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Ecological and Population Modeling for a Putative Relict Homo Species

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Dedicated to the memory of Dr. Jeff Meldrum and Dr. Jane Goodall

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Abstract

Ecological and population modeling provides critical tools for evaluating the potential persistence of a large-bodied, low-density hominin lineage in modern North American ecosystems. While direct physical evidence remains limited, ecological indicators—including habitat suitability, resource distribution, movement corridors, and expected density ranges—offer scientifically grounded approaches for evaluating plausibility. This paper synthesizes ecological theory, foraging models, primate behavioral ecology, and spatial habitat suitability concepts to assess environmental carrying capacity, expected densities, and behavioral adaptations consistent with low detectability. A multi-tier habitat suitability model is proposed using variables standard to conservation ecology (e.g., forest cover, ruggedness, water proximity, and human footprint). The resulting framework shows that, under conservative assumptions typical for cryptic, wide-ranging mammals, a low-density hominin population could be ecologically feasible in remote landscapes, and that evidence—if present—should cluster predictably with resource seasonality and human-

access gradients. This paper provides a quantitative foundation for future non-invasive field research and extends the Relict *Homo* paradigm developed in Papers 1 and 2.

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1. Introduction

Ecology and population biology provide essential perspectives for evaluating whether a large-bodied primate—especially a hominin—could persist into the present. Many species with low densities, broad home ranges, and cryptic behavior remain difficult to detect even under modern survey regimes, particularly in rugged or heavily forested landscapes (Hebblewhite & Merrill, 2008).

In the case of Bigfoot, ecological reasoning offers two kinds of insight:

1. **Feasibility:** Could a large omnivorous primate persist in modern North American ecosystems under plausible energetic and demographic constraints? (Aiello & Wheeler, 1995; Pontzer, 2012)
2. **Predictability:** If such a population existed, where would it be most likely to occur and where should evidence concentrate, given habitat structure, resources, and human footprint? (Scholl & Wiens, 2016)

Population modeling does not require a known census. Instead, it uses resource distributions, habitat structure, plausible home-range requirements, reproductive constraints, and landscape fragmentation to generate testable predictions. The goal of this paper is to integrate ecological theory with conservative modeling assumptions to produce a scientifically defensible framework for evaluating the ecological plausibility of a surviving relict hominin population.

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2. Ecological Requirements of Large-Bodied Primates

Large primates have predictable ecological needs, including energetics, habitat complexity, water access, and avoidance of interspecific conflict and human disturbance (Van Schaik et al., 1996).

2.1 Energetics

A hominin in the approximate range of 90–180 kg would require an omnivorous diet with access to high-caloric seasonal resources, with broad-spectrum flexibility increasing ecological resilience (Aiello & Wheeler, 1995; Pontzer, 2012). Optimal foraging theory predicts flexible switching among resource patches as availability changes seasonally (MacArthur & Pianka, 1966).

2.2 Habitat Complexity and Cover

Persistence of a cryptic large mammal is facilitated by dense vegetation for concealment, rugged terrain that limits human access, and abundant escape corridors. Habitat selection in many wide-ranging mammals reflects the combined effects of cover, ruggedness, and the human footprint (Hebblewhite & Merrill, 2008; Scholl & Wiens, 2016).

2.3 Water Proximity

Primate ecology frequently shows clustering near freshwater or riparian corridors due to drinking needs, plant diversity, and prey availability. Habitat suitability frameworks therefore treat water proximity as a core predictor variable (Scholl & Wiens, 2016).

2.4 Interspecies Competition and Human Conflict

A large hominin would face limited predation risk but substantial constraints from human presence, habitat encroachment, and seasonal resource depletion. Behavioral avoidance of high-risk areas is consistent with “risk landscape” models commonly used in wildlife management (Hebblewhite & Merrill, 2008; Ripple & Beschta, 2004).

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3. Habitat Suitability Modeling

Habitat suitability modeling combines environmental and resource layers to predict where a species is most likely to occur. Contemporary frameworks in ecology emphasize that suitability emerges from both environmental constraints and niche dynamics over time (Scholl & Wiens, 2016). Here, a three-tier suitability model is proposed for a low-density, wide-ranging omnivore operating under high human-avoidance pressure (Hebblewhite & Merrill, 2008).

3.1 Tier One: Core Habitat (Highest Suitability)

Defined by high forest cover, rugged topography, perennial water access, low human footprint, and stable seasonal productivity. Such variables align with standard habitat suitability logic used across elusive species (Scholl & Wiens, 2016). Vegetation structure and regional habitat differences should be treated explicitly (Franklin & Dyrness, 1988).

3.2 Tier Two: Seasonal Habitat

Used intermittently for seasonal foraging, migration, and dispersal. Optimal foraging models predict seasonal movement between patch types as energetic yield shifts (MacArthur & Pianka, 1966).

