

Simulation for Security Force Assistance Climate Adaptation Training

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ABSTRACT

This paper proposes an innovative methodology be used by Security Force Assistance (SFA) planners to leverage a sociocultural simulation for exploring climate change dynamics in Army training. This approach was derived from lessons learned during unclassified Joint exercises associated with the simulation of climate adaptation. According to President Biden's Interim National Security Strategy (NSS), climate change poses a growing threat to U.S. national security. The NSS and the 2022 Army Climate Strategy make it imperative for all Army operational and strategic exercises to include climate change risks and threats by 2028. The Army's use of simulations for training its SFA forces will enable more effective planning for humanitarian assistance and counterinsurgency missions, especially those dealing with emerging requirements for adapting to climate change. The use of simulations that include climate adaptation factors during SFA training will better prepare SFA personnel to conduct humanitarian assistance tasks and will improve their understanding of emergent counterinsurgencies, both of which are critically important to the U.S. military because this knowledge can lead to increased stability in developing areas of the world. The Army SFA Proponent and TRADOC G-2 Modeling and Simulation Office have assessed the results from several recent unclassified exercises and can demonstrate ways in which

simulation can support Joint and Army climate adaptation training in representative partner nation “battleground areas” and show what quantitative benefits might accrue for better understanding the effects of climate change/adaptation on regional populations. This simulation approach may support other equities besides the Department of Defense to include providing support for U.S. allies and partners through the provision of technical assistance, advice, and training to military personnel. Additionally, it may assist stakeholders such as non-governmental and private sector entities who need to be prepared for the aftermath of more frequent and severe extreme weather events. In this paper, the authors argue that the Army will be a more resilient and sustainable land force operating in all domains with effective mitigation and adaptation measures against the key effects of climate change.

ABOUT THE AUTHORS

Mr. Mel Cape, Lieutenant Colonel, U.S. Army (Retired), is the Director of the TRADOC G-2 Modeling and Simulation Office and has 25 years of experience with modeling and simulations. He holds a Master’s Degree in Information Technology Management. Currently he is the subject matter expert with respect to Operational Environment representation in models and simulations (M&S) across the virtual, constructive, and gaming domains; the greater Army M&S Enterprise of M&S-enabled Communities; and for development of the Synthetic Training Environment.

Dr. Jumanne Donahue has worked in support of the TRADOC G-2 Modeling and Simulation Office and U.S. Joint Forces Command in various capacities. He was a cultural researcher and knowledge engineer on the University of Texas at Dallas team that developed the First Person Cultural Trainer simulation for the TRADOC G-2. Dr. Donahue holds a PhD in Arts, Technology, and Emerging Communications from the University of Texas at Dallas. He also holds a Master of Fine Arts in Arts and Technology from UT Dallas and a Bachelor of Science Degree in Computer Science from Texas A&M University, College Station.

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INTRODUCTION

Climate change is a headline issue for nations around the world. While active debate over the natural and manmade factors influencing the world's climate continues the fact that changes are occurring is incontestable. As the climate continues to change, many people groups, particularly those found in less advantaged nations, face increasing challenges to their lives and livelihoods. Frustration and anger over circumstances, exacerbated by shifting climatological factors, will continue to grow leading to increased instability particularly within disadvantaged populations. This in turn, will necessitate action on the part of national leaders to address the increasing needs of these populations while endeavoring to maintain peace and security. Tools must be developed to assist leaders in better understanding the sociocultural, political, and economic impacts of climate change on the various people groups that make up their populations.

The concept described in this paper involves the use of a decision support tool, the Athena Simulation. Athena is a sociocultural modeling capability that employs deterministic analytic techniques to assess population stability over time. Athena was selected because stochastic modeling (i.e., modeling that introduces variability using Monte Carlo analysis methodologies), does not effectively account for broad sociological constructs or provide algorithmic approaches adequate for testing predominately *qualitative*

data. This paper is focused on the use of the Athena Simulation to model the political, military, economic, social, infrastructure, information, physical environment, and time (PMESII-PT)-related variables evident in notional training events conducted by the U.S. Army. The examples included in the paper involve two exercises, the first conducted as an operation below the level of armed conflict, and the second centered on a Humanitarian Assistance operation. These tabletop exercises were not originally intended to evaluate the effectiveness of implementing climate change factors within the context of a military operation but were adapted in this way because the opportunity availed itself.

