# The Crucible

Project 1 - Baseline Crucible

Full Project Report

Research plan and analyses for Sets A-E

Baseline, bottleneck, duel, and climate-severity comparisons

June 17, 2026

# Contents

# Part I - Project Plan

Project 1 is the first structured experimental use of The Crucible as a comparative research instrument. The core world engine is held stable while one major condition is changed at a time: geography, tribe count, pairwise competition, or climate-chaos severity. Each condition is run as ten independent 40,000-pulse epochs so recurring patterns can be distinguished from single-run variation.

The world engine updates agents, regions, energy use, births, deaths, social interaction, regime transitions, and environmental pressure at each pulse. Project 1 uses a frozen candidate engine so set differences remain interpretable.

A proposed fragmented-fertile-basin set was removed before the final Project 1 structure. The default Holocene fertility event already creates multiple fertile clusters, so a basin-isolation study belongs to a separate topology-focused project.

| Set | Epochs | Name | Main condition | Purpose |
|---|---|---|---|---|
| A | 1-10 | Baseline World | 22 tribes, normal geography, default climate-chaos | Establish reference behavior. |
| B | 11-20 | Bottleneck World | 22 tribes, one-pass mountain barrier | Test whether terrain preserves diversity or delays monopoly. |
| C | 21-30 | Duel World | 2 tribes, one-pass mountain barrier | Reduce the system to a controlled head-to-head contest. |
| D | 31-40 | Harsher Climate-Chaos | 22 tribes, default geography, harsher climate-chaos | Test collapse amplification and refugia failure. |
| E | 41-50 | Gentler Climate-Chaos | 22 tribes, default geography, gentler climate-chaos | Test whether reduced climate volatility softens collapse. |

## Terms Used in This Report

| Term | Meaning |
|---|---|
| Agent | An individual simulated actor whose movement, energy, cooperation, reproduction, and death are updated by the world engine. |
| Tribe | A lineage of agents sharing a founding behavioral design and inherited traits. |

| | |
|---|---|
| Epoch | One complete simulation run under a defined condition. |
| Pulse | One time step. Project 1 epochs run for 40,000 pulses. |
| World engine | The logical system that updates agents, regions, resources, regimes, climate pressure, births, and deaths. |
| Regime | A broad complexity stage: Foraging, Agrarian, Industrial, or Technological. |
| Prisoner's Dilemma | A repeated cooperation-or-defection interaction used to model social behavior under survival pressure. |
| Refugia | Small surviving pockets after a larger population and complexity collapse. |
| Xeno | An outsider or foreign lineage in the interaction model. |
| Civic identity | Regional belonging that may compete with inherited tribe identity after shared residence. |

## Primary Questions

| Domain | Question |
|---|---|
| Geography | Does severe geography preserve social diversity, create delayed contact, or merely postpone winner-take-all selection? |
| Tribe count | Does the number of initial tribes change the probability of monopoly, coexistence, delayed contact, or collapse? |
| Agrarian transition | What creates the 9,000-12,000 pulse agrarian bottleneck and demographic singularity? |
| Strategy | Do Prisoner's Dilemma traits materially affect survival, or do thermodynamic limits dominate? |
| Climate severity | Do harsher or gentler climate-chaos settings change crash depth, timing, mortality, refugia, and tribe selection? |

