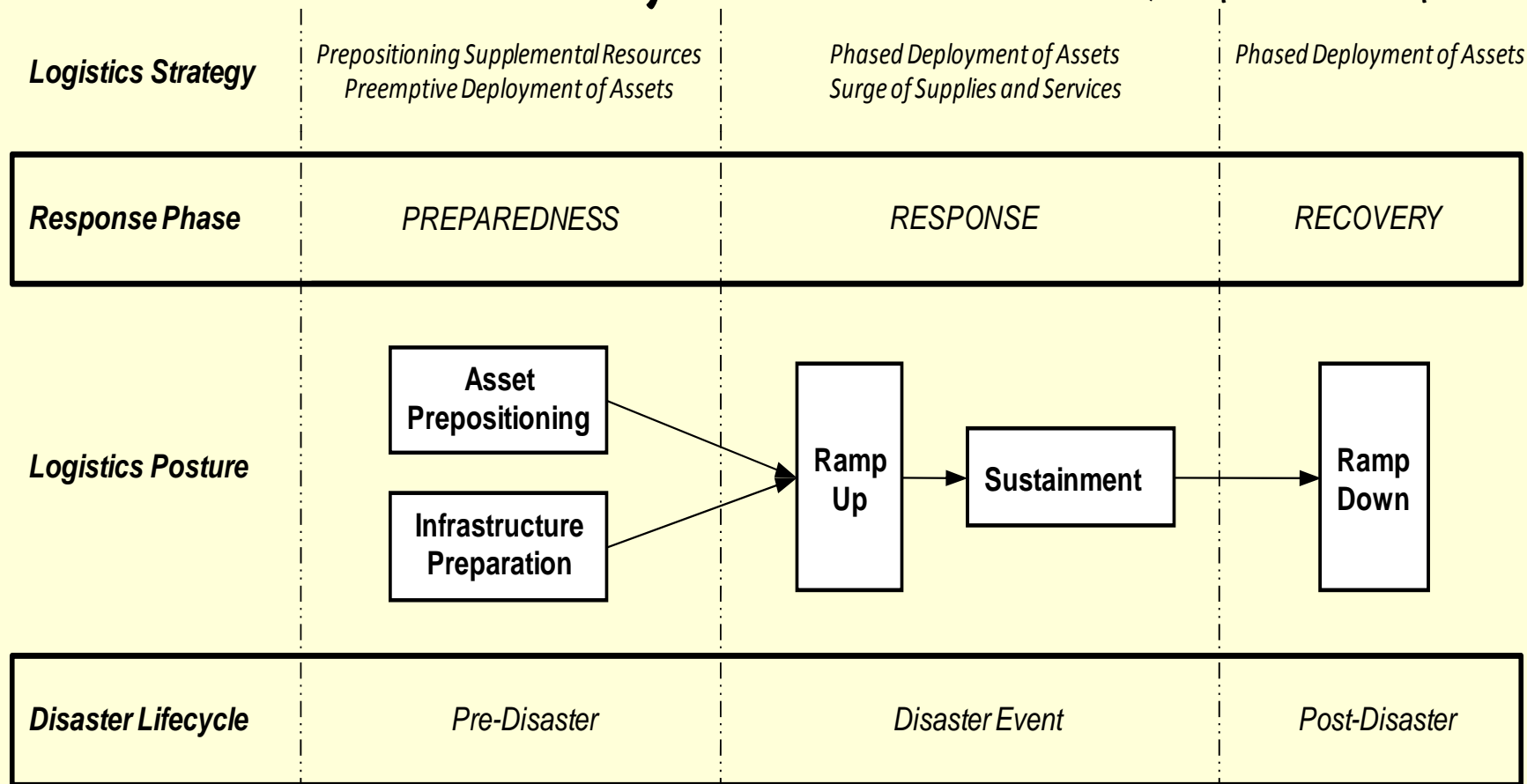




Preliminary assignment of strategies to lifecycle

A preliminary look at the previously mentioned four strategies related to the lifecycle of a disaster suggests the assignment of strategies as follows:

Policies Related to Lifecycle of a Disaster (Adapted from Apte 2009)





Contribution

- The proposed research will
 - Develop conceptual models that will serve as the theoretical base for future empirical work investigating appropriate policy options for different classifications of disasters
 - Contribute to a better understanding of strategies in logistics for HA/DR
 - Recommend strategies in logistics that are appropriate to different types of disasters and to the different lifecycles of a disaster



Way Forward

Supplementing our literature review and analysis of disaster types and the disaster lifecycle, we will employ process analysis, cost analysis and specific case studies to develop policy options to respond to specific disaster types



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QUESTIONS?