RE-COOP

REgional Cooperation, Operability, And Organizational Partnerships

Using Game Theory to Assess and Improve Integration in Tribally Inclusive Geographic Areas to Reduce Risks and Economic Impacts

Co-authors:
Regina Jacobs, Emergency Measures Officer for the Mohawk Council of Akwesasne
Anne Garland, Research Associate DHS CREATE and ARIES

www.ariesnonprofit.com
CRHNET 2015
Background and Context

A. Working Together for a Safer Tomorrow Program (WTST)
   - Missions and Support: ARIES, MCA, DHS CREATE
   - WTST Research Framework
   - Summary of CRIOS Model and Tools (CRHNet 2014)

B. Game Theory for Decision Making
   - History and Diverse Applications
   - Types of Game Models
   - Risk Reduction Games

C. Game Theory Organization Cooperation Mode

D. RE COOP Survey Methodology

E. RE COOP Pilot Study
   *Interactive Discussion and Suggestions*

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Choices to Cooperate
MISSION
ARIES is a non-profit research association promoting collaborative research, public education, and public outreach designed to enhance corporate and community based decision making.

www.ariesnonprofit.com
OUR VISION & STRATEGIC GOALS

MCA’s Emergency Measures Program vision continues to remain as follows:

The Emergency Measures Program will oversee the emergency measures public safety program that will assist the Mohawk Council of Akwesasne’s strategic mission and vision by organizing and coordinating the council’s response to a human induced, technological or natural emergency by establishing procedures in preparedness, response, recovery and mitigation strategies.

MCA’s Emergency Measures Program’s strategic goals are identified as follows:

- To develop and implement a united emergency management organization;
- To improve operational capabilities to manage emergencies through preparedness, response, recovery and mitigation;
- To train and exercise MCA emergency management plans to improve response procedures, coordination and emergency operations; and
- To educate all MCA/community responsible personnel on emergency preparedness, response and recovery procedures.

Regina Jacobs, Emergency Measures Officer
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E: regina.jacobs@akwesasne.ca
Territory of Akwesasne
A Multi-jurisdictional First Nation

- Sits on an International Border between Canada & U.S.A.
- Consists of two (2) Provinces & one (1) State - QC, ON, & NYS
- Has three (3) territorial governments
  1. Mohawk Council of Akwesasne (ON, QC)
  2. Saint Regis Mohawk Tribe (NYS)
  3. Mohawk Nation Council of Chiefs, (Traditional)
- Has ONE territorial Master Emergency Response Plan
- Has ONE Local Emergency Planning Committee (LEPC) w/ 30+ stakeholders.
Working Together for a Safer Tomorrow

Program of:
Applied Research in Environmental Sciences Nonprofit, Inc. (ARIES)

Sponsor:
DHS National Center of Risk and Economic Analysis of Terrorism Events (CREATE) Center of Excellence for Science and Technology DHS Research Associates: Anne Garland and Lloyd Mitchell, Co-PIs
Activities

• Outreach Education
• Integrated Disciplines
• Unitized Research (Team)
• Research and Field Projects
• Practitioner Tools and Products
• Research Transitions
• National Conference Presentations and Publications

Audiences/Participants

• TIGA related (Tribally Inclusive Geographic Areas)
• Minority related (African American, American Indians, Hispanics, Latinos, Chicanos)

http://create.usc.edu/
CREATE Mission

To improve our Nation’s security through research and development of advanced models and tools to evaluate the risks, costs and consequences of terrorism and natural and manmade hazards to guide economically viable investments in homeland security. (Strategic Plan 2012-2016)

CREATE is an interdisciplinary national research center based at the University of Southern California  http://create.usc.edu/
“Working Together for a Safer Tomorrow” Research Framework
(Tribally Inclusive Geographic Area)
Federal Indian Policy:
General Characteristics of TIGA (Alaska Varies)

- Federal or State Trust Lands
  Fee Ownership
  Fee to Trust Lands
- Tribal Enrollment and Tax Free Status
- Tribal Government and often Public Services separate from local and regional communities.
- Sovereign
- Jurisdictional Differences for Community Security Services
  - Police
  - Fire and Emergency Management (regional variations)
    - Tribal or State Disaster Declarations Option
Achieving *regional*, local, and tribal integration to reduce risks and the economic impacts of disaster and terror events.