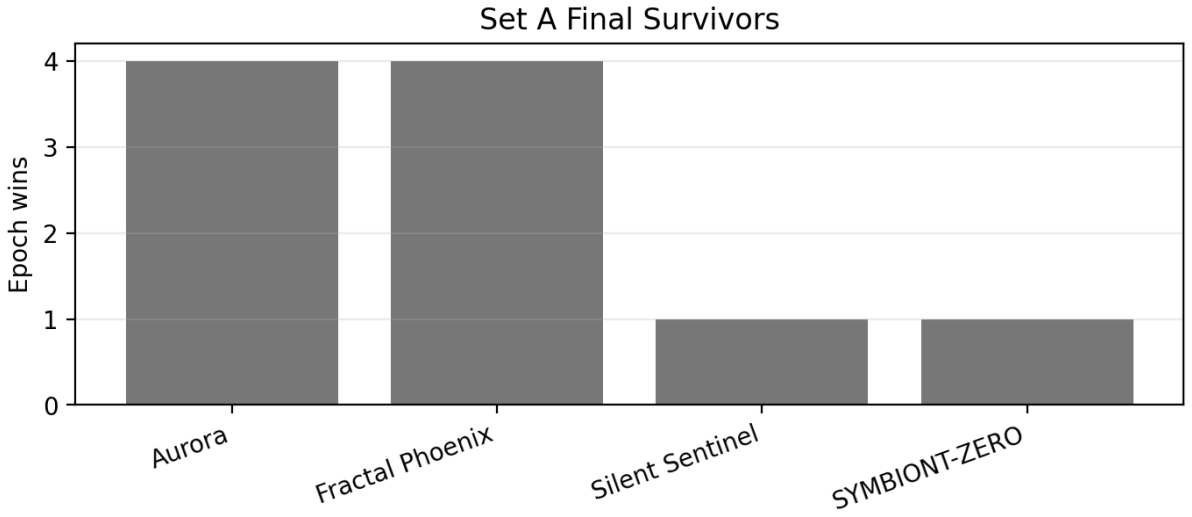
**Project 1 Frame**
**Project 1 tests whether designed social strategies can produce civilization, and whether that civilization survives geography, competition, thermodynamic overshoot, and climate-chaos pressure.**

# Part II - Set A: Baseline World

Set A establishes the reference behavior of Project 1. It uses twenty-two active tribes, normal geography, the default climate-chaos configuration, and 40,000 pulses per epoch. Later sets are interpreted against this baseline.

The central result is that civilization repeatedly emerges, reaches a large population and complexity peak, and then collapses into small agrarian refugia. The final winning tribe varies across epochs, but every baseline epoch ends with exactly one surviving tribe.

| Metric | Set A value |
|---|---|
| Epochs analyzed | 1-10 |
| Active tribes | 22 |
| Final outcome | 10 of 10 epochs ended with one surviving tribe |
| Average peak population | 2,439,589 |
| Average final population | 45,840 (1.88% of peak) |
| Average peak complexity | 1,548,409 |
| Average final complexity | 16,739 (1.08% of peak) |
| Population peak pulse range | 29,150-29,300 |
| Final survivor pattern | Aurora (4), Fractal Phoenix (4), SILENT_SENTINEL (1), SYMBIONT-ZERO (1) |



The winner is not hard-coded, but the one-tribe end state is invariant.

## Baseline Interpretation

Set A does not show stable multi-tribe civilization. It shows a winner-take-all attractor under default geography. The 8,000-12,000 pulse window acts as a crowded transition field rather than a single decisive first-farmer event. Population and complexity later peak near the fossil/modern window, then fall to small mono-tribal refugia.

| Cause | Total deaths | Share |
|---|---|---|
| Starvation | 77,579,800 | 85.0% |
| Hazard | 12,621,045 | 13.8% |
| Old age | about 1.1M | about 1.2% |

Starvation is the main executioner. The early world is more hazard-heavy, but after agrarian transition starvation dominates, indicating food-system instability and systemic stress rather than simple exposure to disasters.

The Prisoner's Dilemma layer changes sharply during the bottleneck: mutual cooperation falls, mutual defection and exploitation rise, and xeno contact becomes high. Climate chaos then acts mainly as a late amplifier and refugia filter rather than the original cause of monopoly.

