Containing ISIS: Analysis of Intervention Policies.

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Abstract:

This paper builds upon a previous dynamic hypothesis that the Islamic State is an emerging state actor with an analysis of intervention policies that aim to contain or reduce ISIS's performance. A review of existing literature on simulation modeling of insurgencies identifies that application of parameterized simulations to current conflicts is limited in system dynamics. The paper contributes to the literature by leveraging a robust simulation model parameterized to ISIS in Iraq & Syria. Six separate policies are tested first in isolation and under ideal conditions, then in combination with operational constraints. Insights of the resulting dynamics as well as importance of timing windows are discussed. This paper's contributions are an attempt to apply system dynamics simulations to real-world current problems, generate insights into the dynamics of emerging-state actors and intervention strategies, and demonstrate utility for future application with other scenarios involving insurgents or emerging-state actors.

Keywords: ISIS, ISIL, DAESH, insurgency, conflict, security, non-state actor, emerging-state actor, intervention, policy analysis

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Introduction

The rapid rise of ISIS and its staying power have created great uncertainty in terms of regional stability. Although its predecessor Al-Queda in Iraq presented a strong threat via a traditional insurgency, ISIS appears to operate in an entirely different manner. In a very short period it managed to capture two-third's of Iraq and a third of Syria. Even when confronted with a five front war including interventions by regional and global powers such as Iran, Russia and the United States; ISIS has shown remarkable staying power. The question posed to policymakers is how to confront, contain and or mitigate the growth and risk of ISIS.

This paper leverages a robust simulation model created to examine ISIS as an emerging-state actor and uses that model to examine a portfolio of policy options under realistic conditions.[1] First a review of the performance of ISIS is provided, followed by a literature review of articles detailing system dynamic simulation models for evaluating insurgencies. An approach in describing ISIS, not as a classical insurgent, but rather an emerging-state actor is demonstrated at a high level by a causal loop diagram. Then an overview of the model structure is provided (full details in Appendix A & B) along with the baseline simulation performance. Next, individual 'best-case' policies are then evaluated against the baseline performance followed by a discussion of insights generated from these tests. Then, the policies are tested in a combined portfolio, and at different timing intervals. The paper finishes with a conclusion that summarizes the insights, discusses weaknesses and identifies future opportunities.

Detailed Problem Description:

About a year after the US invasion of Iraq in 2003 AQI emerged as a potent threat to stability operations. AQI never governed openly in the territory it influenced, instead conducting a classic guerilla insurgency. The strength of AQI peaked in 2006 before declining as the result of three circumstances: a troop surge of US Forces, a Suuni-Shia civil war that AQI helped spark and the indigenous resistance to AQI growing out of the Anbar Awakening. From 2008-2012 the organization almost declined to the point of non-existence.

[1] Clancy, "Dynamics of ISIS - An Emerging State Actor."

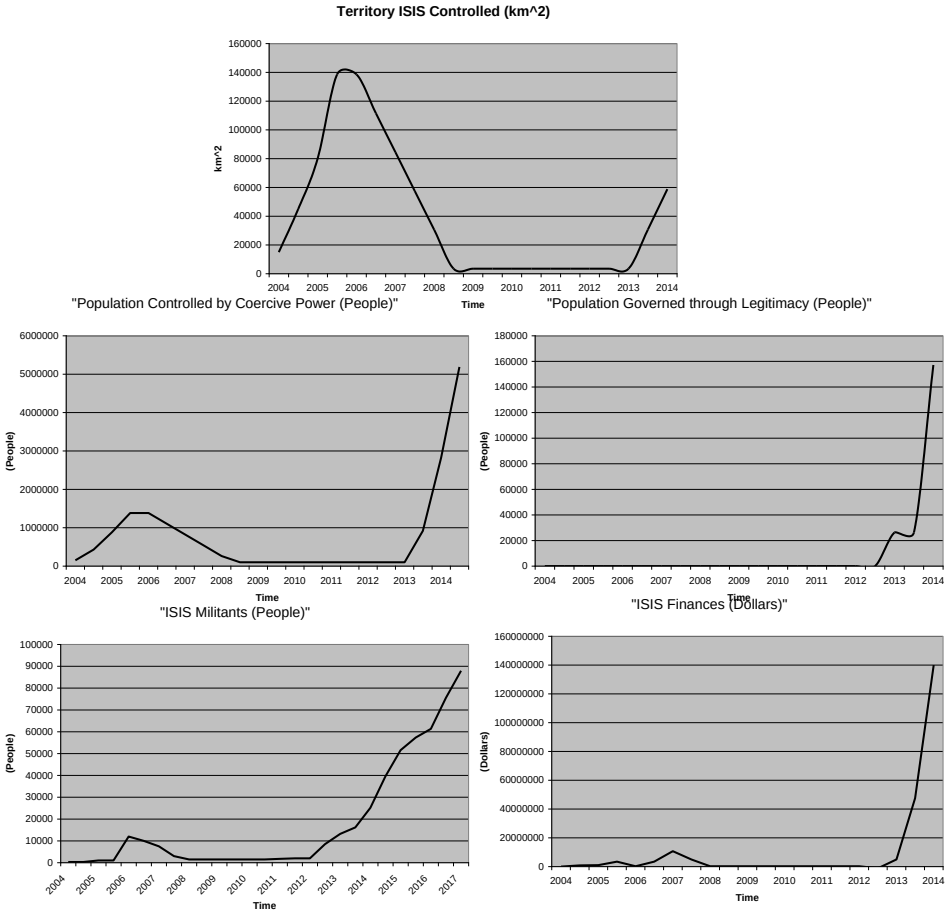


Figure 1: AQI & ISIS Performance 2004-2014

However, in 2013, the Islamic State of Iraq and Syria (ISIS) took control of Ar-Raqqah, a medium sized city in eastern Syria with an estimated 13,200 militants.[2] By late 2014 ISIS had grown to between 50,000-80,000 militants, taken control of nearly 30% of the territory in Syria and Iraq and threatened regional stability. What policies would've limited, or stopped altogether, ISIS's growth? Once it was established what policies would remain effective for containing it?

[2] All size estimates for ISIS are taken from the Department Of State. The Office of Website Management, "Country Reports on Terrorism." The entity now known as the Islamic State first appears in Country Reports on Terrorism in 2004 under the name Tanzim Qa'idat al-Jihad fi Bilad al-Rafidayn.

Literature Review

Although the literature on insurgencies is extensive, in 2009 Kilcullen argued that Cartesian or reductionist quantitative analysis to model insurgencies may not be the best approach and that instead complexity theory and systems theory approaches may be more practical.[3] There are only a handful of quantitative system dynamic efforts dealing with insurgencies or irregular warfare in the manner described by Kilcullen in terms of policy analysis. Most efforts are generic in nature rather than applied to a specific problem case. An early examination of the conditions which give a rise to internal violence in developing economies was conducted by Khalid Saeed in 1983. The paper analyzed how social and political factors determined long term growth. Instability in the form of dissidence and subversive activities were modeled, but not explicitly as a violent insurgency or in a specific geography with parameters initialized to represent an actual conflict.[4] However, Saeed's social groupings were highly aggregated. Lt. Col. Renzi in 2006 emphasized the need to provide local texture to these groups, advocating ethnographic intelligence a human terrain which shares "indigenous forms of association, local means of organization, and traditional methods of mobilization… or latent forms of social organization" to hostile organizations.[5] In 2010 Turnley et. al. specifically modeled an irregular warfare environment to provide a computational representation of the interdependence between kinetic and non-kinetic aspects of battlefield. This approach focused not on individual actors but on groups representing different sets of socially constructed norms. Turnley's model aggregates three groups: Foreign Fighters, Coalition (which may represent both foreign and domestic government forces) and Local Population and models the dynamics between them. This focus highlights the interaction of latent structure as it is

[3] Kilcullen, David, *Counterinsurgency*.
[4] Saeedd, "Economic Growth and Political Instability in the Developing Countries: A System View."
[5] Renzi, "Networks: Terra Incognita and the Case for Ethnographic Intelligence."

affected by kinetic activity but does not model a specific organization of an insurgency in the context of a set of local conditions.[6]

In 2011 Anderson used actual data from the Anglo-Irish War of 1919-1921 to model insurgency and counterinsurgency theories indicating potential gaps in the theory when compared to simulation results. This represents an applied application of quantitative modeling to a specific conflict. However, the insurgency of the Anglo-Irish War represents a 'classical' insurgency that differs significantly from ISIS's behavior as an emerging-state actor.[7] As well Anderson specifically did not model financial funding, a key element in explaining ISIS's growth and vector in limiting it. Finally, Anderson's model is largely built on the theories and perspectives of *Counterinsurgency* (U.S. Army Field Manual 3-24 also referred to as FM 3-24) which precedes the rise of ISIS as a force that can operates both openly and clandestinely. The focus on intelligence gathering implicitly indicates an insurgency operating in a guerilla or unconventional manner, as the IRA did. However the Anglo-Irish and the IRA was never able to seize and hold territory this approach may not best represent the dynamics of a true emerging-state actor.[8]

In 2013 Saeed et. al. developed a generic structure to model political conflict which could include insurgencies.[9] Aimed at understanding a question of political-economy and decision making of what drove Farmers to become Bandits or Soldiers, the model like Turnley focuses on decision making and choices of the population, rather than the explicit structure of how an insurgency like ISIS might operate.