The project aligns with DHS Secretary Napolitano First Action Directives of January, 2009, relative to state, local, and tribal integration.

Student and Mentor Team: Brittany Friend (Elizabeth City State University), Natalya Sousa (University of Maryland, College Park, Long Island University), John Coles & Dr. Zhuang (University at Buffalo), Spencer Garland (Old Dominion University), Kyle Horne (University of London), Simone Balog (Kings College, London), Dr. Anne Garland, Dr. Lloyd Mitchell, and Regina Jacobs (Mohawk EMO)

Collaboratively designed (2008) and implemented by a student participant team of Applied Research in Environmental Sciences Nonprofit, Inc. (ARIES), in the Department of Homeland Security (DHS CREATE) program titled Working Together for A Safer Tomorrow (WTST), this project applies

- a three-step model and user friendly tools for multi-jurisdictionally diverse regions (Tribally Inclusive Geographic Area or TIGA)
- to integrate emergency resources, services, and capabilities
- with the management goal of operating cooperatively as resilient communities in the event of natural disasters or from terrorism.
Step 1&2: Risk Matrix and Integrated Operability Score (IOS)

First, Risk Matrix of Regional and Historical Hazards
Second, a local area in the study region is chosen and a real time
• tri-level status report is conducted by community stakeholders. (tribal or non tribal EM and Fire)
• An integrated operability score, or IOS, is then calculated to determine integrative and cooperative local capabilities.
Step 3: Cumulative Regional Integrated Operability Score

As the model is incorporated for contiguous local and tribal communities, a cumulative *regional* integrated operability score, or CRIOS, is produced. This score is derived from:

- qualitative and quantitative statistical indicators related to stakeholders’ perceived capabilities to function as resilient communities in the event of a disaster (self assessment),

- regular assessments of risks and cooperative *regional* resources, services, and capabilities to remain resilient (e.g. annual collaborative workshops), and

- a time table for jurisdictional improvements of cooperative *regional* resources, services, and capabilities, e.g., 2-5 year cycles.

2/2013 Tornado
## Critical Indicators for CRIOS

### Stakeholder Indicators

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Units to Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual Aid</td>
<td>Jurisdictions (local, tribal, region, state)</td>
</tr>
<tr>
<td>Community Preparedness</td>
<td>Joint outreach activities</td>
</tr>
<tr>
<td>Mapping Technology (iCAV and ACAMS)</td>
<td>Application Levels (local, tribal, regional, field, interactive, friendly,</td>
</tr>
<tr>
<td>Volunteer Training</td>
<td>Frequency (CERT, NIMS)</td>
</tr>
<tr>
<td>Collaborative Training</td>
<td>Jurisdiction Levels, Training Frequency, Time Scale</td>
</tr>
<tr>
<td>Training Scenarios</td>
<td>Frequency, Jurisdictions, Types (varied)</td>
</tr>
<tr>
<td>EM Resources</td>
<td>Sharing Level (local, tribal, region, state)</td>
</tr>
<tr>
<td>Emotional Support</td>
<td>Frequency</td>
</tr>
<tr>
<td>Eco-Heritage Recognition</td>
<td>Involvement (local, tribal, region, state)</td>
</tr>
<tr>
<td>Infrastructure Security</td>
<td>Procedures</td>
</tr>
<tr>
<td>Infrastructure Resources</td>
<td>Capability/Maintenance Levels (water, sewer, transportation, utilities, internet, etc.)</td>
</tr>
<tr>
<td>Economic Funding</td>
<td>Sharing Level (local, tribal, region, state)</td>
</tr>
<tr>
<td>Organizational Structure</td>
<td>Public/Private/Tribal/Combined, Staff Structure, Qualifications, Hours/month</td>
</tr>
<tr>
<td>Medical Facilities</td>
<td>Capacity, Number, Locations (distance-elevation)</td>
</tr>
<tr>
<td>Containment Sites</td>
<td>Capacity and Number, Locations (Casinos, College campuses) (distance-elevation)</td>
</tr>
</tbody>
</table>