On January 27, 2021, President Biden issued Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad*, making climate considerations an essential element of United States foreign policy and national security. This Executive Order calls on federal agencies, including the Department of Defense (DoD), to prioritize climate change in all their activities and to incorporate the security implications of climate change into the development of key strategy, planning, and programming documents as well as other analyses. DoD is required to incorporate the security implications of climate change (Climate Risk Analysis) into crises action planning, tabletop exercises, command post exercises and other analyses. Incorporating climate change factors into studying and executing Stability Operations, including U.S. Security Force Assistance support to Foreign Security Forces (FSF) when they take on stability tasks like establishing civil security and civil control, may enable foreign nations to improve their capability and capacity to maintain stability in the face of changing climate conditions.

Regarding climate change considerations, this paper focuses on how Joint and Army SFA planners might use an existing PMESII-PT modeling framework to better understand the linkages between partner nation security forces' desired strategy and tactics, resilience, and stability outcomes in their operational environments. Partner nation security forces are differently affected by and will differently respond to climate issues, therefore, FSF should be trained to operate in extreme and adverse conditions and to continuously assess and adapt to climate change.

The employment of simulations by SFA planners may become a significant means for demonstrating to partner nation security forces, whether police or military, better ways to assist their own government with assessing climate change impacts, managing climate-related risks, and making stability operations decisions. It may offer insight into how U.S. assistance can help build partner nation adaptability and resilience as well as helping build a partner nation security force's own capacity and capability to address climate change factors. This approach should improve relationships with partner nations, expand access into key partner nation locations in support of crisis and contingency response operations, and ultimately increase U.S. regional influence.

In April 2022, the Athena Simulation was used by the SFA Proponent (SFAP) and the TRADOC G-2 Modeling and Simulation Office, to conduct a notional Joint tabletop exercise to explore incorporating climate change considerations into U.S. Army SFA advisor training. The Athena Simulation modeled area responses in a scenario involving a major coastal region in the Philippines, adjusted to reflect local conditions of extreme sea-level change and major storm surge generated by a typhoon. Separately, an earlier notional scenario, centered on Nigeria and involving drought conditions, was used to examine climate change impacts and local responses. In both cases M&S were used to assess how SFA planners could help partner nation security forces conduct civil security and civil control stability tasks.

THE OPERATIONAL PROBLEM

Executive Order 14008, Section 211, issued 27 January 2021, (EO 14008) the 2021 interim National Defense Strategy and the DoD Climate Adaptation Plan (CAP) make it imperative that Army operational and strategic exercises include climate change risks and threats. The CAP highlights climate change as a serious threat to U.S. national security. It impacts missions, plans, and capabilities and must be met by

ambitious and immediate action. The CAP provides DoD with objectives and tasks to implement climate adaptation objectives. By actively identifying climate-linked issues early, the DoD can better prepare forces to support operations involving humanitarian assistance or adapt and/or strengthen military engagement programs to prepare partner nations to face potential climate-related conflict, thus giving the DoD an advantage over adversaries and competitors when operating across the competition continuum. (JDN 1-19) The CAP highlights climate change as a key PMESII-PT characteristic to inform DoD planning. It recognizes relevant DoD personnel must understand how climate-change factors influence the Operational Environment (OE) and how those factors might impact partner nation militaries. The CAP stipulates DoD build partner nation capacity to respond to climate-related hazards. This is not limited to actively participating in technical, academic, and scientific exchanges to improve DoD's understanding of climate dynamics but includes actively engaging partner nations and their militaries. The primary approach used by DoD to build partner nation force capability and capacity is using U.S. SFA forces. In concert with partner nations, DoD must ensure overseas infrastructure and FSF capabilities and capacity are adapted to local conditions and resilient (HSPD-21), in the face of climate change. Thus, the climate adaptation problem is significant for SFA planners to consider when planning to help partner nation security forces develop the capacity to maintain stability.