[6] Turnley et al., "COIN 2.0 Formulation."
[7] Arthur, Date
[8] Anderson Jr., Edward J., "Modeling Insurgencies and Counterinsurgencies."
[9] Saeed, Pavlov, Oleg V., and Skorinko, Jeanine, "Farmers, Bandits and Soldiers: A Generic System for Addressing Peace Agendas."

In 2014 Aamir presented a paper on modeling terrorist organizations using existing system dynamic models of business entities. This approach was built off a basis of literature that indicated parallels between the managerial challenges of the firm as being similar to those of terrorist organizations. This approach divided into sectors the "functions" of a terrorist or insurgent activity including Territory/Capital Management, Financial Resources, Population Support, Supply Management, Human Resources, and Attacks and Agency. However, the models Aamir used were from existing system dynamics literature on business models, built generically, rather than aiming to model the performance of any one insurgent group.[10]

My contribution to the literature is in applying a robust simulation model parameterized to a specific conflict and evaluating policy options for interventions into that conflict. The evaluations include results over time, including unanticipated consequences. A secondary contribution lies in the insights gleaned from policy analysis against ISIS, and how those might apply to future emerging-state or classical insurgent actors.

Approach

This paper adopts the dynamic hypothesis that ISIS is an emerging-state actor which differs significantly from a classical insurgency. A causal loop diagram of the dynamic hypothesis forms the basis of the construction of a simulation model.[11]

[10] Aamir, "Applying Existing System Dynamics Business Formulations to Model Terror Organizations."
[11] Arthur, Date

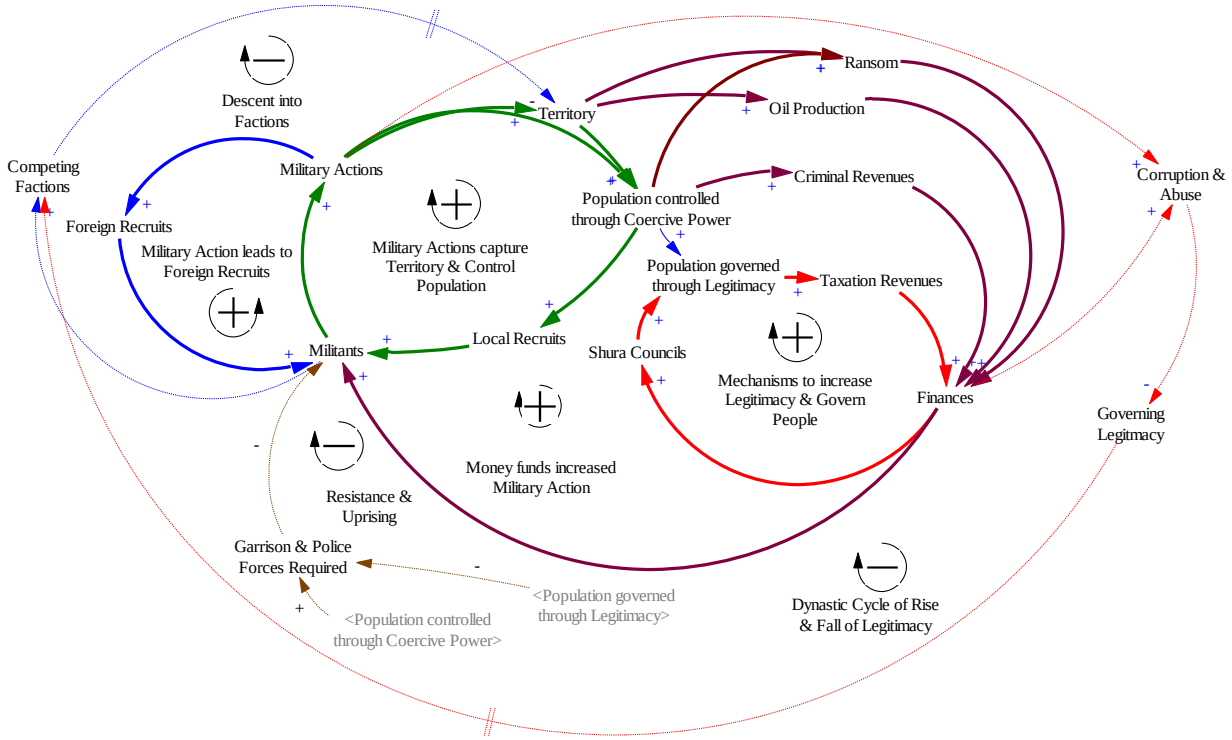


Figure 2: Emerging-State Actor Casual Loop Diagram

In brief this causal loop structure of an emerging state actor theory can be summarized as:

1. Local & non-local grievances bring militants and a non-state actor either emerges or is drawn into conflict.
2. The non-state actor uses Militants and Finances to conduct Military Actions.
3. As the non-state gains Controlled Population it can begin extracting Coercive Revenues through criminal activities and recruiting locally from within the controlled population.
4. The non-state actor within its Territory attempts to monopolize the use of force; taxation; control of movement; and regulation of the economy. Operating in a sovereign manner the non-state actor shifts to an emerging state actor.
5. Coercive Revenues & Territorial Revenues are used to Finance Governing Mechanisms which can begin building legitimacy to shift the Controlled Population into a Governed Population.
6. As the emerging-state actor gains Governed Population it gains taxation revenue and increases its draw of non-local foreign recruits by propagandizing its non-local grievances which may or may not align to local grievances.
7. The loops complete into a positive feedback loop of exponential growth. More Militants mean more Military Actions which means more Territory and access to Controlled Populations which can begin to be Governed fueling Finances which go to fund more Militants and Military Actions.

Negative loops limit the growth, the most immediate and pressing is the "Resistance & Uprising" loop. As ISIS controls more population, it requires more forces to garrison that population and prevent uprisings against their rule, this reduces the number of Militants available to gain more territory. Another negative feedback loop, "Descent into Factions" has its precedence in ISIS's own emergence within the Al-Queda global franchisee network splitting in 2013. Growth and size of any entity may lead to disagreements over both policy and personality, and if those factions are significant enough it may break the emerging state actor apart. The Dynastic Cycle begins with the corruption and abuse of arbitrary power available to a state, similar to that described by Katouzian's theory of arbitrary state and society.[12] The negative feedback loops of Descent into Factions and the Dynastic Cycle have a significant delay function and therefore may develop well after emerging-state actor has established itself. As modeled by Langarudi, the Katouzian dynastic cycle can take decades to manifest.[13]

Model Structure & Baseline Behavior

The simulation model created that tests the hypothesis of ISIS as an emerging-state actor can also be used for policy analysis of the conflict. Although the full details of the model are contained in Appendix A & B, an overview can ground understanding in what the policies are testing. The model is created in two sections – a strategic architecture of ISIS and a world model within which ISIS operates. The strategic architecture identifies the resources and capabilities that determine performance at any point in time. This performance based approach to modeling recognizes that these resources accumulate or deplete driven by flow-rates, the changes in the resource. Sub-systems representing the constants, parameters, information flow and leadership decisions, as well as the influence of other resource levels, all combine to effect the rates of change. Reinforcing and balancing feedback interactions between these

[12] Langarudi and Radzicki, "A Simulation Model of Katouzian's Theory of Arbitrary State and Society," 7.
[13] Ibid., 10–16.

resources can be used to explain the dynamics of strategic performance. The aggregate strategic architecture is depicted in Figure 13.