### CRIOS Tool

The next steps are:

- Request specific data for the criteria from the user groups.
- The user groups and stakeholders cooperatively scale the criteria based on their relevancy. (Graduated Interval Scale 0-5)
- The risk analysis using the scale is valid if completed with the specific data provided with and from the jurisdictional stakeholders.
- The benefits of the CRIOS are to inform the jurisdictions of the cooperative risks in their regional networks and criteria that need improvement.
# Draft of CRIOS Tool

**Interval Scale (Relevant to Stakeholders)**

0-5=Nothing, Insufficient, Unsatisfactory, Sufficient, Satisfactory, Resilient

<table>
<thead>
<tr>
<th>CRIOS TOOL</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
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<td>Volunteer Training (Frequency)</td>
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Mohawk HAVD and Emergency Measures Office Tool

http://www.ariesnonprofit.com/ARIESprojects.php
CRIOS Applications
TIGA Stakeholders
FY 2007-2015

- Iroquois Confederacy, New York – 2008-2010
- Eastern Band of Cherokee, North Carolina -2012
- Joint Center for Disaster Research, Massey University, NZ -2011-1015
- Shinnecock Nation of Long Island, Suffolk County-2012-2015
- Hattiesburg, Missippippi-2013
- Yavapai Nation and Prescott, Arizona -2013
- Coeur d Lene Reservation and Worley, Idaho -2013
- Tohono O'odham Nation, Arizona -2013-2015
- Navajo Nation, Arizona –2013
- Haifa University, International School, Peace and Conflict Program, Israel -2013
The CRIOS model is relevant to the integration of TIGA Emergency and Fire Management, particularly in stakeholder evaluations and recognition of integration risks after 20 case studies. It addresses a variety of complex risks and hazard situations, with some TIGA having high risks.

- CRIOS indicators are critical for risk reduction.
- CRIOS indicators relate directly to economic and behavioral cost benefits.
- CRIOS model assists stakeholders with risk awareness.
- CRIOS tool used to direct improvements in preparedness, and mitigation strategies.
- CRIOS tool used to direct improvements of TIGA budgets.
What is Game Theory?

"the study of mathematical models of conflict and cooperation between intelligent rational decision-makers."[1] Originally, it addressed zero-sum games, in which one person's gains result in losses for the other participants. Today, game theory applies to a wide range of behavioral relations, and is now an umbrella term for the science of logical decision making in humans, animals, and computers. https://en.wikipedia.org/wiki/Game_theory
Examples of Games
Cooperative Games

What are the cost benefits of long term coalitions?

RE COOP study = TIGA EMO

- continuously share services and resources
- improves cooperative capabilities (generosity, familiarity and trust relationships)
- cost benefit is it reduces risks from regional hazards
- emergent hazards may trigger “extortion” strategies (environment changes)
  - “to calculate how often you can defect without demotivating your co-player completely” (Stewart and Plotkin, 2014)

Bats share food so they all reduce their risk of hunger

https://www.quantamagazine.org/20150212-game-theory-calls-cooperation-into-question/

(Press and Dyson, 2012; Stewart and Plotkin, 2014)
Assessing Partnership Efficacy

External and Internal Agencies
- Internal: Agencies that have previously worked in impacted area
- External: Agencies that have NOT previously worked in impacted area
- Differences in objectives and perceptions

Impact of Agency Effort
- Maximizing resource impact
- Leveraging cooperation and avoiding competition
- Matching commitments with complimentary resources

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John Coles, jbcoles@buffalo.edu
Industrial and Systems Engineering
University at Buffalo
Buffalo, New York
Decisions in Disaster Recovery Operations: A Game Theory Perspective on Actor Cooperation, Communication, and Resource Utilization

Mr. John B. Coles, Ph.D. Student, Industrial and Systems Engineering, University at Buffalo, jbcotes@buffalo.edu
Dr. Jun Zhuang, Assistant Professor, Industrial and Systems Engineering, University at Buffalo, jzhuang@buffalo.edu