U.S. allies and partner nations are increasingly faced with the challenge of understanding the potential second- and third-order effects of climate change on their local populations and on regional stability. As sea levels rise, exacerbated by more powerful storms and tidal surges; as deserts expand and global temperatures climb; and as access to clean water becomes more challenging, there is increasing pressure on noncombatant civilian populations, particularly for those living in rural, less advantaged areas. These climate related pressures, along with a comparative lack of jobs or opportunities, are pushing populations to migrate from those less advantaged regions into urban areas. The growth of megacities is one result. These migratory flows increase pressure on urban authorities to meet a growing demand for food, water, and shelter, worsening the plight of large urban populations who already face resource shortages. This resource challenge in urban areas is further impacted by the fact most of the major urban areas are in regions which are highly susceptible to climate factors, particularly rising sea levels and the effects of heightened storm surges, resulting in significant risks to civilian populations.

Climate change is a key component of the evolving OE and must be understood, integrated, and synchronized across all facets of military operations. A fundamental problem for SFA planners is the absence of tactics, techniques, and procedures (TTPs) for using M&S to provide the regional stability information required. If SFA planners cannot help improve the situational awareness of partner nation forces regarding climate dynamics, resilience, and mitigation opportunities, a commander's ability to fully visualize the OE, much less interpret it correctly, is limited. In addition to providing an improved operational understanding of the OE, climate adaptation considerations incorporated into simulation can illuminate the need for additional programmatic resources. For example, the CAP indicates a requirement to increase the number of partner nation security forces participating in annual training exercises and engagements, and emphasizes the importance of conducting focused SFA engagements with partner nation militaries. During such engagements, simulations which include climate adaptation factors can effectively inform funding decisions for infrastructure, training, force strategies and tactics, as well as other related decisions across many areas. The aim is to integrate climate adaptation concepts into annual security cooperation activities to build professionalism, improve institutional processes and change the behavior of partner nation forces pertaining to climate change mitigation. Approaches such as the use of simulation as described in this paper are needed to promote relevant and widespread training opportunities for partner nation security personnel on climate adaptation principles and to then incorporate those into their local stability operations training.

Problems such as how to improve compliance with the CAP and/or demonstrate for a partner nation the implications of climate change over time are complex, expensive, and time-consuming to examine in a real-

world operational context; the use of computers and numerical simulation is a practical means around these issues. Complex algorithmic approaches such as non-linear equations and Bayesian Time Influenced Networks are often used when addressing such complexities but are limited due to the *qualitative* nature of the modeling inputs. Using simulations, SFA planners may better be able to demonstrate how plausible and independent results derived from the application of climate change variables in exercises can demonstrate for commanders and staffs how climate considerations can be introduced to improve operational outcomes.

ANALYTIC FRAMEWORK AND APPROACH

This paper will address:

- The use of a PMESII-PT model, such as Athena, by joint force commanders, staffs, or security force assistance planners to improve CAP implementation and stability operations.
- The use of simulation to support training aimed at integrating climate adaptation principles and resilience perspectives when developing campaign and contingency plans.
- The use of simulations of climate adaptation to facilitate the training of headquarters staffs and partner nation security forces on climate adaptation principles.
- The use of simulation to provide situational awareness and situational understanding of the noncombatant “perceptions” of the effects of climate change.
- The use of simulation to leverage military-to-military partnerships to advance climate adaptation principles across partner nation security sectors.
- The use of simulation to integrate climate principles and challenges within security cooperation, humanitarian assistance, joint and multilateral exercises, and warfighting seminars.
- The use of simulation to permit a broader conception of climate risks and threats encompassing a combination of natural and human-made conditions, as well as ideas about adaptive capacities, techniques, and methodologies.