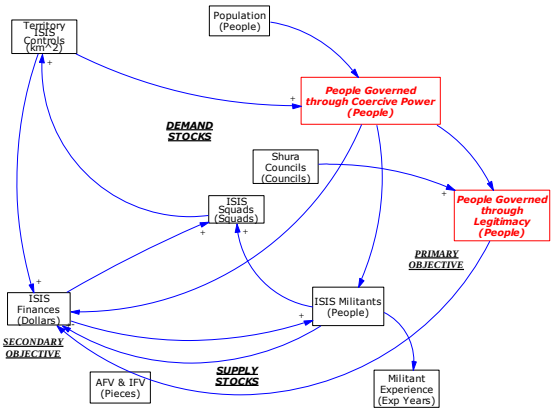
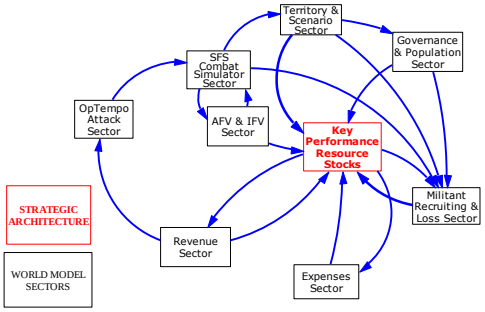


Figure 3: ISIS Strategic Architecture

The demand stocks in the strategic architecture represent first and foremost the 'target population' that the state and emerging-state actor are competing over and important attributes of that population. Likewise the mechanisms by which the insurgents gain access to the 'target population' and through the means that they 'establish a normative system [of governance]' are the demands that ISIS is trying to meet. To meet these demands ISIS will use supply-stocks representing its capabilities and capacity.



This strategic architecture is then located in a world model, as shown in Figure 14. The world model defines the "environment" within which subsystems interact with local conditions (where recruits and resources are located relative to what is controlled), competitors (who will resist expansion and using what means), and even internal dynamics (how effectively are revenue and expenses managed) interact with the subsystems. The world model includes a detailed combat simulation that determines ISIS's geospatial location and current conditions, conducts a combat using RAND's Situational Force Scoring method, and then endogenously updates both the Strategic Architecture and world model with the results of that combat. This creates an integrated feedback-rich simulation where combat changes the world, and the world subsequently affects combat.[14]

Figure 4: World Model

The baseline scenario seeks to replicate the conditions in Syria and Iraq beginning in 2013 and the expansion of ISIS as an emerging state-actor absent the significant intervention of third parties through 2017. Simulated as is, the model creates a baseline performance of exponential growth that tapers off into an equilibrium at nearly 47% of the simulated territory. This bears similarity to the actual growth of ISIS 2013-2015. This baseline performance can be discussed quantitatively in a dashboard of key stocks in the model, displayed in Figure 5, and also qualitatively via a narrative that supports the dashboard. ISIS is able to grow exponentially for a time by seizing territory, gaining a population which it first rules with coercive power and then shifts to legitimate government. This allows ISIS to gain additional resources from taxation. As ISIS draws from global grievances an increasing percentage of militants are foreigners, which over time requires an increasing Garrison & Police Force requirements for ISIS to maintain its holdings. Increased combat intensity also increases Garrisoning requirements. If

[14] Clancy, "Art of War: Modeling Combat Simulation with Endogenous Geospatial Feedback."

ISIS cannot meet the Garrison & Police Force requirement, it begins facing Local Opposition Fighters, in addition to Iraqi & Syrian forces, begin resisting ISIS's rule.

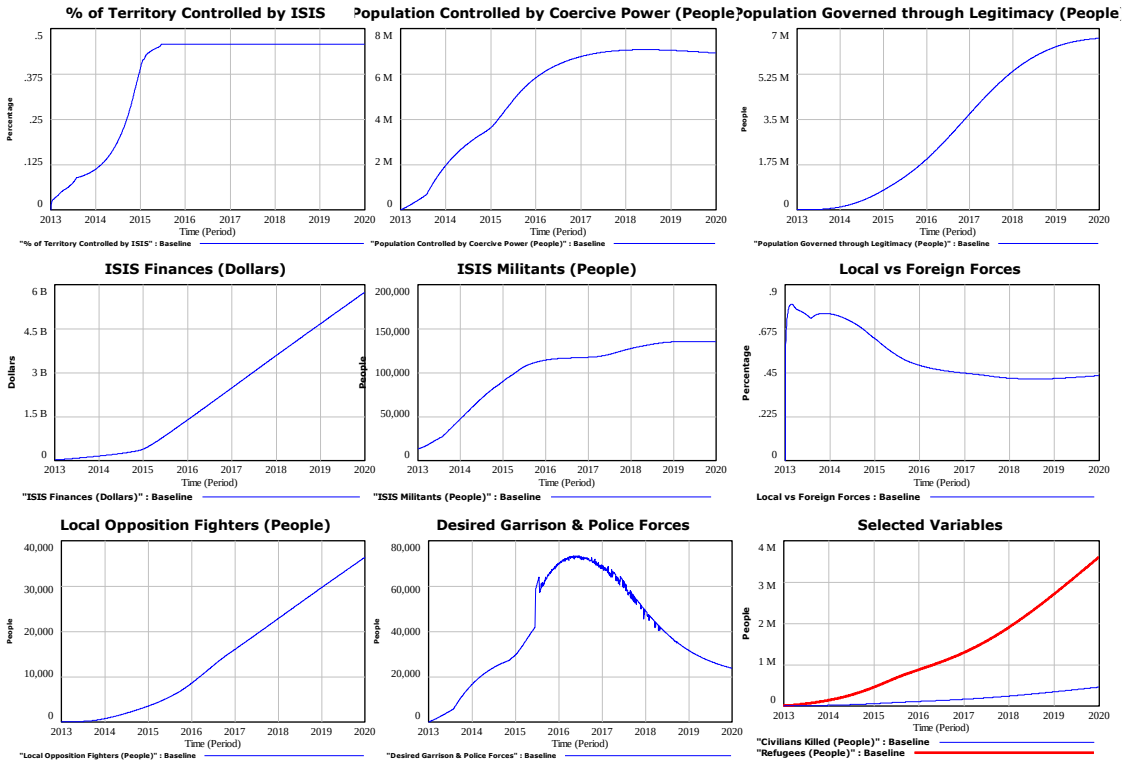


Figure 5: Baseline Dashboard of Performance

However, as ISIS shifts population from being controlled via coercive power to legitimate government, the number of garrisoning troops per cohort of population declines. These dueling tensions of combat intensity, percentage of local fighters and number of population governed through legitimacy drive the overall number of garrison troops required. The more garrison troops required, the fewer available for military expansion. This tension reaches an equilibrium point in the model around 45% of all of Iraq & Syria (somewhere between Kobani and Aleppo in Syria and with most of Anbar in Iraq). There are nearly 8M people underneath ISIS's rule from a conflict that has created nearly 500,000 casualties and close to 4 million refugees. Most worrisome, ISIS is creating free cash flow measured in the billions of dollars. This surplus allows it to pursue a growth-strategy through acquisition of a global

network to both compete with Al-Queda and other state-actors world-wide. Experiments are constructed as changes to model structure or parameter value. Policy simulation results can be compared against this baseline. Significant change in the behavior mode (general shape and magnitude of behavior over time) are noteworthy, while minimal change is of little value.

'Best Case' Policy Tests

The model is set to enable policy testing against the Strategic Architecture. Commonly debated policies on how to confront ISIS are restated below in the form of how they might affect resource dynamic flows into the key resource stocks. These only include political viable policies – so a full scale ground invasion by US forces is ruled out:

1. Do nothing.
2. Attack ISIS's oil production (BPD) and work to reduce the effectiveness of oil smuggling ($ per BPD) in order to decrease the inflow of revenue to ISIS Finances.
3. Convince allies not to pay ransom for ISIS hostages to decrease the inflow of revenue to ISIS Finances.
4. Embed military advisers and personnel to improve the fighting quality via a boost to morale and experience of forces opposing ISIS, in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.
5. Work to reduce the effectiveness of foreign recruiting to reduce the inflow to ISIS Militants.
6. Supply opposing forces with advanced military equipment improving their capabilities (Weapon Values) in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.
7. Leverage close air support missions to aid opposing forces engaged in combat with ISIS, in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.