3.3 Tier Three: Marginal Habitat

Used rarely and typically under high-resource conditions or ecological pressure, including fragmented woodlands and edges near human activity. Such movement is consistent with the pattern that many wide-ranging species expand into marginal habitats when short-term energetic gains outweigh risk costs (Hebblewhite & Merrill, 2008).

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4. Population Density and Territory Modeling

Estimating density for an unconfirmed species necessarily relies on indirect reasoning. For wide-ranging, low-density species, models typically incorporate habitat productivity, home-range requirements, reproductive constraints, and landscape fragmentation (Brown & Maurer, 1989; Hebblewhite & Merrill, 2008).

4.1 Home-Range Estimates

Under conservative assumptions, individual home ranges for a large omnivorous primate would be expected to scale upward as habitat productivity declines. Macroecological theory predicts this inverse relation between resource density and required space (Brown & Maurer, 1989). This yields a plausible range of large territories in lower-productivity or highly disturbed regions.

4.2 Effective Population Density

Rather than presenting precise census-like numbers, this framework treats density as an order-of-magnitude parameter dependent on tiered habitat suitability. In core habitat, densities could be modeled at very low levels consistent with cryptic persistence; in seasonal and marginal habitats, presence would be intermittent and detection probability highly variable (Hebblewhite & Merrill, 2008).

(Editorial note: highly specific state/province totals were removed because they imply precision not supported by cited sources.)

4.3 Detectability Paradox

Low density, high mobility, rugged habitat, and strong human avoidance can yield extremely low encounter probabilities even when a population is present. This is a standard problem in wildlife monitoring and is one reason habitat modeling and human-footprint integration are used to guide survey design (Hebblewhite & Merrill, 2008).

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5. Resource Mapping and Seasonal Strategies

Ecological mapping allows reconstruction of probable seasonal strategies for a low-density omnivorous population.

5.1 Seasonal Resource Peaks

High-calorie resources are expected to structure annual movement: spring pulses (including ungulate vulnerability), summer berries and fish, autumn mast productivity, and winter reliance on riparian microclimates and scavenging. This pattern is consistent with broad-spectrum foraging logic and patch switching under seasonality (MacArthur & Pianka, 1966; Pontzer, 2012).

5.2 Keystone Resource Triad

Fish, mast crops, and ungulates represent a plausible triad of high-yield resources in many North American ecosystems. The argument here is ecological rather than evidentiary: if a large omnivorous primate existed at low density, these resources would be expected to shape movement and seasonal concentration (Pontzer, 2012).

5.3 Human Avoidance and Temporal Shifts

Resource modeling must be coupled to risk avoidance. Wildlife–human relationship models predict temporal shifts (including nocturnality or crepuscular activity) and spatial avoidance of roads, settlements, and frequently used trails (Hebblewhite & Merrill, 2008).

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6. Ecological Feasibility of a Relict Hominin

Ecological feasibility rests on four pillars: biomass availability, habitat refuge, behavioral crypticity, and survivorship of archaic *Homo* ecological flexibility.

6.1 Biomass and Carrying Capacity

Many North American ecosystems support large omnivores and high ungulate biomass, indicating that the energy base exists for low-density large mammals in general. Energetic constraints and diet breadth strongly shape feasibility (Aiello & Wheeler, 1995; Pontzer, 2012).

6.2 Habitat Refuge

Roadless areas, mountainous terrain, and large forest blocks reduce access and increase detectability challenges. Regional vegetation structure and productivity influence where refugia are most plausible (Franklin & Dyrness, 1988).

6.3 Behavioral Crypticity

Concealment, avoidance, and risk-sensitive movement are standard drivers of low detectability in wildlife systems, particularly near human activity gradients (Hebblewhite & Merrill, 2008; Ripple & Beschta, 2004).

6.4 Survivorship of Archaic *Homo* Traits

Archaic hominins are inferred to have had ecological flexibility and low-density population structures shaped by resource distribution and mobility constraints. Such traits are compatible with cryptic persistence in remote landscapes, in principle (Pontzer, 2012).

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7. Conclusions and Scientific Implications

Integrating ecology, foraging theory, and habitat suitability logic indicates that a relict *Homo* population is **ecologically plausible in principle** under restrictive conditions: large, contiguous habitat; low human footprint; seasonal resource availability; and strong behavioral avoidance of people. The value of this framework is not to claim confirmation, but to establish testable expectations about where signs—if present—should concentrate and how seasonal movement should track resource pulses and human-access gradients (Hebblewhite & Merrill, 2008; Scholl & Wiens, 2016).

This paper establishes a quantitative foundation for future research, including predictive survey models, ecological monitoring, and seasonal habitat investigations anchored in standard conservation and movement ecology.

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