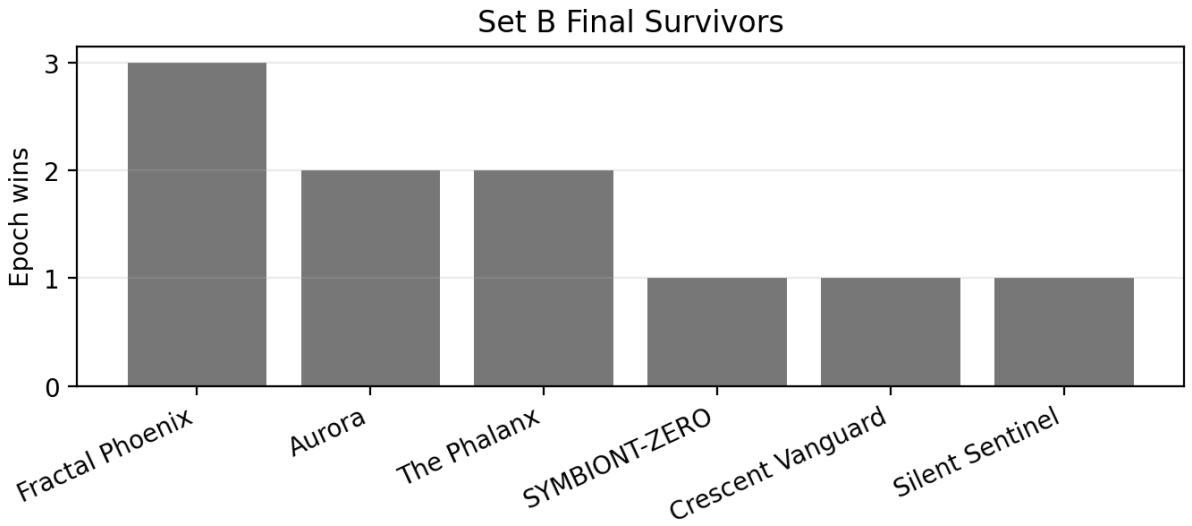
> **Set A establishes the core Project 1 pattern: plural lineages can create civilization, but the baseline world repeatedly collapses into one-lineage agrarian refugia.**

# Part III - Set B: Bottleneck World

Set B tests whether severe geography can preserve diversity. It uses the twenty-two-tribe library, a near-total mountain barrier with one pass, default climate-chaos, and 40,000 pulses. Because the map wraps at its edges, the barrier is interpreted as strong contact friction, not a sealed continent divider.

The bottleneck world changes the route and the list of winners, but it does not preserve pluralism. Every epoch still ends with one surviving tribe.

| Metric | Set B result |
|---|---|
| Epochs analyzed | 11-20 |
| Active tribes | 22 per epoch |
| Final survivors | 1 per epoch |
| Extinct tribes | 21 per epoch |
| Average first extinction pulse | 12,415 |
| Average last extinction pulse | 14,400 |
| Tribes reaching Agrarian | 22 per epoch |
| Tribes reaching Industrial/Technological | 1 per epoch |




Set B produces six different winners, showing that geography perturbs selection even though monopoly remains the final structure.

| Tribe | Type | Wins | Best final population |
|---|---|---|---|
| Fractal Phoenix | LLM | 3 | 48,007 |
| Aurora | LLM | 2 | 56,231 |

| | | | |
|---|---|---|---|
| The Phalanx | LLM | 2 | 24,754 |
| SYMBIONT-ZERO | LLM | 1 | 55,106 |
| Crescent Vanguard | LLM | 1 | 43,344 |
| SILENT_SENTINEL | Biologic | 1 | 34,924 |

## Transition and Social Exposure

The 8,000-12,000 pulse window again behaves as a phase change. Population rises, inequality increases, Agrarian population overtakes Foraging, same-tribe interaction falls, and xeno contact surges. The transition period is socially exposed and competition-heavy.

| Period | Coop | Defect | Exploit | Same tribe | Xeno |
|---|---|---|---|---|---|
| Early | 0.393 | 0.273 | 0.334 | 0.794 | 0.152 |
| Transition 8k-12k | 0.140 | 0.458 | 0.402 | 0.181 | 0.807 |
| Consolidation | 0.186 | 0.391 | 0.423 | 0.866 | 0.134 |
| Fossil/modern | 0.187 | 0.426 | 0.387 | 1.000 | 0.000 |
| Post-collapse | 0.281 | 0.281 | 0.438 | 1.000 | 0.000 |

## Climate-Filtered Refugia

Late climate severity is strongly negatively associated with final population in Set B. Once a lineage has captured the world, climate stress filters how large the final refugia remain.