The overarching climate adaptation analysis described in this paper was implemented within the context of humanitarian assistance scenarios further influenced by potential warfighting considerations. These notional venues provided a framework for introducing and addressing climate change considerations in conjunction with Athena’s computational modeling processes. Climate considerations in the Philippines scenario were a result of a simulated severe weather event and short-term sea-level rise effects in an OE-relevant context. The Nigeria scenario replicated a prolonged drought. In these unclassified exercises, climate adaptation considerations shaped the decisions of the joint force commander. Using the Army’s award-winning Athena Simulation, the TRADOC G-2 M&S Office employed this proof-of-principle approach as an early foray into experimenting with climate adaptation analytics and as a tool to help its Army and Joint clients better understand and visualize climate change factors impacting the OE.

A large body of work surrounds the representation of PMESII-PT factors in simulation and training. This paper explores an analytic approach using the Athena Simulation as a decision support tool to support climate change-oriented (including adaptation, resilience, mitigation) training of military staffs, including SFA planners, and others focused on integrating climate factors into security cooperation programs and activities. (JP 3-20) It addresses strategic, operational, and tactical level uses of Athena to train individuals on challenges which may be best resolved through analysis of climate dynamics. This paper examines short-term and long-term opportunities for improving joint force, Army, and SFA advisor pre-deployment training effectiveness, using simulation to identify and explore non-standard variables.

ATHENA SIMULATION

The Athena Simulation was developed by the California Institute of Technology (CalTech) Jet Propulsion Laboratory (JPL) for the U.S. Army and placed into service to address the Army’s M&S capability gaps

with respect to PMESII-PT focused modeling. Athena is a sociocultural modeling capability and decision support tool, which provides staffs, commanders, and key decision makers a framework to better understand complex PMESII-PT-based problems, and a simulation for computationally assessing the long-term consequences of employing various engagement options across the OE. Athena enables the analysis of second- and third-order effects upon populations and their possible responses to discern potential outcomes resulting from political, military, economic and social interventions. Athena allows leaders and analysts to understand the intended and unintended consequences of their proposed actions through a simulation process that incorporates social science “universals” into course of action analysis and campaign planning.

The Athena program was established by the U.S. Army as an innovative approach to modeling the OE. Critical to this modeling effort was the establishment of a solid underpinning of social science theory to substantiate the sociocultural results generated by Athena. Based on input from the social science community, a series of social science “universals” were derived that enable Athena to computationally assess human behavior and relation change dynamics over time. Athena is normally operated by a two-member team, one operations research and systems analyst to design the experiment and engage the staff, and one modeler/analyst to operate the simulation. These individuals are often augmented by a researcher during research and database development phase. The simulation is scalable and has been used to support studies of megacities and countries, and in some cases, multi-nation regions. The simulation runs very quickly and efficiently, a relatively complex three-year run will normally be completed in 15-20 minutes allowing multiple runs to be conducted in a relatively short period of time thereby enabling several courses of action to be assessed, compared, and contrasted.

Athena has predominantly been employed in support of the Joint Staff and Combatant Commands, with studies and analyses having been conducted for CENTCOM, INDOPACOM, EUCOM, and SOUTHCOM. Athena has also supported an operational deployment to Jordan to look at the early stages of the Syrian refugee crisis; was used in Tampa, FL (SOCCENT J-5) to help better understand the emergent behavior of ISIS (the Islamic State of Iraq); and finally, to Kuwait in support of Operation Inherent Resolve. Studies and/or experiments have also included the use of the simulation in support of the Defense Threat Reduction Agency, the U.S. Army Special Operations Command (USASOC), the Mission Command Battle Laboratory, and the Unified Quest series of experiments. Finally, Athena has been employed to support leader development, training, and education in venues such as the School for Advanced Military Studies, the U.S. Army War College, and the Joint Forces Staff College.

CLIMATE CONSIDERATIONS MODELED IN ATHENA

The Athena team conducted cultural and historical research into each of the PMESII-PT variables being modeled in each scenario, while paying particular attention to those that might be most susceptible to adversarial actions since those were most likely to be used to manipulate population opinion/satisfaction or exacerbate fault lines related to climate change.

