The number of disasters is growing, as well as the number of people affected by them.

Logistics plays a central role in all phases of disaster management and supporting humanitarian operations.

The fundamental task of a logistics system is to deliver the appropriate supplies, in quality condition, in the right amounts, to the locations at the time that they are needed.
Some Motivation Behind Offering This Course and Course Goals

However, due to the inherent nature of disasters, humanitarian logistics is faced with unique challenges:

• the critical infrastructure, including the transportation and communication systems, may have been severely negatively impacted and their functionality compromised;
• there is a short time window in which to respond with the critical needs products, which must be delivered in order to prevent loss of life and human suffering, and
• there may be great uncertainty due to the disruptions, among other complications.
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- there may be great uncertainty due to the disruptions, among other complications.
This course covers the challenges and solutions associated with humanitarian logistics in emergency mitigation and preparedness, disaster response, and recovery.

The course overviews similarities and differences between commercial supply chains and relief chains, introduces performance metrics, and provides tools for the analysis and design of supply chains for humanitarian critical needs products, as well as for the coordination and teaming of humanitarian organizations.

It also covers such major issues as risk management, material convergence, and competition for financial funds for disasters.
This course is based on primary source reading materials, including journal articles, case studies, newspaper articles, and videos.
The word *logistics* comes from the Greek *logistikos*, which means “skilled in calculating,” and from medieval Latin, where *logisticus* means “of calculation.”

The Random House dictionary defines *logistics* as the branch of military science and operations dealing with the procurement, supply, and maintenance of equipment, the movement of personnel, the provision of facilities, and with related matters.
The US Department of Defense (2002) defined logistics as the science of planning and carrying out the movement and maintenance of forces ... those aspects of military operations that deal with the design and development, acquisition, storage, movement, distribution, maintenance, evacuation and disposition of material.

There is an old military saying, which speaks volumes: Armchair generals talk strategy. Real generals talk logistics.
Some Background – Definitions of Logistics

**Business Logistics** - The science of planning, design, and support of business operations of procurement, purchasing, inventory, warehousing, distribution, transportation, customer support, financial and human resources. – (MDC, LogLink / LogisticsWorld, 1997).
Complex Logistical Network

Suppliers

Manufacturers

Distribution Centers

Demand Markets

Domestic Manufacturer

Information

International Manufacturer
In this course, we will use *supply chains* and *logistics* interchangeably.
According to Nagurney (2006): Supply chains are the critical infrastructure and backbones for the production, distribution, and consumption of goods as well as services in our globalized Network Economy.
Supply chains may span thousands of miles, involve numerous suppliers, retailers, and consumers, and be underpinned by multimodal transportation and telecommunication networks.
Examples of Commercial Supply Chains

- food and food products
- high tech products
- automotive
- energy (oil, electric power, etc.)
- clothing and toys
In this course, we will be focusing on humanitarian and healthcare supply chains.
Humanitarian Relief Chains
Healthcare Supply Chains

[Images of healthcare supply chain processes, including medical equipment, pharmaceuticals, and waste management.]
Supply chains may be characterized by **decentralized decision-making** associated with the different economic agents or by **centralized decision-making**.
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Hence, any formalism that seeks to model supply chains and to provide quantifiable insights and measures must be a system-wide one and network-based.
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Supply chains are, in fact, Complex Network Systems.

Hence, any formalism that seeks to model supply chains and to provide quantifiable insights and measures must be a system-wide one and network-based.

Indeed, such crucial issues as the stability and resiliency of supply chains, as well as their adaptability and responsiveness to events in a global environment of increasing risk and uncertainty can only be rigorously examined from the view of supply chains as network systems.
Multilevel Network Structure of the Supply Chain

Flows are Commodity Shipments

Flows are Prices

Logistical Network

Informational Network

Financial Network

Characteristics of Supply Chains Today

- **large-scale nature** and complexity of network topology;
- **congestion**, which leads to nonlinearities;
- **alternative behavior of users of the networks**, which may lead to paradoxical phenomena;
- **possibly conflicting criteria associated with optimization**;
- **interactions among the underlying networks themselves**, such as the Internet with electric power networks, financial networks, and transportation and logistical networks;
- recognition of **their fragility and vulnerability**;
- policies surrounding them may have major impacts not only economically, but also **socially, politically, and security-wise**.
What is Humanitarian Logistics?