| Climate variable | Correlation with final population |
|---|---|
| Max climate heat | -0.930 |
| Max climate damage | -0.913 |
| Max climate chaos | -0.863 |
| Total extreme pool loss | -0.916 |

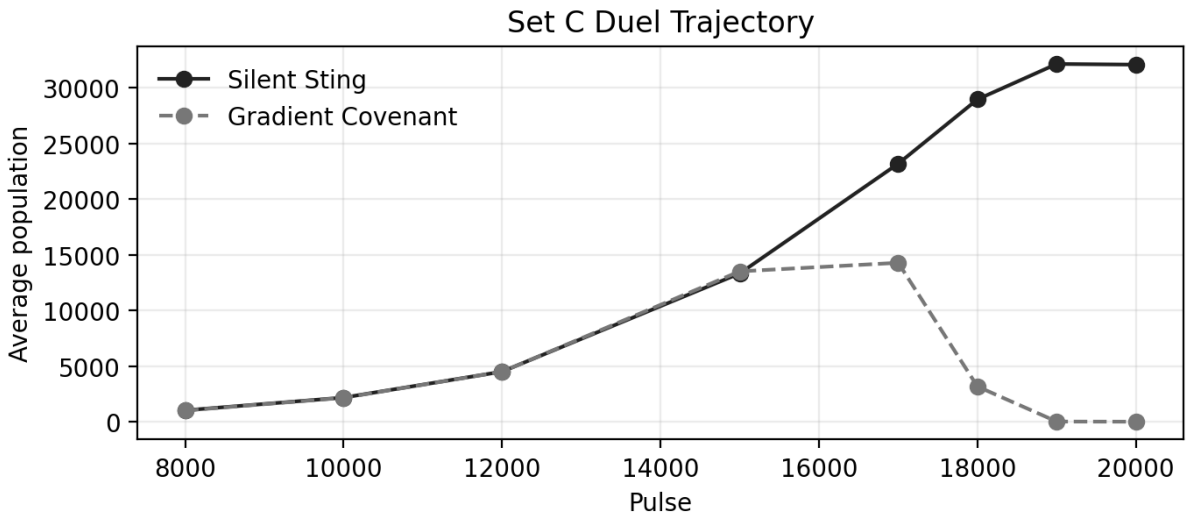
**Set B confirms that geography matters, but not enough in this topology. It changes winners and pathways without preventing the one-lineage endpoint.**

# Part IV - Set C: Duel World

Set C reduces The Crucible to a controlled head-to-head contest between Silent Sting and The Gradient Covenant. It uses two active tribes, one-pass mountain geography, default climate/regime settings, and ten 40,000-pulse epochs.

The result is decisive. Silent Sting survives, scales, reaches Technological complexity, endures collapse, and monopolizes the final inhabited world in all ten epochs. Gradient Covenant repeatedly reaches Agrarian but dies before modernity.

| Metric | Set C value |
|---|---|
| Epochs analyzed | 21-30 |
| Active tribes | Silent Sting and The Gradient Covenant |
| Outcome | Silent Sting won 10 of 10 epochs |
| Silent Sting regime reach | Technological in all runs |
| Gradient Covenant regime reach | Agrarian only |
| Average Gradient Covenant survival pulse | 19,090 |
| Final geography | 100% winner-dominated inhabited regions; zero mixed regions |




The trajectories stay close until the agrarian/pre-industrial failure window. Gradient Covenant slightly leads at pulse 15,000, then collapses between roughly 16,000 and 19,500 pulses.