These variables and their interrelationships determine the nature of an OE and how it might affect or be affected by a military operation. The OE data sources, include, but are not limited to:

- Strategic partners (e.g., NATO, United Nations, World Bank, international community)
- Interagency partners (e.g., Department of State, U.S. Agency for International Development, Central Intelligence Agency)
- Multinational partners (e.g., host nation governments)
- Non-governmental organizations (e.g., environmental organizations)
- Industry and academia
- TRADOC G-2 Global Cultural Knowledge Network and Foreign Military Studies Office
- Operational Environment and Threat Analysis Directorate

Secondary research provided sufficient fidelity for the two notional scenarios. PMESII-PT operational variables and sub-variables were used as inputs for the Athena simulation runs, during which Athena calculated the initial relationships and changes in the relationships between and among key regional actors, the various force groups (e.g., police, militias, and military) and the noncombatant civilian populations. The OE represented in these scenarios involved significant levels of interaction between the U.S. forces being sent into the region and the local populations. When accounting for civilian population dynamics, implementing and accounting for climate adaptation within the simulation design was particularly relevant, if not vital, to helping decisions makers better understand the many interactive and linked aspects of the PMESII-PT factors involved.

As part of a literature review of climate adaptation, and as specifically noted in the Climate Adaptation Plan (CAP, 2021), when climate change considerations are acted upon, the effectiveness of military operations can be improved. The goal of these exercises was to see if simulation-based results confirm whether improvements across the operational spectrum occur when climate adaptation considerations are implemented in training exercises as required by DoD policy. The analytic design, as shown in Figure 1, indicates the Athena team ran each scenario in the simulation comparatively, with and without climate considerations, to determine the value added of implementing and accounting for climate change factors during security force assistance operations.

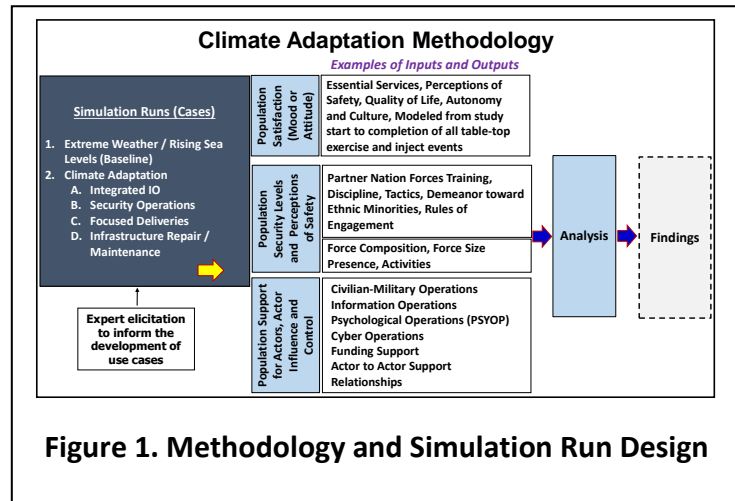


Figure 1. Methodology and Simulation Run Design

The five selected areas for simulation as shown in Figure 1 were as follows:

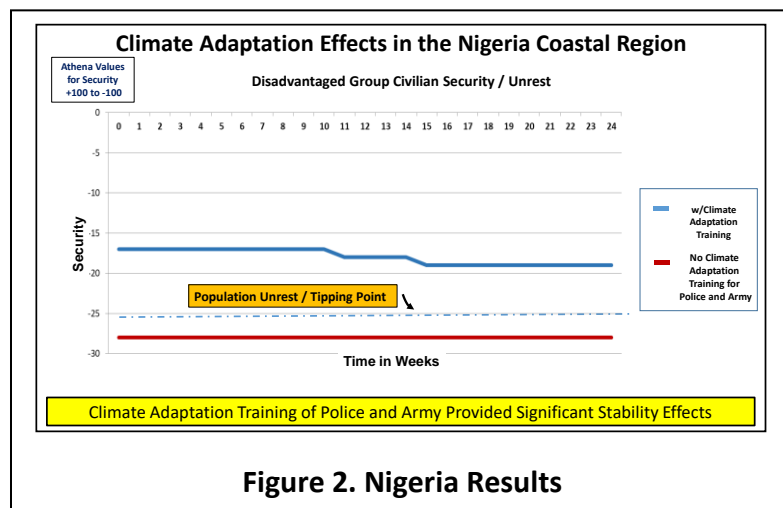
- 1. FSF protection of civilian populations.** Foreign Security Forces need to see their role as one of supporting and protecting the civilian populations of their country against external threats, one of which is climate change. That support needs to be perceived by all civilians as just and balanced. As identified during outside research, “climate adaptation raises equity concerns and requires ensuring that responses do not further marginalize the most vulnerable populations, especially in fast-growing cities in developing countries. Adaptation to climate change can have a negative impact on some social groups and localities by increasing poverty, vulnerability, and inequity.” (See and Williamson 2020)
- 2. FSF support to climate adaptation infrastructure construction, maintenance, and reconstruction.** Foreign Security Forces can facilitate coordination and cooperation between local communities for access to commodities and to infrastructure, such as, roads, transport, and telecommunications. Communities surrounding partner nation installations face the same climate change-related challenges as the FSF and often these communities are vital to the resilience of the installation, providing resources and labor during recovery. This infrastructure may also include resources to support pre- and post-disaster information operations (IO) needed to keep local communities informed of actions of the partner nation government and security forces. For example, weather alert systems could collect climate information from the region, and disseminate it in real-time via the Internet, TV, radio, etc., to the local population, who can then better prepare for the impacts of extreme climate events.

3. **FSF support to information operations.** Foreign Security Forces will need to be involved in producing and disseminating useful information and promoting safer behaviors on the part of civilian communities. IO campaigns by a partner nation and its security forces can better enable a country to address near-term climate crisis events and long-term climate adaptation necessities to maintain stability and confidence in the government.
4. **FSF conducting integrated emergency protocols and training programs.** Foreign Security Forces can refine and standardize existing emergency protocols for extreme weather events under a common framework, so they are easier to understand and are accessible to the public. Training programs to educate and inform public officials on climate change and its effects, both primary and second/third order, would be designed to inform the public on correctly managing emergency situations and developing appropriate responses.
5. **FSF role in providing humanitarian assistance to displaced persons.** Foreign Security Forces certainly have a role in assisting their partner nation governments in providing support to the local civilian populations during a crisis. This may include providing and managing temporary shelters, or other internally displaced persons (IDP) facilities, and may also include providing food, water, and medicine, as well as access to communications devices, etc. In Athena, getting the right medicine and shelter established impacts both the *safety* of civilians and their *quality of life*. Local members of the police and army know to work with local organizations to get the right humanitarian relief measures in place. This leads to improved trust and compliance with population management directives (e.g., directing them to move or remain in place). Athena modeling includes factors assessing both acceptance of new inhabitants by original inhabitants and acceptance by the new inhabitants of the original inhabitants of areas or camps.

RESULTS AND LIMITATIONS

Joint Force Exercise #1 (Nigeria): Drought

The primary objective for the Athena team was to model joint force operations across the continuum of “competition-to-conflict” with a return to competition, and through that modeling process, to identify key engagement points for U.S. forces. Those key nodes represent moments in time when U.S. forces can most effectively generate influence in a region, particularly by training and equipping the various partner nation militaries and/or providing an effective liaison between the partner nation and the whole-of-government resources of the U.S. and NATO. Due to the variability of potential futures in this operational area, this study could not definitively ascertain every possible effect of climate change on regional stability, therefore the focus was narrowed to water scarcity and population migration due to drought.