The Fritz Institute, working with senior logisticians, came up with the following definition since there was a clear need: *it is the process of planning, implementing and controlling the efficient, cost-effective flow of and storage of goods and materials as well as related information, from point of origin to point of consumption for the purpose of meeting the end beneficiary’s requirements* (Thomas and Mizushima (2005)).
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For humanitarians, logistics consists of the processes and systems involved in mobilizing people, resources, skills and knowledge to help vulnerable people affected by disaster (Van Wassenhove (2006)).
What is Humanitarian Logistics?

Disaster relief (and associated cost) is approximately 80% logistics; hence, more transparent, efficient, and effective logistics operations and supply chain management in disasters cannot only save lives but enables better preparedness for natural as well as man-made disasters.
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Moreover, donors, who pledge millions in aid and goods, see the impact of the aid.
Humanitarian Sector Funding Flows

What is a Disaster?

As noted in the *Fragile Networks: Identifying Vulnerabilities and Synergies in an Uncertain World* book by Nagurney and Qiang (2009): The Emergency Events Database (2008) defines a *disaster* as an event that fits at least one of the following criteria:
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2. 100 or more people affected;
3. results in a declaration of a state of emergency;
4. results in calls for international assistance.
What is a Disaster?

According to the Federal Emergency Management Agency (FEMA) (1992), a catastrophe disaster is an event that:

• results in large numbers of deaths and injuries;
• causes extensive damage or destruction of facilities that provide and sustain human needs; produces an overwhelming demand on state and local response resources and mechanisms;
• causes a severe long-term effect on general economic activity;
• and severely affects state, local, and private-sector capabilities to begin and sustain response activities.
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What is a Disaster?

From these definitions, we see that although disasters may have different meanings, depending on the specific domain, they have one thing in common: they have a catastrophic effect on human lives and a region’s or even a nation’s resources.
## Classification of Disasters

<table>
<thead>
<tr>
<th>Natural</th>
<th>Man-made</th>
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<tbody>
<tr>
<td><strong>Sudden-onset</strong></td>
<td>Earthquake</td>
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<td>Hurricane</td>
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<td>Tornadoes</td>
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<td><strong>Slow-onset</strong></td>
<td>Famine</td>
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<td>Drought</td>
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<td>Poverty</td>
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<td>Terrorist Attack</td>
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<td>Coup d’Etat</td>
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<td>Chemical leak</td>
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<td>Political Crisis</td>
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<td>Refugee Crisis</td>
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Examples of Recent Disasters

• The Indian Ocean earthquake and (Indonesian) tsunami on December 26, 2004 resulted in over 230,000 deaths in 14 countries;
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- The Haiti earthquake that struck on January 12, 2010 with government reporting over 300,000 deaths and the Chilean one on February 27, 2010 with over 500 losing their lives;
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• The triple (earthquake/tsunami/nuclear) disaster in Japan on March 11, 2011 with a death toll over 18,000.
The Triple Disaster in Japan on March 11, 2011

The world reeled from the aftereffects of the triple disaster in Japan with disruptions in the high tech, automotive, and even food industries with potential additional ramifications because of the radiation continuing to this day.
Superstorm Sandy

Superstorm Sandy struck the northeastern US and beyond on October 29, 2012. It killed at least 125 people in the United States, including 54 in Haiti. Sandy is being blamed for about $62 billion in damage and other losses in the US, the vast majority in New York and New Jersey, a number that could increase. **It was the second-costliest storm in US history after 2005’s Hurricane Katrina**, which caused $128 billion in damage in inflation-adjusted dollars. Sandy caused at least $315 million in damage in the Caribbean.
Haiyan Typhoon in the Philippines