## Trait and Mortality Evidence

| Trait or metric | Silent Sting | Gradient Covenant | Interpretation |
|---|---|---|---|
| Founder hardiness | 47.25 | 42.00 | Silent Sting starts hardier. |
| Founder xeno trust | 0.281 | 0.433 | Gradient Covenant is more open to outsiders. |
| Founder distress wander | 0.381 | 0.749 | Gradient Covenant begins much more mobile under distress. |
| Peak kin trust | 0.805 | 0.941 | Gradient Covenant retains very high kin trust. |
| Peak stranger trust | 0.616 | 0.827 | Gradient Covenant remains more trusting generally. |
| Last hardiness | 45.86 | 60.63 | Gradient survivors were hardy but too few and too late. |

| Metric | Silent Sting | Gradient Covenant |
|---|---|---|
| Avg failed-birth rate | 0.100 | 0.161 |
| Avg starvation death share | 0.813 | 0.609 |
| Avg hazard death share | 0.174 | 0.344 |
| Avg survival pulse | 40,000 | 19,090 |

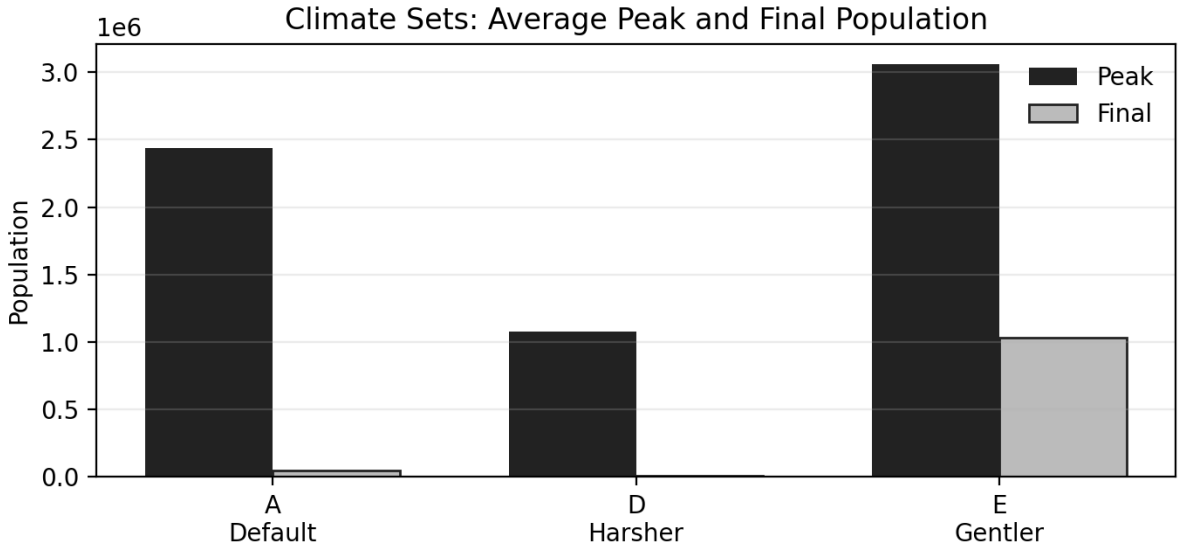
The trait comparison suggests that inherited packages matter in the model. Silent Sting begins harder, less xeno-trusting, and less mobile under distress. Gradient Covenant is more open, more trusting, and much more mobile, and it carries a higher failed-birth rate and hazard-death share.

> **Set C shows that agent design is not cosmetic. Within this model, inherited behavioral and physical packages can repeatedly determine whether a lineage reaches modernity or dies in the agrarian/pre-industrial window.**

# Part V - Climate Severity Comparison

Sets A, D, and E isolate climate-chaos severity. All three use the twenty-two-tribe library and default geography. Set A is the default climate standard, Set D raises climate hazard and chaos, and Set E softens the same mechanism.