One type of policy analysis available is a "hypothetical best case" scenario. These policies are tested without realistic operational constraints and begin at 2013. These best case results can then be compared to the Baseline which is the policy of "do nothing." If even the 'best case' scenario does not perform better than the baseline, it is unlikely to do so when realistic operational constraints and an

implementation time table is placed upon it. The hypothetical tests involve arbitrarily setting parameters in the model to the values indicated in Table 1.

Table 1: Hypothetical Best Case Policy Tests Summary

Proposition Tested	Hypothetical Best Case	Subsystem & Formulation
Policy 1: Do nothing. (Baseline)	No Changes	No Changes
Policy 2: Attack ISIS's oil production (BPD) and work to reduce the effectiveness of oil smuggling ($ per BPD) in order to decrease the inflow of revenue to ISIS Finances.	Sever link to oil production from captured territory.	Territory Subsystem Changes: Available Oil Production = 5.013e+008*Disable Oil Disable Oil = 1 (normal) OR 0 (Proposition 2)
Policy 3: Convince allies not to pay ransom for ISIS hostages to decrease the inflow of revenue to ISIS Finances.	Sever link to Ransom Revenue creation.	Revenue Subsystem Changes: IF THEN ELSE(Time>Policy Intervention Time, Ransom Elimination,1) Ransom Elimination = 1 (normal) OR 0 (Policy3)
Policy 4: Embed military advisers and personnel to improve the fighting quality via a boost to morale and experience of forces opposing ISIS, in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.	Increase Blue Force Morale by 25% and Blue Force Average Experience by 1 Year.	Territory Subystem Changes: Moral Effect = IF THEN ELSE(Time>Policy Intervention Time,"Embed US Advisers (Morale)",0) Embed Us Advisors (Morale) = 0 (Normal) OR .25 (Policy4) Experience Effect = IF THEN ELSE(Time>Policy Intervention Time,"Embed US Adivsers (Experience)",0) Embed US Advisors (Experience) = 0 (Normal) or 1 (Policy4)
Policy 5: Work to reduce the effectiveness of foreign recruiting to reduce the inflow to ISIS Militants.	Disable foreign recruiting in the model.	((Actual Recruits per Suicide Attack*"Suicide Actions (Military Actions/Period)")*Foreign Recruiting Eliminated)*Bankruptcy Switch Foreign Recruiting Eliminated = 1 (Normal) or 0 (Proposition 5)
Policy 6: Supply opposing forces with advanced military equipment improving their capabilities (Weapon Values) in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.	Increase Weapons Value for Blue Forces by 25%.	Situational Force Scoring Subsystem: SFS Avg Blue Inf WEI/WUV = 1+Supply Better US Equipment Supply Better US Equipment = 0 (Normal) .25 (Policy 6) The same change is applied to Avg Blue Heavy Weapons & Artillery.
Policy 7a & 7b: Leverage close air support missions to aid opposing forces engaged in combat with ISIS, in order to increase the outflow of ISIS Militants (killed or capture) and decrease the rate at which Territory is Controlled by ISIS.	Increase overall Blue Force Combat Strength by 10% for 7a and 50% for 7b representing minimal and intensive support.	Blue Force Strength = (SFS Blue Heavy Weapons Situational Strength+SFS Blue Indirect Attack Situational Strength+SFS Blue Infantry Situational Strength)+((SFS Blue Heavy Weapons Situational Strength+SFS Blue Indirect Attack Situational Strength+SFS Blue Infantry Situational Strength)*Ground Support Campaign Start) Ground Support Campaign Start = IF THEN ELSE(Targeting Switch=0,US Airpower Support Step Height,0) Airpower Support Step = 0 (normal) 1.1 (7a minimal campaign) and 1.5 (7b intensive campaign)

These tests are also implemented with zero ramp up time and beginning at the start of the simulation in 2103, unrealistic in the real world but simplified for purposes of evaluating if these polices could ever be successful.

The results of these tests are summarized in Table 1 that provides final values across four performance measures compared to the baseline.

Table 2: Hypothetical Best Case Results

Ending 2020 Values	*Territory % Controlled*	*"Population Controlled by Coercive Power (People)"*	*"Population Governed through Legitimacy (People)"*	*"ISIS Finances (Dollars)"*	*"ISIS Militants (People)"*
Baseline	46%	6,916,093	6,623,453	$ 5,738,208,768	135,069
Policy 2	0%	720,020	1,141,213	$ (11,855,729)	11,206
Policy 3	46%	6,747,141	6,473,906	$ 5,710,391,296	146,514
Policy 4	46%	6,636,047	6,243,996	$ 5,045,048,320	153,598
Policy 5	46%	7,072,286	6,731,906	$ 5,821,407,744	80,085
Policy 6	46%	6,695,826	6,384,421	$ 5,446,244,864	149,387
Policy 7a	46%	6,748,507	6,475,611	$ 5,676,901,888	146,468
Policy 7b	46%	6,748,507	6,475,611	$ 5,676,901,888	146,468

Only two policies in the best case scenario create meaningful change, Policy 2, the complete reduction of oil revenue from the beginning hamstrings ISIS's performance. Policy 5, elimination of foreign recruits, leaves ISIS with just over half the militants as in the baseline, but at one of the largest Controlled Populations. This seemingly paradoxical result is explained in more detail below. Even though the remaining policies all seem to end at about the same place, the behavior patterns over time show that some of these policies have delayed the pace at which ISIS expanded as shown below in Figure 6 comparing policies 3-4 and 6-7b with the baseline in terms of % of Territory Controlled by 2020. However this is simply delaying the inevitable as in all scenarios ISIS has reached its natural limit of territorial gain at about 47% of Syria and Iraq by 2016.

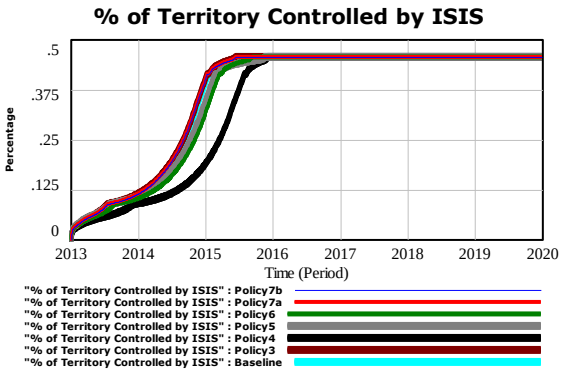


Figure 6: % of Territory Controlled in Select Policy Scenarios

A few insights are gained even from this unrealistic best case scenario tests- some policies actually improve ISIS's position while others only delay the inevitable and only one policy significantly changes the outcome (Policy 2). Insights from these results are discussed below as a Foreign Recruiting Dilemma and Importance of Ethnographic Envelopes.

The Foreign Recruiting Dilemma

The results of Eliminating Foreign Recruiting (Policy 5) are surprising as it leaves ISIS in a stronger position, even with less militants. This can be explained by looking at Average Militant Experience which is a tracking co-flow of ISIS Militants and placing it next to % of Local vs. Foreign Troops that tracks the mix of locally recruited ISIS fighters versus Foreign Recruits from abroad.