Typhoon Haiyan was a tropical cyclone that devastated portions of Southeast Asia, especially the Philippines, on November 8, 2013. It was the deadliest Philippine typhoon on record, killing at least 6,190 people in that country alone. Haiyan was also the strongest storm recorded at landfall. The overall economic losses from Typhoon Haiyan totaled $10 billion.
The 7.8 magnitude earthquake that struck Nepal on April 25, 2015, and the aftershocks that followed, killed nearly 9,000 people and injured 22,000 others. This disaster pushed about 700,000 people below the poverty line in the Himalayan nation, which is one of the world’s poorest. About 500,000 homes were made unlivable by the quakes, leaving about three million people homeless. Much infrastructure was also badly damaged and 1/3 of the healthcare facilities devastated. According to The Wall Street Journal, Nepal needs $6.66 billion to rebuild.
Video and Commentary of Devastation Wreaked by Hurricane Katrina and the Aftermath

Click on underlined text for video.
Images of Devastation of Hurricane Katrina in August 2005
The Haitian and Chilean Earthquakes
Click on underlined text for video.

Graphic Video of the Aftermath of the Haiti Earthquake from The New York Times
H1N1 (Swine) Flu

As of May 2, 2010, worldwide, more than 214 countries and overseas territories or communities reported laboratory confirmed cases of pandemic influenza H1N1 2009, including over 18,001 deaths (www.who.int).

Parts of the globe experienced serious flu vaccine shortages, both seasonal and H1N1 (swine) ones, in late 2009.
The Impact of Disasters

Disasters have brought an unprecedented impact on human lives in the 21st century and the number of disasters is growing. From January to October 2005, an estimated 97,490 people were killed in disasters globally; 88,117 of them because of natural disasters.
The number of disasters is increasing globally, as is the number of people affected by disasters. At the same time, with the advent of increasing globalization, viruses are spreading more quickly and creating new challenges for medical and health professionals, researchers, and government officials.

Between 2000 and 2004, the average annual number of disasters was 55% higher than in the period 1994 through 1999, with 33% more humans affected in the former period than in the latter (cf. Balcik and Beamon (2008) and Nagurney and Qiang (2009)).
Natural Disasters (1975–2008)

Natural disasters reported 1975 - 2008

Number of people reported affected by natural disasters 1975 - 2008
The most expensive disasters globally in 2013 hit First World nations, but the ones that cost the most lives struck developing countries.

German insurer Munich Re, in its annual report on disasters, noted in January 2014, that about 20,000 people died in natural disasters in 2013, about twice as many as in 2012. Most of the deaths resulted from Typhoon Haiyan that hit the Philippines, Vietnam, and China in November with a loss of about 6,100 lives. This was followed by floods in India that killed about 5,500 people in June.

Insurance losses will likely be low, Munich Re said, because fewer people and businesses there carry insurance.
The Impacts of Disasters in 2013

In contrast, flooding in central Europe in May and June 2013 topped the list of global economic damage last year at more than $15 billion, with the insurance industry paying $3 billion in claims. The most costly event for insurers in 2013 were hailstorms that struck southern Germany in July, damaging hundreds of thousands of cars and buildings and resulting in $3.7 billion in insurance payouts.

Interestingly, both the $125 billion global economic damage caused by natural catastrophes in 2013 and the $31 billion in claims paid by insurers were below the average of the last 10 years of $184 billion and $56 billion, respectively, according to Munich Re.
The Ebola epidemic (2014-2015) in West Africa was the largest outbreak of Ebola. According to the World Health Organization, as of December, 2015, the death toll was about 11,000, impacting Liberia, Guinea, and Sierra Leone.

Image thanks to cnn.com.
Debbie Wilson Worked with Doctors Without Borders in Liberia for 6 Weeks in Fall 2014

She spoke on the importance of logistics in February 2015 in this course.

Link to Debbie Wilson’s slides from her lecture
The Syrian Refugee Crisis

Syria’s civil war has created the worst humanitarian crisis of our time. Half of the country’s pre-war population — more than 11 million people — have been killed or forced to flee their homes.