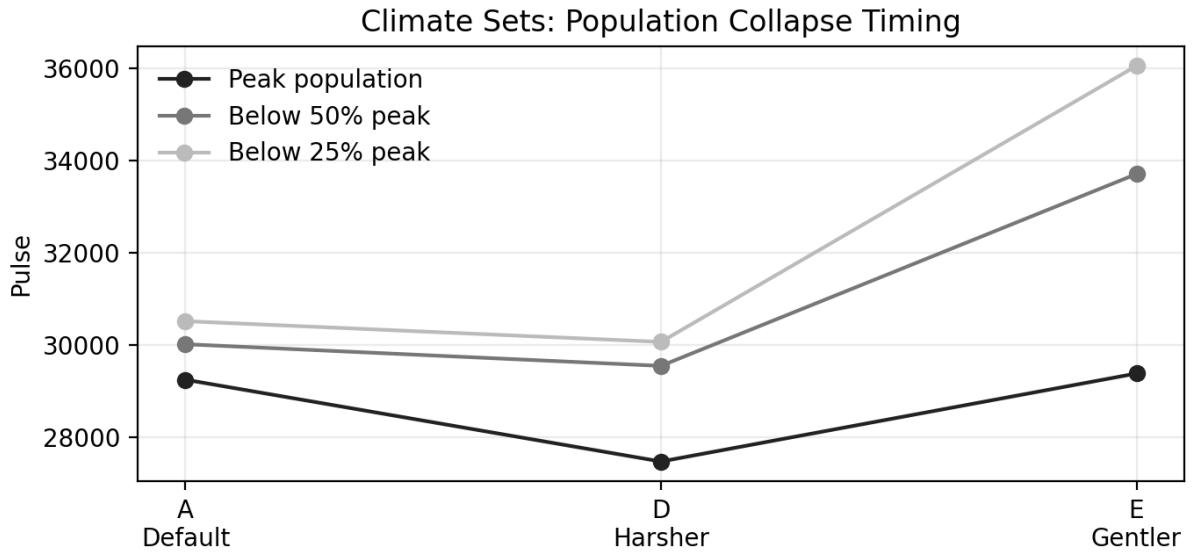
The comparison does not claim climate is the only cause of collapse. It tests how climate severity changes an already vulnerable civilizational trajectory: expansion, crash timing, complexity loss, mortality, refugia, and tribe selection.




Gentler climate preserves much more final population, while default and harsher climate approach near-total collapse.

| Set | Avg peak pop | Avg final pop | Post-peak decline | Avg peak complexity | Avg final complexity | Avg max chaos |
|---|---|---|---|---|---|---|
| A - Default climate | 2,439,589 | 45,840 | 98.1% | 1,548,409 | 16,739 | 0.488 |
| D - Harsher climate | 1,076,045 | 9,920 | 99.1% | 1,084,664 | 3,801 | 0.587 |
| E - Gentler climate | 3,057,787 | 1,031,214 | 65.8% | 2,065,133 | 368,990 | 0.474 |

## Collapse Timing and Persistence




Gentler climate delays the fall below half of peak by more than 3,600 pulses compared with default and more than 4,100 pulses compared with the harsher condition.

| Set | Peak pop pulse | Below 50% pop | Below 25% pop | Peak complexity | Below 50% complexity | Below 10% complexity | Final complexity % |
|---|---|---|---|---|---|---|---|
| A - Default | 29,250 | 30,020 | 30,520 | 28,765 | 29,775 | 30,505 | 1.1% |
| D - Harsher | 27,475 | 29,550 | 30,070 | 26,620 | 28,935 | 29,965 | 0.4% |
| E - Gentler | 29,385 | 33,713 | 36,060 | 29,045 | 31,873 | 37,112 | 18.2% |

Climate severity changes both the height of the peak and the speed of decline. Gentler climate does not remove overshoot, but it leaves a much larger late world and much more final complexity.

## Tribe Robustness and Final Refugia

| Tribe | A survived | D survived | E survived | A avg final pop | D avg final pop | E avg final pop |
|---|---|---|---|---|---|---|
| Aurora | 4 | 4 | 4 | 19,699 | 4,748 | 520,945 |
| Fractal Phoenix | 4 | 3 | 2 | 20,447 | 6,238 | 236,643 |
| SILENT_SENTINEL | 1 | 1 | 1 | 3,475 | 2,206 | 62,124 |
| SYMBIONT-ZERO | 1 | 0 | 0 | 38,319 | | |
| The Phalanx | 0 | 1 | 0 | | 2,475 | |
| Crescent Vanguard | 0 | 1 | 0 | | 3,234 | |

| Set | Avg top-region pop | Avg tribes per region | Avg stress | Avg chaos | Dominant tribes in top refugia |
|---|---|---|---|---|---|
| A - Default | 1,764 | 1.00 | 0.182 | 0.020 | Aurora; Fractal; SYMBIONT; Silent Sentinel |
| D - Harsher | 989 | 1.00 | 0.249 | 0.050 | Aurora; Fractal; The Phalanx; Crescent Vanguard |
| E - Gentler | 32,485 | 1.00 | 0.121 | 0.017 | Aurora; Fractal; Silent Sentinel; others |

