

Application of game theory to the interface between militarization and environmental stewardship in the Mariana Islands

Thomas E. Marler,* Greg Wiecko and Aubrey Moore

Western Pacific Tropical Research Center; University of Guam; UOG Station; Mangilao, GU USA

We recently described threats to the terrestrial biological resources on the Mariana islands of Guam and Tinian resulting from the large-scale buildup of military operations. Attitudes that view these military buildup plans in a zero sum context whereby the positives of greater security and improved local economy can be attained only with corresponding negatives of environmental destruction are prevalent. We argue these attitudes oversimplify the complicated interactions between military operations and environmental damage. Here we discuss aspects of our case study that would benefit from application of game theory. Declines in ecosystem health are not unavoidable forms of collateral damage of peace-time military operations. We repeat, conservation of environmental resources is not ancillary to national security, it is integral.

Background

An extensive buildup of military personnel and operations has begun on the Mariana Islands of Guam and Tinian. We recently communicated that this situation presents an exemplary ecological ethics case study with provocative history and compelling contemporary events.¹ We detailed failures in adhering to respectful environmental protection expectations, explained that construction contracts have already been awarded despite these failures, and predicted sustained damage to terrestrial biological resources during the 10–15 y that will comprise the military operation.

Our resolve to publish a refereed article vetted by an international environmental

science journal was to deviate from the established approach of partisan groups promulgating self-serving opinions in journalistic venues. We intended for the case study to serve as an example for other disciplines covering issues directly influenced by the military buildup. Some of the mentioned disciplines were cultural, geological, hydrological and marine resource management.

The case study has prompted feedback from various audiences, including plant and soil scientists responding to a presentation during the 2011 annual meeting of the American Society of Agronomy. The prevailing attitude we have encountered is that the benefits from this military operation, such as improvement in national security and a boost to the local economy, outweigh the consequential damage to the environment. This is a zero sum mindset, and we believe it disallows constructive discussions surrounding a complex occurrence such as this massive increase in militarization notwithstanding predicted collateral damage to the environment.

A modest literature base has developed on warfare ecology since the term was introduced in 2008.² To our knowledge, no mention of applying game theory³ to the subject has occurred. This is surprising as conflicts involving natural resources are often rooted in conflicts between human parties with differing objectives. Yet the research and approaches to solutions are typically focused on ecological concepts rather than human attitudes. Sustainable solutions may be better achieved by understanding perceptions of each other and identifying perceived barriers to consensus within the discussions. Our case study

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*Correspondence to: Thomas E. Marler;
Email: tmarler@uguam.uog.edu

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illuminates the need for game theory to understand the multifarious interactions among all stakeholders when peace-time military operations inflict damage to natural resources.

The Game

Game theory has been applied to numerous facets of ecology,⁴⁻⁷ and here we contend it has application to warfare ecology. In the Guam case study, various stakeholder groups have emerged during the planning and initiation of construction phases of expanded militarization on Guam and Tinian. Several of the outspoken groups are the United States Department of the Navy (DoN), residents concerned about access to cultural resources, residents concerned about ecosystem health and natural resource conservation, the local executive and legislative branches of government, and residents belonging to the indigenous Chamorro population. If all positives and all negatives of the military operation perpetrated by the DoN were spread evenly among all stakeholder groups, then the resulting benefits and penalties would be equally shared. Contrary to this, our observations indicate the benefits are skewed toward sustaining a military culture and a financial infusion into the local economy; and the negatives are skewed toward consequent damage of natural resources.

In a non-cooperative game each player considers the needs of the other players but makes decisions independently, therefore application of game theory to the Guam case study would be within this non-cooperative framework. Effectiveness is measured under the assumption of perfect communication where intentions of the other players are transparent. Therefore, a sense of teamwork must be self-enforced by each player in order to achieve the most effective outcomes.

Opportunities for Restraint Missed

The process to date has been characterized by partisan bickering, overt failures in communication among the stakeholder

groups, and little expressed desire to understand and respect the motivations of the other players. Military culture is justifiably authoritarian, but when military officials are interfacing with the general public and the constituents deserving of respectful treatment are not military, the expectation that the military players act cooperatively may sometimes clash with military culture. We believe this clash of cultures is part of the foundation of the mistake-ridden process defining this nascent peace-time military buildup being imposed on the islands of Guam and Tinian.

In this game, island ecosystem health and sustainability could be considered a Common-Pool Resource (CPR) shared by all stakeholders. This CPR presents a commons dilemma for the DoN, as clearly it is in every stakeholder's long-term interest to minimize damage to this CPR. This would include the stakeholder groups that have explicitly entered the game through official responses to the Environmental Impact Statement (EIS) or by filing of lawsuits to curb plans of the military buildup, but also the remaining residents of these vulnerable islands who have not entered the public communications. Therefore, actions by the military players that degrade this CPR have the potential to generate a tragedy of the commons⁸ within the context of game theory, if pursuit of their agenda occurs via the zero sum mentality. Averting a tragedy of the commons in our case study could have been achieved by enlightened self-interest if the military architects of the EIS process voluntarily exhibited restraint and viewed their role within a Nash equilibrium⁹ context. This did not occur.

Averting a tragedy is also achievable via restraint by coercion through outside agencies.⁸ In our case study restraint by coercion was practicable via the Environmental Protection Agency's Office of Federal Activities if the EIS process codified in the National Environmental Policy Act (NEPA) had been adequately enforced. This also did not occur. For example, one of the greatest threats to the

Guam and Tinian natural resources is the acute increase in risk of new invasive species arriving during the military buildup tenure.¹ The plans to address this threat were promised by the DoN as a document dubbed the Micronesia Biosecurity Plan (MBP). Restraint by coercion was possible if the Environmental Protection Agency had respected the need to protect the CPR by forcing the DoN to disseminate the MBP for public review and comment prior to approval of the Final EIS. Despite continued failures to disseminate this promised information the Record of Decision was signed, ushering in the awarding of more than \$1 billion in military buildup contracts to date. Yet as of early 2012, the MBP is still not available for the stakeholders despite promises initially made in the Draft EIS in November 2009 and reiterated in the Record of Decision in September 2010.

Conclusions

As the US military proceeds with plans to impose a peace-time buildup of military operations on Guam and Tinian, clear divisions among the various stakeholders persist. The distinct breaks in communication have disallowed appropriate protection of environmental resources. We believe a case study employing a game theory approach would illuminate constructive criticisms of the process to date, which may foster improved communications among the players and avert a similar situation during future peace-time military operations. Although state security issues underpinning the military buildup undoubtedly present logistical challenges, we contend that any hope of achieving a reasonable level of national security is predicated on the appreciation for and protection of terrestrial resources. These are the very resources that provide invaluable services for the stakeholders that the military is commissioned to keep secure. Toward that end, we repeat that conservation of environmental resources is not ancillary to national security, it is integral.¹

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