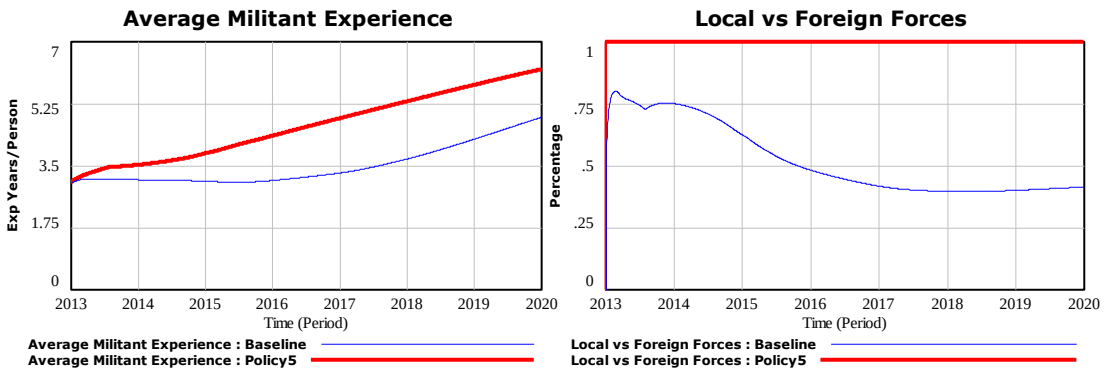


Figure 7: Foreign Recruiting Dilemma

The more foreign recruits ISIS has the lower its Average Militant Experience will be as those recruits begin showing up. Since Average Militant Experience drives combat performance, recruiting performance, resource exploitation, transition to governance and more– the more skilled ISIS is in terms of Average Militant Experience the better it performs. When Policy 5 eliminates foreign recruits by 100% the loss in manpower is more than made up for by the improvement in other factors that drive ISIS's performance. This is not to say there aren't very valid reasons for seeking to stem the flow of foreign recruits – such as they may return from whence they came militarized. Such factors and considerations are beyond the scope of this model.

Importance Ethnographic Envelopes

Policy 4 (embed advisors) and Policy 6 (supply weaponry) result in ISIS controlling less population, but having more militants by the end of the scenario. This dynamic is key to many policy tests and illustrates the importance of ethnographic envelopes, changes in the underlying human terrain as envisioned by Renzi as ISIS either advances or falls back. The inner ethnographic envelope in this case is the human terrain favorable to ISIS, the outer ethnographic envelope the human terrain unfavorable. Because of the scenario loaded, ISIS begins operating on its inner-ethnographic envelope in human

terrain favorable to their cause. Policies which slow ISIS's growth early, but neither stop nor destroy the organization, allows them gain more recruits and resources earlier than they would have by growing rapidly. The temporary setback to territory gain is reversed when ISIS has increased its manpower and finances, and now stronger than it would've been originally, it performs better over time in the ensuing territories than if it crosses into the outer ethnographic envelope earlier. This can be demonstrated in a few charts narrowed in on a timeline 2014-2016, the key period where this paradox emerges.

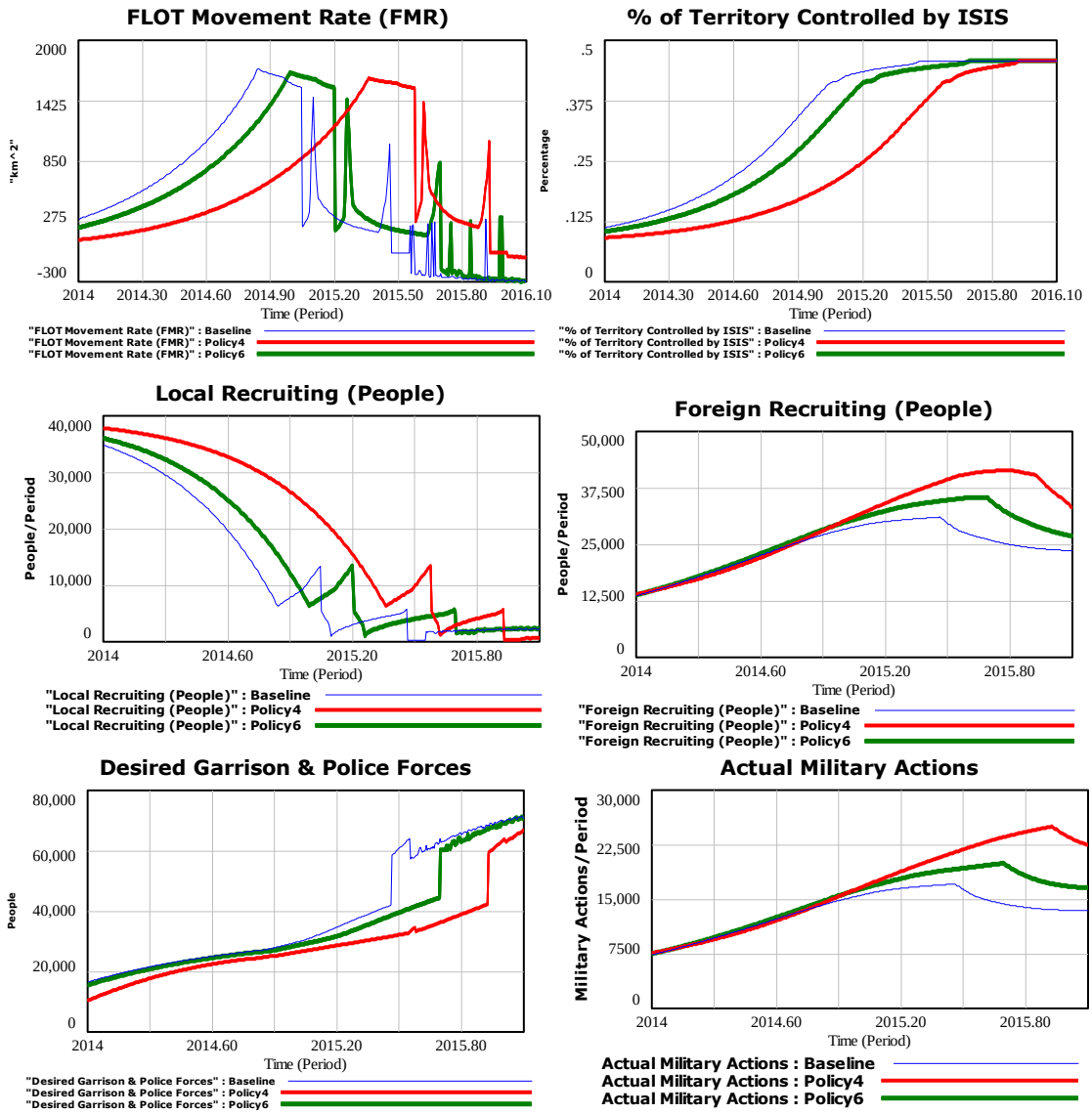


Figure 8: Importance of Ethnographic Envelopes 2014-2016

First, as expected we see that Policy 4 and Policy 6 both have limited ISIS's Forward Movement Rate due to the marginally increased combat effectiveness provided by US support via embedded advisors and advanced weaponry. This is reflected in the decreased amount of % Territory Controlled by ISIS. However, the local recruiting and foreign recruiting are both higher, as the areas where ISIS does control are more favorable. Likewise Desired Garrison & Police Forces are lower – which in turn allows

more Military Actions. In the long run the larger Militant Force will gain experience earlier than would've occurred in the Baseline Scenario, allowing ISIS to outperform versus they expanded into the outer ethnographic envelope earlier. Had the policy measure been timed to occur just as ISIS crossed into the outer ethnographic envelope, unfavorable human terrain, it would've "pinned" ISIS in areas that made recruiting, resource extraction more difficult and garrison more costly. As an additional note – do to the ability of ISIS to scavenge weapons in the simulation - when the US supplies the Blue Force with more powerful weapons, ISIS eventually gains some of them as well.

Portfolio Analysis with Operational Constraints

Another form of policy test that can be conducted on the model is to simulate a basket of policy options, selecting a timing window and with operational constraints that are realistic. We know that Policy 2, attacking ISIS oil infrastructure stopped ISIS's growth in its track in the hypothetical best case scenario, but this policy assumed a 100% successful destruction of ISIS's nascent oil infrastructure in 2013, well before ISIS was considered a serious national security threat. However, at the point the US began its air campaign against ISIS during the Anbar offensive of 2014, would combining additional policies with targeting oil production via an air campaign have resulted in reversing or containing ISIS's growth? Or will it result in the dynamic of keeping ISIS within its inner ethnographic envelope, but not destroyed, and thus ultimately performing better?