Climate severity changes population scale and survival depth, but it does not by itself produce durable mixed refugia. Even under gentler climate, top final regions average one tribe per region.

> **Climate severity strongly determines the depth and survivability of the final crash. A gentler climate leaves more civilization behind; a harsher climate makes refugia thinner and earlier. Neither condition removes the overshoot logic.**

# Part VI - Project 1 Synthesis

Project 1 establishes the first baseline map of The Crucible. Across controlled conditions, civilization repeatedly emerges from designed strategies, scales into high population and complexity, and then collapses into agrarian refugia. The specific winner varies, but plural lineages do not persist to the final world under Project 1 settings.

| Finding | Project 1 interpretation |
|---|---|
| Civilization emerges | All main conditions can produce agrarian, industrial, and technological development in the surviving lineage. |
| Pluralism fails | Sets A and B end with one survivor in every epoch, and Set C ends with Silent Sting replacing Gradient Covenant in every run. |
| Geography matters but does not solve monopoly | The bottleneck set changes winner distribution but does not preserve coexistence. |
| Strategy matters | The duel shows repeatable differences between inherited packages; Silent Sting scales where Gradient Covenant fails. |
| The agrarian bottleneck is central | The 8,000-12,000 pulse window concentrates population, increases xeno exposure, reduces cooperation, and sets the path to dominance. |
| Fossil expansion creates the peak | Population and complexity peak in the late fossil/modern window and then collapse toward agrarian refugia. |
| Starvation dominates | After early hazard-heavy periods, starvation becomes the main counted death cause. |
| Climate is a late amplifier and filter | Harsher climate thins refugia and advances crash timing; gentler climate preserves much more population and complexity. |
| Civic identity is weak | Civic override remains too small to prevent inherited tribe identity from dominating final outcomes. |

Project 1 supplies the evidence base for later Crucible work. Project 2 separates intrinsic viability from opponent-specific competition through solo, duel, and triad tests. Project 3 asks whether LLM-designed tribes improve when given the evolutionary record. Project 4 tests abrupt shocks. The Epilogue projects post-collapse futures under longer horizons and more persistent climate-feedback structures.

**Project 1 shows a world where designed strategies can build civilization, but where civilization is not stable by default. Survival repeatedly becomes less about preserving the peak than about enduring the descent.**

# Appendix - Analysis Source Workbooks

The analysis content is derived from four Project 1 query-result workbooks. Each workbook contains the tabulated query outputs used to construct the corresponding narrative, charts, tables, and synthesis. Earlier introductory drafts and operational execution notes are treated as archival project materials rather than primary analysis sources.

| Workbook | Analysis section | Content used |
|---|---|---|
| Project1_SetA_Query_Results.xlsx | Set A - Baseline World | Baseline population, complexity, monopoly, death causes, Prisoner's Dilemma behavior, climate stress, trait signals, and late refugia. |
| Project1_SetB_Query_Results.xlsx | Set B - Bottleneck World | One-pass geography, winner diversity, transition dynamics, Prisoner's Dilemma behavior, death causes, climate filtering, and final refugia. |
| Project1_SetC_Query_Results.xlsx | Set C - Duel World | Silent Sting / Gradient Covenant duel outcomes, comparative traits, collapse timing, mortality, social behavior, and final replacement geography. |
| Project1_SetADE_Query_Results.xlsx | Sets A-D-E climate comparison | Default, harsher, and gentler climate-chaos comparison for population scale, collapse timing, complexity loss, mortality, resilience, tribe sensitivity, and refugia. |