Abstract

Using perspectives from game theory in the problem of cooperative interaction between international and local agencies, we discuss the potential for improvement in humanitarian logistics using cooperative strategies for relief that can be applied globally. On March 11th, 2011, the world turned to Japan and was reminded of the power that can be unleashed at a moments notice (Figure 1). Hit by a 9.0 earthquake and a 10-meter tsunami, Japan lost thousands and raced to stabilize two nuclear power plants. As agencies around the world race to assist in this new catastrophe, interagency cooperation will be critical as it was following the earthquakes in Haiti and Chile (Coles, Yates, Zhuang, 2011; Kapcu, 2006). The approach and sensitivity of these organizations to the culture and to one another could significantly improve the efficacy of the relief operations and significantly impact the long-term recovery of the region economically and socially (Haaken, 2002; ROWAN, 1994).

Project Objective

Since the time necessary to sufficiently understand an unfamiliar situation may not be available to the in an emergency environment, we here discuss a methodology for utilizing interactions between local and external actors to increase efficiency in the final stage of emergency management: the recovery phase. By analyzing the dynamics of relationships that may occur in disaster recovery through the lens of game theory, we provide a new perspective on optimizing the efficacy of disaster relief operations (HAaken, 2002; MARSHAK & RADNER, 1972). In this project we provide a framework describing a two-player game involving local and external entering actors where their objective is to maximize the perceived impact of their effort (Coles, Zhuang 2011).

The Two-Player Game

- Game of Imperfect Information
  1. Actors choose whether or not to work together.
  2. Actors chose level of relational effort
- Partnership Possibilities
  1. A local (L) and external (E) actor
  2. Two local (L) actors
  3. Two external (E) actors
- Types of Actors
  1. Business
  2. Government Agency
  3. Individual
  4. Military
  5. Nonprofit Organization

Utility Structure

Utility Functions

Constants

Utility Functions

Constants

Conclusion and Future Work

By examining the partnership problem using game theory, we were able to develop a framework for emergency managers to use when responding to a disaster and forming new relationships. Using partnership dynamics identified in the literature, and data from previous research, we have developed simple, quantifiable objective functions dependent on the values in a comprehensive table of actor interactions. We hope to continue development of this framework and provide actors entering unfamiliar environments with tools to rapidly assess the utility of partnerships and optimize resource allocation.

References


Acknowledgment

This research was supported by the United States Department of Homeland Security through the National Center for Risk and Economic Analysis of Terrorism Events (CREATE) under award number 2010-ST-061-R0001. However, any opinions, findings, and conclusions or recommendations in this document are those of the authors and do not necessarily reflect views of the United States Department of Homeland Security, or CREATE. This research was also supported by the National Science Foundation (NSF) under award #1034730 and an NSF Graduate Research Fellowship to John B. Coles.
The survey provides Emergency Managers’ responses about critical indicators, perceived risks, and case study scenarios to:

• study the “real” parameters of organizational cooperation to compare across regions

• assess accuracy of the game model for organizational cooperation

• assess how well the survey motivates the game model

• modify the game model for diverse organizational regions (e.g., CA, NZ, AU)

• Based on best practices from diverse regions, provide a variety of game strategies that inform and assist stakeholders

• Transdisciplinary Applications

• Progress Report about the game theory survey tool and the final draft is available upon request.

Note: TIGA EM and Fire include a variety of risks and hazard situations relevant to integration much like a collage.

Methodology = Participatory Research (Practitioners/Researchers Collaborate)
1. Team formation:
   Grad students (cohort mentors)
   - S. Garland (ODU Computer Science, MS.)
   - J. Coles (UB Industrial Engineer, PhD.)

Mentors and Consultants
- Regina Jacobs Mohawk EMO
- Anne Garland ARIES Researcher, Applied Anthropology, PhD
- Jun Zhuang (UB Faculty, Industrial Engineer, PhD.)