An examination of Figure 2 indicates when partner nation forces make no effort to address climate change-related effects the local civilian population’s level of *security* is compromised such that they literally exist below the theoretical threshold for initiating a migratory action. Thus, whenever they have the

resources, they will seek to migrate away from the crisis area, with or without the support of the partner nation's government or military. This sort of unconstrained movement during either a short-or long-term crisis can negatively impact the population's confidence in its government, as well as create fresh problems in nearby areas, both inside and outside the country. It is therefore preferable for the government to maintain a degree of control, so circumstances do not reach a migratory tipping point. To some degree, as seen in Figure 2, when climate factors are considered by the partner nation military, thus improving the population's sense of *security*, they do not cross that migratory threshold.

Further, what became apparent through the course of the analysis was certain sociocultural fault lines, including several with inherent climate related ties, could be exploited by a U.S. near-peer adversary seeking to impact the security and satisfaction levels of local noncombatant populations within Nigeria and other nearby West African countries, thereby providing a means for both state and non-state actors to significantly influence potential regional futures. Athena modeling demonstrated that an understanding and monitoring of these fault lines by U.S. SFA personnel, coupled with the establishment of an enduring and responsive presence with pre-approved U.S. government permissions and authorizations to engage proactively with partner nation forces, was highly effective during the early stages of the "competition-to-conflict" continuum, as a means of mitigating the success of a near-peer adversary.

Joint Force Exercise #2 (Philippines): Humanitarian Assistance (Typhoon)

The primary focus for the Athena team during Philippines exercise was to model U.S. joint forces responding to a humanitarian crisis caused by a major regional weather event. As was done in the Nigeria exercise, the simulation was run twice, first without and then again with climate adaptation considerations included. This enabled comparative assessments of the results to determine the value added of implementing representation of and responses to climate factors.

The results, as shown in Figure 3, were striking. By improving the throughput of Foreign Humanitarian Assistance and setting conditions that resulted in better compliance by the population in their willingness to receive humanitarian assistance in an orderly fashion, the trust among various population groups was significantly increased. These results were further influenced by improving the messaging being employed in terms of its design and reach/focus, which led to increased cooperation from the population in reporting adverse situations and potential threats, thereby improving civilian *security*. This also improved the ability of the partner nation government and military to manage the local populations, including those who had become internally displaced, because there was better compliance with evacuation instructions and relocation directives.

By making small changes in climate change strategies and tactics, substantially less time was required for U.S. joint forces to have to remain on the ground providing disaster relief in response to each severe weather event. The use of SFA personnel to develop the partner nation military's capabilities to better respond to climate adaptation led to an improved tailoring of that country's responses, and based upon the use of simulation, demonstrated that this capability is a force multiplier.

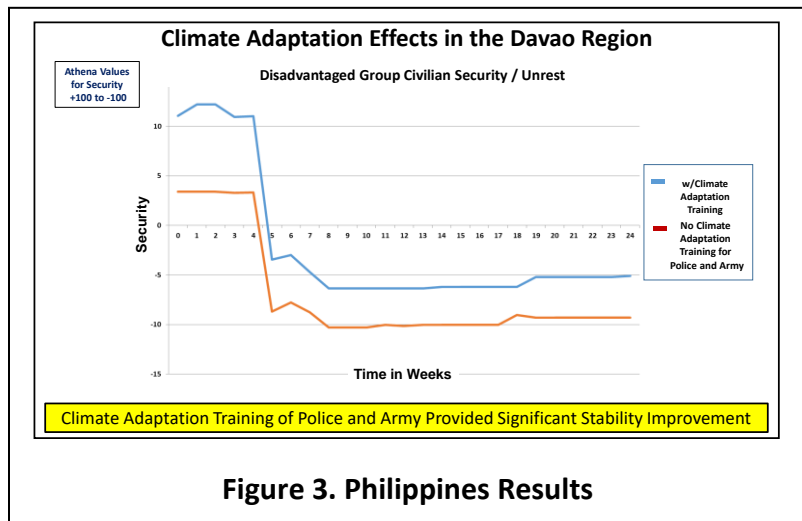


Figure 3. Philippines Results

The Athena outcomes also indicated an improved level of population resilience, which was reflected in the improved *safety* and *quality of life* values as compared to the no adaptation use case.