In this portfolio analysis Policies 2, 4, 6 & 7 are combined. This scenario is equivalent to a US & Coalition air campaign that targets both ISIS oil infrastructure as well as provides close-air support to Blue Forces. In addition US advisors are embedded with Blue Forces and advanced US weaponry is supplied to Blue Forces. This is not an implausible scenario to simulate as it accounts for a significant intervention, but well short of a full scaled invasion that would be politically untenable. The intervention date is set at June of 2014 – the actual point in which US military intervention began with an air

campaign against ISIS. Since Policies 4 & 6 are not in conflict, they can be tested as they were individually above. However, policies 2 & 7 both rely on air assets to conduct different missions – one is the targeting of ISIS oil infrastructure the other close-combat support of Blue Forces. These options are further constrained by much US airpower can be projected into the region. The current rate of air strikes is roughly 10/day roughly split between missions between Iraq and Syria (see Appendix on Airpower). Furthermore an air strike targeting a modular oil refinery takes about between 300-500 BPD of production. How many air strikes are needed to significantly impact ISIS's oil production? And would that level of airpower detract from the ability to provide close ground support?

To test these parameters three activity levels will be set for airpower: 10/day to indicate today's policy, 100/day to indicate a ten-fold increase in operational tempo and 500/day which indicates a theoretical maximum sustained operational tempo for a significant period of time. [15] Furthermore the air strikes will target ISIS oil production 100% until it is destroyed, and then shift into a Ground Support role. This is based off the knowledge that eliminating ISIS's oil revenue was a key factor in reducing its growth under the hypothetical best case scenario. Parameters are indicated in Table 3. All policies include embedding US troops as advisors and supplying weaponry as per Policies 4 & 6 previously, and all policies begin with an intervention date of 2014.5.

Table 3: Portfolio Policy Analysis Air Campaign Parameters

Scenario	Strikes/Day	Strikes vs. Oil Production until Destroyed	Combat Effectiveness increase from Ground Support Airpower after Oil Destroyed
Policy 8 Minimal Air Campaign	10/day	10/day	1%
Policy 9 Significant Air Campaign	100/day	100/day	10%
Policy 10 Intensive	500/day	500/day	50%

[15] One hundred strikes a day was established and maintained for 10 weeks in the late 1990's Kosovo Air Campaign. The largest single day airpower attack in modern history was the first day of the invasion of Iraq where 1200 strikes were carried out in a single day. But this is not considered sustainable.

Air Campaign			

We can now compare these portfolio policies against the baseline performance in the original dashboard used above.

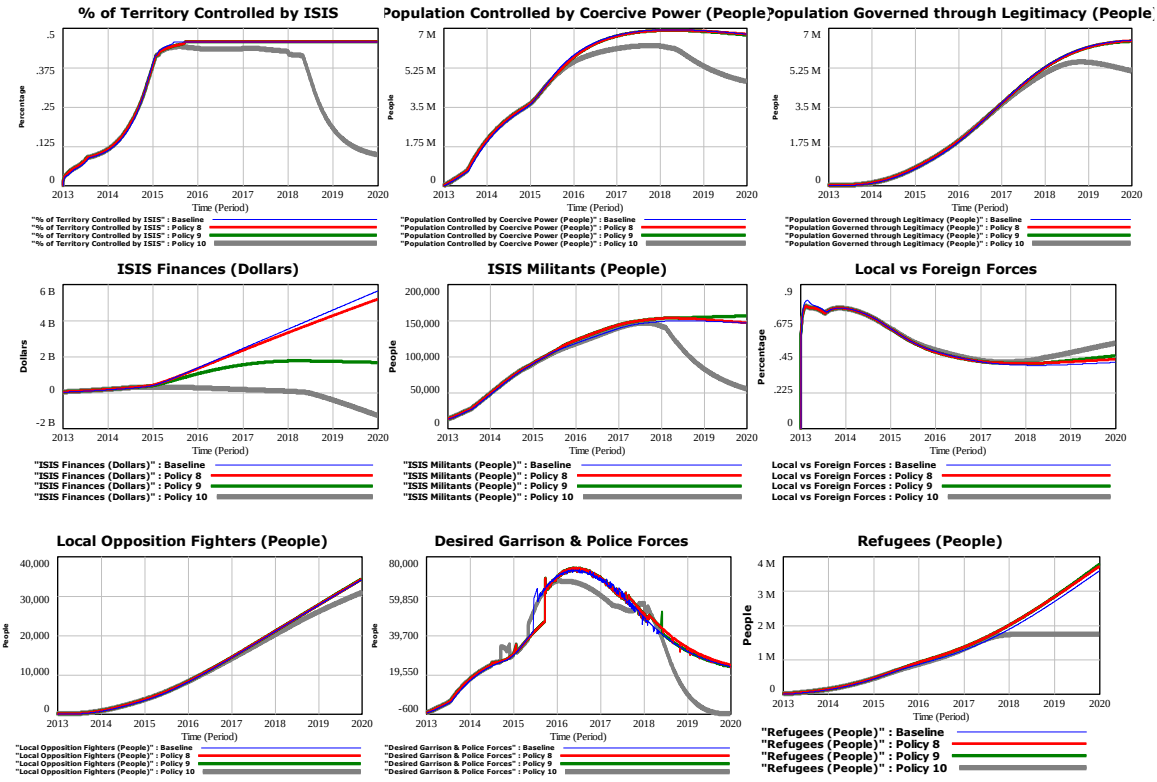


Figure 9: Portfolio Analysis with Operational Constraints Implemented at 2014.5

In narrative, both Policies 8 & 9 struggle to materially impact the conflict. This is because the rates of strikes per day against the oil production are insufficient to destroy it completely over the length of the simulation. Only Policy 10, at a 500/strike/day tempo can both destroy the oil production and then subsequently shift to support the ground war with air strikes. As a result only Policy 10 shows ISIS being pushed back, its population under Control reduced, number of Militants depleted. In summary, the results are better, but not great. How is it that a combination of effective policies performed little better than any one single policy? The reason is threefold: keeping ISIS within its inner ethnographic

envelope, timing and overlapping targets. As ethnographic envelopes has been discussed above focus will turn now to matters of timing and overlap of targets.

POLICY TIMING

First on timing. Most of the feedback loops activated early in the causal loop diagram depicted in Figure 2 create positive feedback, a path-dependent system. This means earlier interventions with an emerging-state actor like ISIS have far greater effect than later interventions, even if the later interventions are significantly larger. These intervention windows exist prior to the significant acquisition of territory that grants ISIS access to exploitable resources and population to control and then seek to govern. This prevents the reinforcing feedback loops from activating that are highlighted in Figure 2. To illustrate the importance of timing the set of same policy interventions as Policy 8 can be moved back to 2013.5, relabeled "Policy 9 Early" and compared against Policy 10 begun in 2014.5. Policy 9 Early, Policy 10 and the Baseline are now compared in the dashboard set of graphs.