2. Survey Format (Brief/User Friendly)
Part 1 Check lists
- Services and Resources
- Comparative Strategies of Shared Services/Resources
Part 2 “What if” Scenarios
- Cooperative Strategies
- Risk Reduction Capabilities

3. Survey Content
- Based on Variables for Partnership Efficacy
- Diverse Variables for Varied Strategies
- Quantifiable Data for Games Mathematics
- Behavior economics (Scenario Examples?)
- Goal:=Capture of Actual Behavior and Lessons Learned
- Researcher and Practitioner partnership
  - Team worked with Mohawk EMO
  - 5 drafts of survey to date
  - Cooperative and participatory research

### Game Theory:
Types of Social Interactions

<table>
<thead>
<tr>
<th>You</th>
<th>Gain</th>
<th>Lose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other Person</td>
<td>Gain</td>
<td>Reciprocity/Mutualism</td>
</tr>
<tr>
<td>Lose</td>
<td>Selfishness</td>
<td>Spite</td>
</tr>
</tbody>
</table>


Pilot Study for Interagency Partnerships for Risk and Disaster Management

4. Automated Survey
   - Typeform Template, Spreadsheet, Database
   - Visuals for Clarification vs. No Visuals
   - Time frame for Survey Completions
   - Technical Support
     Chat, Skype, Facebook group

Automated Typeform Survey
https://sgarland.typeform.com/to/ikGHNl

5. Incentives
   - Recognition from superiors
     Certificates
   - Equipment Raffle
   - Secure Competition on Facebook or Website
   - Bias Results
   - Suggestions?

6. Pilot Study
   - 6 TIGA EM (3 non tribal)
   - Complex Border TIGA with history of EM
     Mohawk NY/CA
     Tohono Odham AZ/Mexico
     North Slope Borough AK/NW Passage
   - Recent TIGA EM
     Shinnecock NY Long Island
     Pamunkey Va.
   - Suggestions of CA TIGA for participation?
RE-COOP

Acknowledgement of Akwesasne and St Regis Mohawk for Research Partnership
- Mohawk Council EMO
- Hogansburg Akwesasne Volunteer Fire Department

Citations
Stewart and Plotkin, *Proc Natl Acad Sci U S A*. 2014 Dec 9;111(49)
https://www.quantamagazine.org/20150212-game-theory-calls-cooperation-into-question/

QUESTIONS and SUGGESTIONS?
ariesnonprofit@yahoo.com
www.ariesnonprofit.com
Goal of the assessment tool is to assign a rank to each alternative group/jurisdiction by using criteria to weigh cooperation.

EM Stakeholders determine the:

- different criteria (CRIOS indicators) for how a TIGA is operating which they rank/score

- hierarchy of TIGA criteria to discover how their jurisdictions are cooperative

- priorities among the evaluating criteria by making a series of judgments based on pairwise comparisons

- process to synthesize the judgments to provide a set of overall priorities for the hierarchy combining the judgments of each alternative group/jurisdiction

- consistency of the judgments and make sure it is less than or equal to a 10% difference to derive a final decision using the results of the assessment tool.
The survey provides Emergency Managers’ responses about
• critical indicators,
• perceived risks, and
• case study scenarios

The survey is being developed with the Mohawk Emergency Management Office as reviewers and research partners. The second draft is:
• completed for review,
• requested for application among selected CRIOS participants for revisions,
• applied during CRIOS workshops among TIGA EM,
• posted on ARIES website for review and applications,
• included in relevant newsletters of EMHS organizations, Ready and National Coalition Forums, etc.