Findings and Results. In both scenarios, the results, when viewed from the perspective of civilian group security, indicate that implementing climate adaptation measures can be a force multiplier. This is to say that without climate adaptation, more partner nation forces are needed to achieve the same level of civilian security. The modeling outcomes reflected more effective humanitarian assistance and better compliance with partner nation force instructions, as well as improvements in civilian security. What was particularly noteworthy in the Nigeria use case, was that the climate adaptation excursion supported a much more normal day-to-day economy because civilian perceptions of *safety* were sufficiently high that they now felt confident to shop, go to work, go to school, etc.

Insights Derived from the Simulation of Climate Adaptation

The use of simulations by SFA personnel for the purpose of training and advising FSF to “[b]uild partner nation capacity to respond to climate change-related hazards” (CAP, 2021) as specified in the CAP, has been shown to be an effective tool. Indeed, such methods have already been generally accepted when considering the operational environment in other areas of military planning, e.g., Intelligence Preparation of the Battlefield, Weather effects, Intelligence, Surveillance, Reconnaissance (ISR), social media, infrastructure, etc. The simulation of climate change factors at the earliest stages of joint operational planning as directed in the CAP will help ensure the entire training audience, including Theater SFA planners, will gain awareness of climate considerations when working with partner nation security forces. (CAP, 2021)

Operations involving interactions with civilian populations are ripe for climate considerations, not merely as variables to analyze, but as objectives in and of themselves. How and whether an FSF implements climate adaptation techniques, including climate-related restrictions, represent good questions to assess with simulation. Just as using simulations to assess such things as establishing checkpoints, deciding upon rules of engagement (ROE), and/or managing IDPs, the use of simulations to better understand the effects of climate change on local civilian populations is powerful and valuable.

NOTES ON METHODOLOGY

Climate change factors are not directly modeled in Athena, so for the two scenarios assessed in this paper, the Athena inputs of *stance* (a force group’s attitude toward a civilian group) and civilian group *demeanor* (ability to project force) were adjusted to simulate and account for the potential behavior of the partner nation security forces responding to climate change. The underlying modeling design assumption was that by adjusting the stance and demeanor relating to these groups, the partner nation forces are more likely to work to address root-cause fault line issues and more likely to promote citizen confidence in democratic institutions, as they would if climate change dynamics were considered realistically in the real world.

To address climate change dynamics, Athena Simulation modeling was altered in these excursions with climate adaption factors to reflect an improved resonance of information messaging by the joint force information operations campaign within and between the climate at-risk area populations (i.e., the “battleground area populations”). Civil-military operations and law enforcement operations involving partner nation forces were also given an increased efficacy factor based on assumptions underlying climate adaptation which indicate greater receptivity by poor, marginalized communities that lack access to infrastructure and services, that have minimal education and poor health care, and that exist in countries with poor governance as they are likely to be among the most vulnerable. (OECD, 2002)

APPLICATIONS & FUTURE WORK

The implication of this research affects the implementation of training programs for existing SFA organizations and can provide additional help in shaping new initiatives in ways that have not been considered before. There is inherent value in gaining an improved awareness of climate change in the OE using simulation not just for knowledge's sake but to discover ways to improve SFA operations. Moreover, efforts are underway to expand the list of selected climate adaptation techniques modeled to include additional applications for SFA planners.

CONCLUSION

This paper has presented an approach for simulating various SFA courses of action involving climate considerations using the Athena Simulation. The iterative simulation runs were designed to determine what benefits may accrue when SFA personnel advise partner nation security forces on climate adaptation factors and the various methods and techniques for addressing those and their impacts on the noncombatant civilian populations. This paper also highlights ways to use a PMESII-PT-effects simulation for training joint and Army SFA planners and practitioners. This approach may help partner nation forces become more climate literate, as the CAP puts it, and thus more resilient and sustainable. Appropriate climate literacy training will better equip those forces to introduce climate adaptation measures to address many of the hazards of climate change impacting their regions.

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