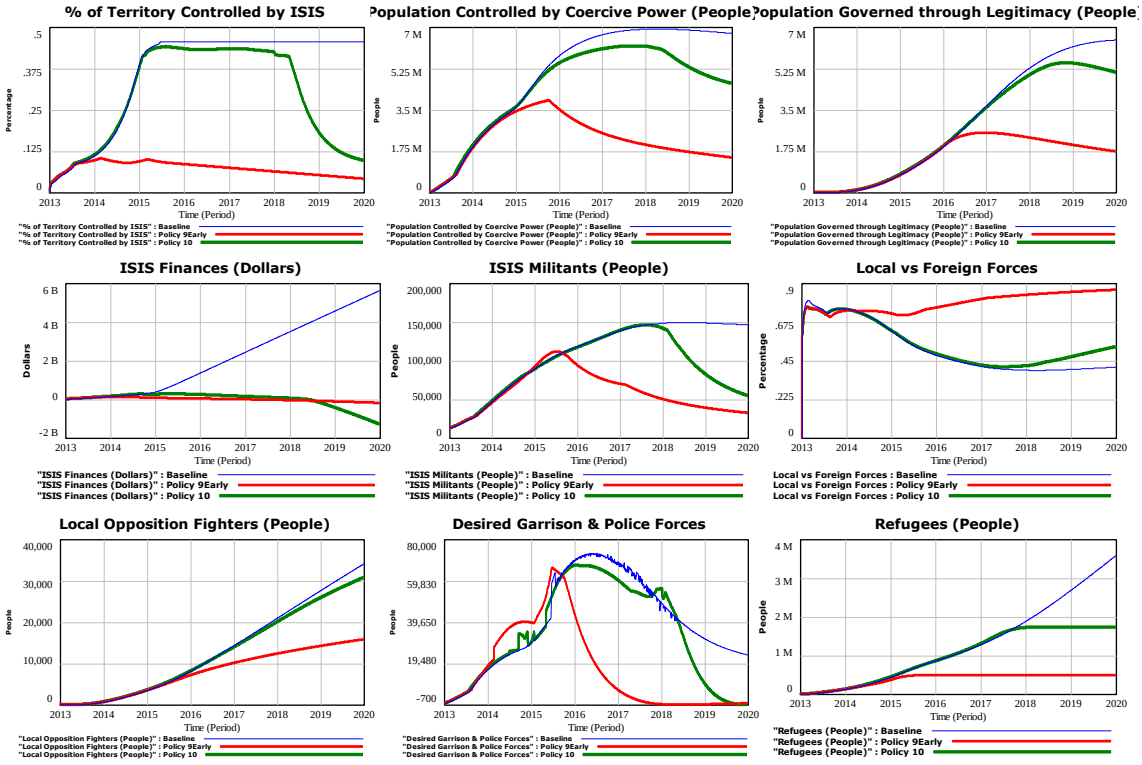


Figure 10: Comparison of Significant Air Campaign at 2013.5 vs. Intensive Air Campaign at 2014.5

As can be seen in Figure 10, even though the Significant Air Campaign of Policy 9Early is only 20% the number of air strikes per day as the Intensive Campaign, because it begins earlier, in 2013.5 vs. 2014.5; it has an outsized impact on the dynamics of the overall conflict. ISIS's oil production, which is smaller, is destroyed more quickly allowing air assets to switch to ground combat support. The earlier ground support prevents ISIS from gaining more territory. As ISIS cannot gain territory it cannot gain more oil resources, populations to recruit from, militants or other benefits. This is reflected in the sharply weaker performance of ISIS. However, the analysis would also reflect that because ISIS was never able to conduct a foreign recruiting campaign by launching suicide bombing and IED attacks, the number of foreign recruits remains low relative to the population. This means that what populations ISIS does control are easier to garrison and police, than in other scenarios where more of the force is composed of foreign fighters. Timing therefore is crucial for policy consideration, and the earlier the better with an

opponent who seeks to gain power through territorial conquest as an emerging-state actor like ISIS would.

POLICY OVERLAP

A second challenge to the set of policies is overlap of targeting factors. All three policies aimed at combat power of the opposition: embedding US troops to bolster experience and morale, equipping opposition forces with modern US weaponry and providing close combat support all serve the same purpose. In combat, more ISIS forces are destroyed relative to how many would've been, and this reduces ISIS Militants through the outflow of Losses. But unless the support is sufficient to actually enable the opposing forces to prevail over ISIS, the effect is not enough. The same ISIS Militant can only be killed or detained once: whether by a more experienced and higher morale soldier, through better equipment, or US combat airpower.

Incremental Knowledge Gain

Conducting a limited suite of policy intervention evaluations does reveal key insights into conducting interventions against emerging-state actors. Exogenous factors can provide only an incremental setback for the emerging-state actor until Territory is taken away from them, and are challenged to overcome the reinforcing feedback loops an emerging-state actor benefits from until that occurs. Because an emerging state actor relies on few exogenous factors for its success there are only limited avenues to "harm" an actor like ISIS from outside the territory it operates in. Except for a minimal amount of foreign donations and the flow of foreign recruits – all other key resources ISIS relies upon to be successful can be found within the territory they control. It follows that only the retaking of this Territory, in some fashion that disrupts the ability of an emerging state actor to govern, will lead to conditions that may enable changing the dynamic of behavior. But taking territory severs the key feedback loops which

make emerging state actors different, and more dangerous, than a classic insurgent non state actor. This is a key difference to understand from a policy standpoint between classic non-state actor insurgents and emerging state actors such as ISIS.

A Systems Thinking Approach to Containing ISIS

Incorporating the incremental knowledge gain into intervention policies can result in an innovative approach. Policy 11 is one such approach that combines existing policies of embedding combat advisors and using a significant airpower campaign but targeting that air campaign in a very different way. Additionally it does not require providing advance weapons to the Blue Force which the model demonstrates will end up in ISIS hands. First, local ethnographically favorable partners pin ISIS on its outer ethnographic envelope, when they have crossed from friendly to unfriendly human terrain. This means ISIS faces a harder time holding the territory, less generation and less recruiting along their front lines. At the same time the airpower interventions are not focused on destroying oil production, but rather attacking the mechanisms of governance itself. The goal is not to reduce revenue, but to reverse the flow of population from the stock of Governed through Legitimacy back into Controlled through Coercion so essential for an emerging-state actor. This is based on the theoretical assumption that an emerging-state actor benefits over an insurgency by openly governing the territory it holds; and that were it not for this governing it would face resistance it would be hard pressed to match. [16] This might mean targeting ISIS governing buildings, public works efforts – even the execution scaffolding and plazas. Anywhere ISIS uses the institutions of governance to create credible processes that fuel the transition from coercion to legitimacy. In the model the result of attacking governance results in increased Garrison requirements that pull ISIS troops away from frontline expansion to police the populations they already control. As the problems in their rear mount, locally favorable ethnographic

[16] Clancy, "Dynamics of ISIS - An Emerging State Actor." 17-18

partners supported by a significant air campaign providing close combat support attack ISIS, crossing the outer ethnographic envelope. ISIS now faces two fronts of conflict – an interior uprising and external pressure. Easier to accomplish in a model than the real world, but the model does show promising results.

Table 4: System Thinking Intervention Policy Parameters

Proposition Tested	Elements	Subsystem & Formulation
Policy 9: Combat Advisors, Supply Weaponry and Significant Air Campaign Targeting Oil then Close Combat Support	• Increase Blue Force Morale by 25% and Blue Force Average Experience by 1 Year • Increase Weapons Value for Blue Forces by 25%. • 100 Strikes/Day on oil until destroyed then Increase overall Blue Force Combat Strength by 10% representing close air support	See Policy 4, 6, & 7a in Table 1 Above
Policy 10: Combat Advisors, Supply Weaponry and Significant Air Campaign Targeting Oil then Close Combat Support	• Same as above except 500 Strikes/Day on oil until destroyed then Increase overall Blue Force Combat Strength by 50% representing close air support	See Policy 4, 6 & 7b in Table 1 Above
Policy 11: Combat Advisors, Significant Air Campaign Targeting Governance & Close Combat Support	• Increase Blue Force Morale by 25% and Blue Force Average Experience by 1 Year • 100 Strikes/Day on oil until destroyed then Increase overall Blue Force Combat Strength by 10% representing close air support	See Policy 4 & 7a in Table 1 Above Set Loss of Governance from Attacks on Governance to 1 Set Reduction in Time to Transition to Governance to 100

Policy 11 is run at the same intervention time, 2014.5 and compared to the Baseline, Policy 9 and Policy 10 the results are depicted in Figure 11.