(Final draft of survey tool available upon request)
Public Education

Examples:

- **Professional**
  Conference Presentations, Poster Competitions, Reports, Journal Articles, Networks, Field Research

- **TIGA Emergency and Fire Stakeholders**
  Workshops, Meetings, Interviews, Website, Webinar, Power points,

- **Student Participants**
  Research, Website, DL dot.Project Management Tool, Phone/Skype, Field Study, Team Meetings

- **Community Engagement**
  Youth Preparedness (HERMYS /PolarTREC), docudrama, audio documentaries, PSA, visual and musical arts

Haifa University International School, Israel, Natalya Sousa

CHTAC Word Art Exhibit: Cumbie (music), Garland (lyrics)

Joint Center for Disaster Research Summer Institute, NZ

NAAAS Conference 2013

- NCSE 2013-recruit Simone Balog
  www.chasingice.com J Balog
CRIOS 2008-2010
New York

- New York Iroquois Confederacy (6 TIGA)
- Seneca TIGA of SW New York
- Preparation, response and recovery from 2009 Gowanda Flood
- Research, Fieldwork and Workshop
Hogansburg Akwesasne Volunteer Fire Department
Mohawk Council of Emergency Measures

Co-researchers:
Former Fire Chief Norman Peters
Emergency Measures Officer Regina Jacobs
CRIOS 2011-2013
Joint Center for Disaster Research at Massey University Wellington, NZ

Maori Preparedness Study and Program
Ministry of Social Development and Ministry Civil Defense and Emergency Management
CRIOS 2012-2013
Eastern Band of Cherokee Emergency Management

Regional Hazard Mitigation Plan
1. Liquor Sales on Reservation
   Tribal Referendum 4.15.2012

2. Gaming Compact with Exclusivity Zone in Western NC.
   -Governor Agreement
   11.2012
   -Legislature TBD-Spring Session
CRIOS 2012-2013
Shinnecock Nation
Long Island
Historical Ecology for Risk and Disaster Management
Mitigation and Preparation with Natural Barriers:
• Wetlands
• Oyster Beds
• Conservation Zones
CRIOS 2008 and 2013
North Slope Borough
Historical Ecology for Risk Management
**Inclusive Geographic Areas to Reduce the Economic Impact of Natural Disaster and Terror Events**

Brittany Friend, Elizabeth City State University and Natalya Sousa, University of Maryland and Stony Brook University

**Mentors:** Dr. Anne Garland, Applied Research in Environmental Science (ARIES), DHS USC CREATE, UMD Dr. Lloyd Mitchell (Oneida), Working Together for A Safer Tomorrow, DHS USC CREATE, ECU

**Abstract**

Designed and implemented by a student team from the CREATE sponsored Working Together for A Safer Tomorrow (WTST) program, this project applies a three step model to determine the ability of multi-jurisdictional, demographically diverse areas, especially tribally inclusive geographic areas (TIGA), to integrate resources and services with the goal of operating cooperatively as self-sustaining communities in the event of natural disasters or terror attacks.

**Methods:**

Step 1: A risk matrix is used to determine a risk ranking of regional disaster and terror events.

Step 2: An area in the study region is chosen and a real time tri-level status report is conducted by area stakeholders. An integrated operability score, or IOS, is calculated to determine cooperative capabilities.

Step 3: As the model is incorporated across jurisdictions and agencies, a Cumulative Regional Operability Score, or CRIOS, is derived. Once the CRIOS tool is applied, strategies incorporating integration and shared utilization of regionally available human and material resources can be coordinated, preparedness and mitigation capabilities for both tribes and communities.

**Results:** Beginning in October 2008, this project became directly aligned with the January 2009 Homeland Security’s mission relevant directive requiring local, state, and tribal integration. A pilot model was field tested in the Pacific Northwest and results submitted to the WTST mentor. To date, 15 case studies, including NY Iroquois, are included with the Shinnecock TIGA, Long Island, since Spring, 2012.

**Discussion:** This project is related to the Social and Behavioral Sciences research area via the introduction and application of a user friendly model and tools designed to promote diverse entities and jurisdictions to work together to identify critical indicators and strategies to operate as self-sustaining communities within tribal regions in catastrophic events.