This crisis dates to March 2011, when anti-government demonstrations began, as part of the Arab Spring. The peaceful protests quickly escalated after the government’s violent crackdown, and armed opposition groups began fighting back. By July 2011, according to Mercy Corps, army defectors had started to organize the Free Syrian Army and many civilian Syrians took up arms to join the opposition. Divisions between secular and religious fighters, and between ethnic groups, continue to complicate the politics of the conflict.
The Syrian Refugee Crisis

SYRIAN REFUGEE CRISIS
Families Fleeing Violence

About 11 million Syrians are on the run, including some 4.8 million who have been forced to seek safety in neighboring countries. Inside Syria, more than 6.3 million people are displaced and 13.5 million are still in need of humanitarian assistance.

1 in 4 people is a Syrian refugee
LEBANON 1,017,433

1 in 10 people is a Syrian refugee
JORDAN 655,404

As of December 16, 2016
Sources: http://data.unhcr.org/syrianrefugees/regional.php
UNOCHA.org/syria
In November 2016, the Radcliffe Institute for Advanced Study at Harvard University convened an expert panel on the international refugee crisis.

Click on underlined text for video.

Video of the panel at Radcliffe on the International Refugee Crisis

Of special relevance to this class is the presentation by Dr. Abdulkarim Ekzayez of Save the Children International Syria Response. His presentation can be viewed by scrolling to 40 minutes of the panel video.
The Impact of Disasters

Although the average number of disasters has been increasing annually over the past decade the average percentage of needs met by different sectors in the period 2000 through 2005 identifies significant shortfalls.

According to Development Initiatives (2006), based on data in the Financial Tracking System of the Office for the Coordination of Humanitarian Affairs, from 2000-2005, the average needs met by different sectors in the case of disasters were:

- 79% by the food sector;
- 37% of the health needs;
- 35% of the water and sanitation needs;
- 28% of the shelter and non-food items, and
- 24% of the economic recovery and infrastructure needs.
Disaster response may be at the local/regional, national, or international levels (Van Wassenhove and Pedraza Martinez (2012)).
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Typically, the immediate response to disasters comes from local systems. These systems are comprised of governmental agencies NGOs (non-governmental agencies) with local representation, National Societies of Red Cross and Red Crescent with local branches, the army, fire and police departments, and other civil agencies.
When the local response system is overwhelmed by the size of the disaster, the national system is activated.
Disaster Response

When the local response system is overwhelmed by the size of the disaster, the national system is activated.

If the national system does not have the capability/capacity to respond and the affected country approves it, the international system is activated.
The international disaster response system is organized in clusters (food, health, shelter) and is coordinated by the OCHA – the United Nations Office for the Coordination of Humanitarian Affairs.
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The response, as a whole, should be led by the national government of the hosting country, with respect for the national sovereignty (Van Wassenhove and Pedraza Martinez (2012)).
The ultimate humanitarian supply chain has to be able to respond to multiple interventions on a global scale as quickly as possible, and within a short time-frame.

**Therefore, such supply chains need to be multiple, global, dynamic and temporary.**

Due to the enormous impact of disasters, disaster management and humanitarian logistics have become topics that are drawing attention from researchers in various disciplines.

Practitioners and researchers are working more closely together to learn from one another and to push knowledge in this growing and very challenging field forward.
Humanitarian Logistics: Networks for Africa

Rockefeller Foundation Bellagio Center Conference, Bellagio, Lake Como, Italy
May 5-9, 2008
Conference Organizer: Anna Nagurney, John F. Smith Memorial Professor
University of Massachusetts at Amherst

http://supernet.isenber.g.umass.edu/hlogistics/hlogistics.html
In this course, we will be covering the foundations of humanitarian logistics and healthcare supply chains with a focus not only on qualitative analysis and conceptual studies but also on quantitative methods and analytical tools.

The course will use both primary and secondary sources and will also feature experienced practitioners who will share their knowledge.

In addition, videos in which experts share the state-of-the-art of supply chain management and humanitarian logistics in times of disasters (and post) will also be viewed.

⇒ Department of Defense (2002), *Dictionary of Military and Associated terms*, University Press of the Pacific, USA.