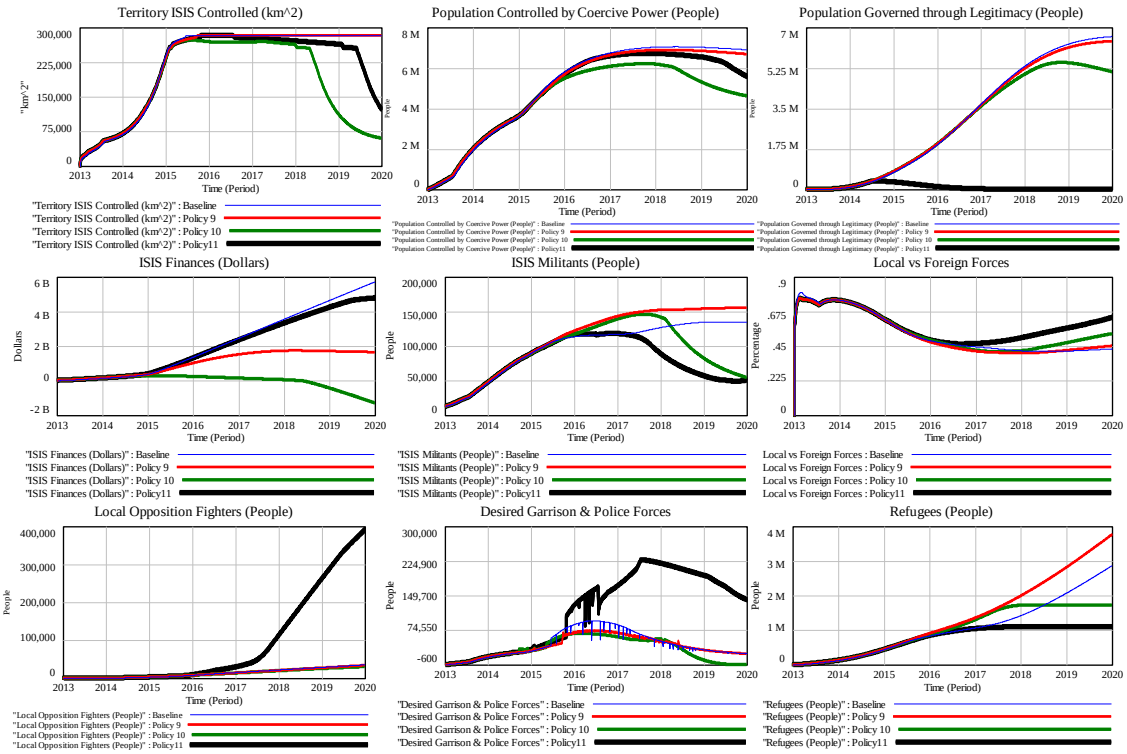


Figure 11: Systems Thinking Intervention (Policy 11) Compared to Others

Policy 11, the black line, show a clear tradeoff. ISIS is contained, but still remains quite dangerous. The attacks on governing mechanism results in the gradual decline over ~2.5 years of Population Governed by Legitimacy, and as predicted this results in a larger Desired Garrison & Police Force than ISIS can maintain, thus leading to increasing Local Opposition Fighters. Prevented from staying within their favorable ethnographic envelope for recruiting, ISIS militants reaches a ceiling earlier than the other intervention policies. ISIS Militants also declines sooner than any other policy – a combination of increased causalities and reduced foreign recruiting which will be touched on below. As a tradeoff however, because the targeting is focused on governance, and not oil, ISIS's Finances remains barely untouched. This could have dramatic geopolitical ramifications that are outside the scope of this model. Also two unanticipated results of the Policy are the increasing mixture of Local v. Foreign Forces and the dramatic reduction in Refugees. The causes of this, as it turns out, are related.

In the model foreign recruiting is driven by suicide bombings on civilian populations, and the propaganda that results. Meanwhile refugees are driven by the number of ethnic cleansing and suicide bombings against civilians. When ISIS troops become "pinned" on the front and in the rear garrisoning a population that must be coerced rather than governed – they are no longer available to conduct ethnic cleansing and suicide bombing actions. This reduces refugees as well as lessons incoming foreign fighters. This relationship is displayed below.

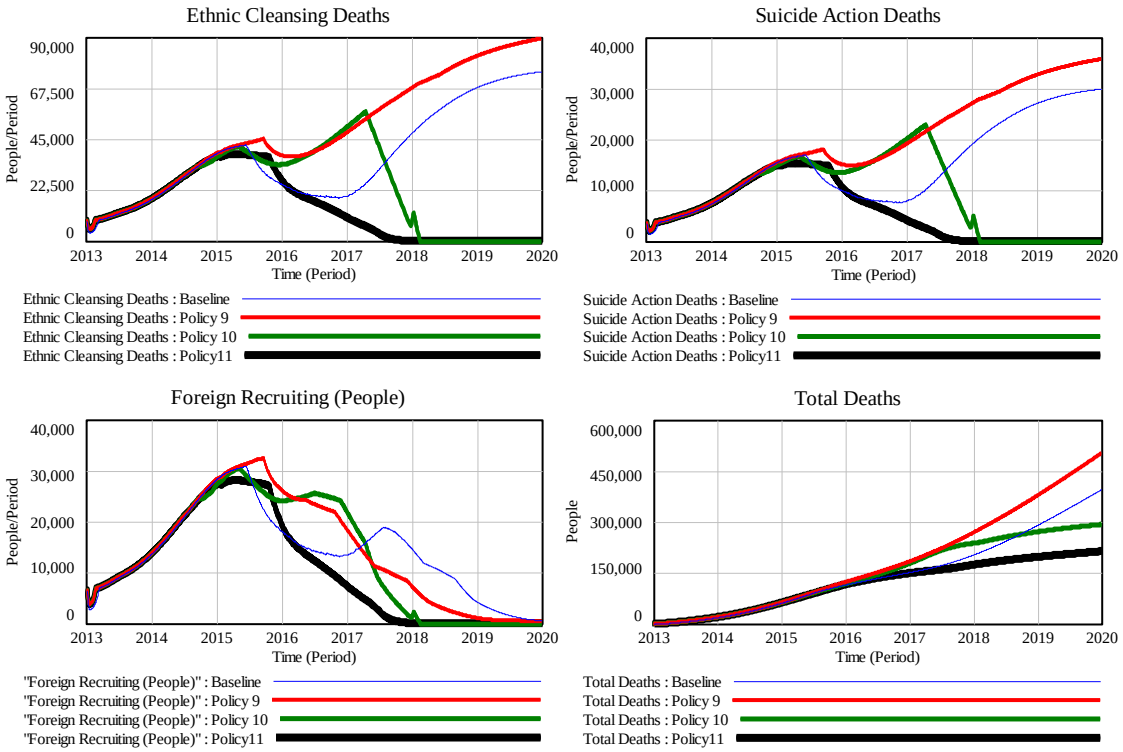


Figure 12: Decline in Ethnic Cleansing, Suicides & Foreign Recruiting

As an added benefit, the reduction in civilian deaths and fewer foreign fighters to side with ISIS results in a Total Deaths (Civilians + ISIS Militants + Blue Force + Local Opposition Forces) that is the lowest of the Baseline or any intervention policy.

Conclusion

By leveraging a robust simulation model policies for intervention against emerging-state actors can be simulated in isolation, combination and at different timing windows. Evaluation of these policies yields both information on performance but also reveals key insights into the dynamics of intervention against these actors. As an emerging-state actor ISIS is different from other militant terrorist groups and insurgencies in that it seeks to acquire territory and govern openly. This presents a policy dilemma in planning effective interventions. Reducing or degrading ISIS's capabilities from abroad is made exceedingly difficult because the majority of their resources are generated from within the territory they control. There are few levers to pull from outside this territory. Any efforts that slow – but do not stop or reverse dramatically – early growth allow ISIS to enjoy the benefits of operating in their inner ethnographic envelope and ISIS will finish in a better position relative than the baseline. Additionally, how interventions are timed is critical in that those timed after the acquisition of territory have significantly less effect than prior to territorial gain. Finally, many policies overlap over the same form of target – attempting to kill an ISIS militant, means that even a portfolio of policies may not have an aggregate effect equal to the sum of its parts. Leveraging these dynamic insights with systems thinking may result in an atypical intervention strategy that, at least within the boundaries of the model, appears to perform better at containing ISIS. But not without its own tradeoffs.

This paper also demonstrates how the creation of a robust, scenario based simulation model allows for policy testing of what interventions might help contain or mitigate the growth of ISIS and other emerging-state actors.

This paper has several weaknesses. Weaknesses related to modeling choices are covered at the conclusion of the Appendix B. The policies selected for analysis were not comprehensive of all possible policies and combinations, but instead selected to illustrate key dynamics and insights. As well,

parameter values to represent the policies were arbitrarily selected in some cases. Combinations of different policies, or tested with different parameters, could yield contrary results. Finally there is no mental model of the behavior or ideation of the participants in the simulation model. As introduction of US troops, even as advisors, could engender significant local distrust this may result in a dramatic change from the performance of a policy discussed above. Future work on policy analysis could include more accurate parameterization, construction of different policy options, and optimization testing to cover a broader policy space with thousands of permutations rather than a handful. Generalizing the model to different scenarios – both in region and time – could yield additional insights into the contingencies within which intervention policies may find success or failure.

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