**Broader Impacts of this study include:**

a.) The creation of a risk ranked database that can be used for the establishment of resource allocation priorities based upon the CRIOS. A user friendly multi-variable decision making program is being designed to provide a strategic database for TIGA EM stakeholders to apply CRIOS (G. Garland, Old Dominion University and NAVSEA).

b.) The development of qualitatively derived statistical indicators related to TIGA EM perceived abilities to function across jurisdictions as self-sustaining communities in the event of disasters. In collaboration, the Organization Cooperation Model by Coles and Zhuang is being applied to TIGA EM (“Decisions in Disaster Recovery: A Game Theoretic Perspective of Organization Cooperation” JHSEM, vol.8, 2011). Based on a survey of perceived abilities, a pilot model is being designed in collaboration with the Mohawk Council of Akwesasne’s Emergency Measures Program and the Hogansburg Akwesasne Volunteer Fire Department (HAVFD).

c.) Improved cooperation of resources and capabilities reduces economic impact of disaster events and aligns with CREATE’s mission.

**Step 1: Risk Matrix Example: Tri-County Region of SW New York TIGA (Region V)**

**ABSTRACT**

4.6. Describe multi-jurisdictional, multi-disciplinary agreements needed for decision-making and for sharing resources.

**Step 2: Tri-Level Status Report**

Joint Center for Disaster Research, Michigan, University of Michigan, Ann Arbor, Michigan, University Programs. Contact: Brittany Friend, Elizabeth City State University and Natalya Sousa, University of Maryland and Stony Brook University

**Step 3: Cumulative Regional Operability Score (Partial Application)**

**Tool:**

- **RISK MATRIX**
  - Utilize Risk Matrix to Identify Higher Risks in TIGA
  - Organize qualitative and quantitative data to identify hazard frequencies

**Tools:**

- **2. Data Gathering:** (See all photos)
  - A. real time events
  - B. site visitsations
  - C. non-obtrusive field methods
  - D. interviews
  - E. workshops/symposia
  - F. survey assessments
  - 3. Find Results:
    - For sample, social, news, internet media
    - Compare with specific field and real time data
  - 4. Draft model and assessment tool from research
  - 5. Engage Emergency Stakeholders:
    - Revise and use TIGA specific tool

**References:**


**Discussion:** This project is related to the Social and Behavioral Sciences research area via the introduction and application of a user friendly model and tools designed to promote diverse entities and jurisdictions to work together to identify critical indicators and strategies to operate as self-sustaining communities within tribal regions in catastrophic events.

**Broader Impacts of this study include:**

a.) The creation of a risk ranked database that can be used for the establishment of resource allocation priorities based upon the CRIOS. A user friendly multi-variable decision making program is being designed to provide a strategic database for TIGA EM stakeholders to apply CRIOS (G. Garland, Old Dominion University and NAVSEA).

b.) The development of qualitatively derived statistical indicators related to TIGA EM perceived abilities to function across jurisdictions as self-sustaining communities in the event of disasters. In collaboration, the Organization Cooperation Model by Coles and Zhuang is being applied to TIGA EM (“Decisions in Disaster Recovery: A Game Theoretic Perspective of Organization Cooperation” JHSEM, vol.8, 2011). Based on a survey of perceived abilities, a pilot model is being designed in collaboration with the Mohawk Council of Akwesasne’s Emergency Measures Program and the Hogansburg Akwesasne Volunteer Fire Department (HAVFD).

c.) Improved cooperation of resources and capabilities reduces economic impact of disaster events and aligns with CREATE’s mission.
The risk matrix, tri-level status report, IOS, CRIOS, and the key for the cooperative indicators are available at ARIES website for stakeholders to download and apply.

Refinement of CRIOS model and tools with TIGA stakeholders. Currently, these are Mohawk, Seneca, Onondaga, Gowanda EM and VFD in NY, Eastern Band of Cherokee EM, NC, North Slope Borough Risk Management and Barrow Arctic Science Consortium, Shinnecock Nation of Long Island, NY, Maori Preparation and Participation in Civil Defence (Joint Center for Disaster Research, Massey University, NZ.)

Plans for dedicated web pages for each CRIOS user to demonstrate variability about integration in TIGA. Allows revision of the CRIOS tool that is specific for TIGA stakeholders. Web pages can provide examples about successful EM integration in TIGA for comparative purposes and continued applications.

Applications of Game Theory based on Organization Cooperation Model for Disaster Recovery (Coles and Zhuang, University at Buffalo, Decisions in Disaster Recovery Operations: A Game Theoretic Perspective on Organization Cooperation)

Public Outreach (Current and Future Plans - Old Vic New Voices, UK):

To assist TIGA communities with score derivations, several scenarios in a docudrama can demonstrate the range of indicators about cooperative regional resources that produce resilient communities and reduce risks and economic impacts of disasters.

The TIGA communities for the docudrama represent diversity of political and geographical considerations. They include regions based on current fieldwork and Emergency and Risk Management partnerships. They are the North Slope of Alaska and New York.

Additional CRIOS demonstrations are provided by audio documentaries from emergency personnel who participated in the real time tri level status reporting. Their contributions enabled the efficient development of these tools for replication among other diverse communities.

The docudrama and the audio documentaries are to be available for download and community comparisons from the ARIES website.
“Working Together for a Safer Tomorrow”
Research Framework
(Tribally Inclusive Geographic Area)
ARIES Role for WTST Program
Student Participant Coordination
“Next Generation of Homeland Security Professionals”

FY 2008-2009
• Guide students to develop projects about their career interests and DHS CREATE Research Categories
• Mentoring student projects and assist with outreach symposia
• TIGA fieldwork and research
• National Conference Poster Competitions

FY 2010-2013
• Students career interests are designed to assist with Mentors’ and CREATE Directed Projects related to DHS Research Categories
• Students assist with Models/Tools/Products developed and implemented with and for relevant users and practitioners, often in TIGA.
• Student Driven Projects
• National Conference Poster Competitions
Step 1: Risk Matrix

Risk matrix is used to determine a risk ranking of regional disaster and terror events.

Risk Matrix Example: Tri-County Region of SW New York TIGA
Risk Occurrence Scale= 1 (monthly), 2 (quarterly), 3 (bi-annually), 4 (annually), 5 (2-5 years), 6 (5-10 years)

<table>
<thead>
<tr>
<th>DISASTER EVENTS</th>
<th>Tribal</th>
<th>Cities and Towns</th>
<th>County</th>
<th>Region</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flooding</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Blizzards</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Debris Flows</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Nuclear Waste</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Roadway Vandalism</td>
<td>5</td>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Business Closures (smoke shops)</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Bio-Terrorism</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Second, a *local* area in the study region is chosen and a real time

- tri-level status report is conducted by community stakeholders. (*tribal or non tribal EM and Fire*)

- An integrated operability score, or IOS, is then calculated to determine integrative and cooperative local capabilities.
## Multi-Jurisdictional Cooperation

### Tri-Level Status Report

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>DEFINITION</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>What we are doing best</td>
</tr>
<tr>
<td>Medium</td>
<td></td>
<td>What we are trying to do</td>
</tr>
<tr>
<td>Low</td>
<td></td>
<td>What we cannot do well</td>
</tr>
</tbody>
</table>

### Integrated Operability Score (IOS)

- **SCIP=**Weighted Evaluation Criteria  
  (applied to Local/Regional IOS)

  (Updates of SCIP)

**Examples:**

1. **20% Governance**
   4%
   4.4 Identify the members of the governing body and any of its committees. (List them according to the categories recommended for a communications interoperability committee in the All-Inclusive Approach.)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Units to Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organizational Structure</td>
<td>Public/Private/Tribal/Combined</td>
</tr>
<tr>
<td>Staff Structure/Qualifications</td>
<td>Hours/month</td>
</tr>
<tr>
<td>Emotional Support</td>
<td>Frequency</td>
</tr>
<tr>
<td>Eco-Heritage Recognition</td>
<td>Involvement Levels</td>
</tr>
</tbody>
</table>

3%
4.6. Describe multi-jurisdictional, multi-disciplinary agreements needed for decision-making and for sharing resources.

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Units to Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutual Aid</td>
<td>Procedures and Practice</td>
</tr>
<tr>
<td>Emergency Management Resources</td>
<td>Sharing Levels</td>
</tr>
</tbody>
</table>

Modified with Permission from Elaine Willman, Public Administrator, Hobart, WI, Citizens Equal Rights Alliance.