Can AI Revolutionize the Huckleberry Market?

Report by:
Anastasia Chapel
Marta Pérez
Spencer Sveda Wood
Omar Harradi
Samuel Ginzburg
Guillermo Medina Moltó

Mentor:
Julius Von Davier

Academic Integrity Declaration:
We hereby certify that this report is our own original work, completed independently, except where sources are cited and acknowledged.

Part One: Exploration of the Huckleberry and our General Goals for this Project

I. Executive Summary

Wild huckleberries sit at a unique crossroads of ecology, culture, and commerce. Prized by Indigenous communities as a sacred First Food and commanding prices of $50–80 per kilogram on niche markets, the mountain huckleberry (*Vaccinium membranaceum*) remains almost entirely wild-harvested because its growth hinges on a delicate mix of high-elevation climate, acidic soils, and even periodic fire disturbance. Yet those very dependencies also make huckleberry supply increasingly erratic as climate patterns shift, frustrating foragers, land managers, and businesses alike. Through our work, we aim to leverage technological advancements to better understand and capitalize on a highly demand-driven, yet largely unstructured and uncommercialized industry.

This report introduces an AI-driven species-distribution model that turns four-plus decades of high-resolution climate and habitat data into maps of where huckleberries can thrive today—and potentially in the future, where changing conditions are likely to push them next. Built in partnership with Microsoft's GRIDMET dataset, the model captures non-linear links among temperature, moisture, elevation, and fire indices to deliver forecasts at the scale decision-makers need.

From that analytical core arise two complementary business paths. A consumer app, "Find My Huckleberry," translates predictions into simple heat maps for recreational foragers, while a B2B intelligence service provides deeper land-use insights for cooperatives, tribal nations, and conservation agencies. Because the underlying pipeline is crop-agnostic, its reach extends beyond berries: by swapping in crop-specific growth data, the same framework can help investors spot the next almond belt or emerging viticultural zones before land values catch up. In short, we begin with an elusive fruit to prove the concept, but our horizon is far broader—leveraging climate intelligence to guide resilient agriculture and unlock new asset value in a warming world.

II. Significance of the Huckleberry

A Sacred First Food

Huckleberries are more than just a wild fruit, they are a sacred first food for many Indigenous nations across the Pacific Northwest, including the Yakama, Nez Perce, Confederated Salish and Kootenai, Coeur d'Alene, and others. Known in some tribal languages as *wíwnu*, these berries are deeply embedded into cultural ceremonies, oral traditions, and seasonal food systems.

For generations, Indigenous families have journeyed into mountain meadows each summer to harvest huckleberries together: gathering, drying, preserving, and sharing them as both sustenance and ceremony. As Elaine, member of the Yakama Nation describes, these foraging trips are spiritual experiences passed down through family lineages, reaffirming connections to both land and identity (OPB, 2025).

Historically, tribes maintained huckleberry fields with controlled burns, clearing trees and stimulating berry production. This land management reflects a deep understanding of ecological balance. Today, those practices are being revived through tribal-led restoration projects with U.S. Forest Service partners, to help restore areas affected by fire suppression and huckleberry habitat loss.

However, rising commercial demand has created tensions. In 2024, the U.S. Forest Service issued over 900 commercial permits for huckleberry picking on public lands in one forest alone, a volume that tribal members argue threatens both the ecological sustainability and cultural accessibility of this sacred berry (OPB, 2025). There are increasing calls for co-management, regulation, and respectful harvesting, to ensure tribal rights and long-term habitat health are prioritized.

Idaho: From State Fruit to Regional Symbol

In Idaho, the huckleberry has become a powerful symbol of state identity and natural heritage. Declared the official state fruit in 2000, the huckleberry now represents much more than a crop, it embodies Idaho's rugged landscapes, outdoor culture, and pride in wild foods.

Throughout the state, the huckleberry is woven into community events (like the Donnelly Huckleberry Festival), tourism branding, and food products from jams and syrups to milkshakes and confections. Locals often joke that "you're not really from Idaho until you've picked huckleberries."

A High-Value, Underdeveloped Market

Despite its popularity and cultural prestige, the huckleberry market remains largely uncommercialized. Most huckleberries are still hand-picked in the wild because the species is notoriously difficult to grow on farms. It requires very specific environmental conditions and doesn't respond well to conventional agricultural methods. As a result of this scarcity, combined with rising demand, huckleberry prices can reach $11–$50 per pound, making them one of the most expensive wild-harvested berries in North America. (Global Market Insights, 2024). This unique combination of high value, cultural significance, and supply limitations makes the huckleberry market ripe for innovation.

Market Size and Growth Projections

In parallel with its cultural relevance, the global huckleberry market is undergoing significant economic expansion. Valued at $1.01 billion in 2023, it is projected to grow to $1.88 billion by 2032, representing a compound annual growth rate (CAGR) of 7.1% from 2024 to 2032. This robust growth trajectory is driven by rising consumer demand for natural, wild-sourced, and antioxidant-rich products across a diverse range of sectors: from food and beverage to nutraceuticals, cosmetics, and functional health products.

In North America alone, the market accounts for over $370 million, with especially high activity in the Pacific Northwest, as huckleberries are increasingly featured in a range of high-value applications:

- Specialty foods and craft products (e.g., huckleberry jams, syrups, confections)
- Health and wellness supplements (due to high anthocyanin and antioxidant content)
- Cosmetic and skincare applications (leveraging natural pigmentation and anti-aging properties)

According to market segmentation estimates:

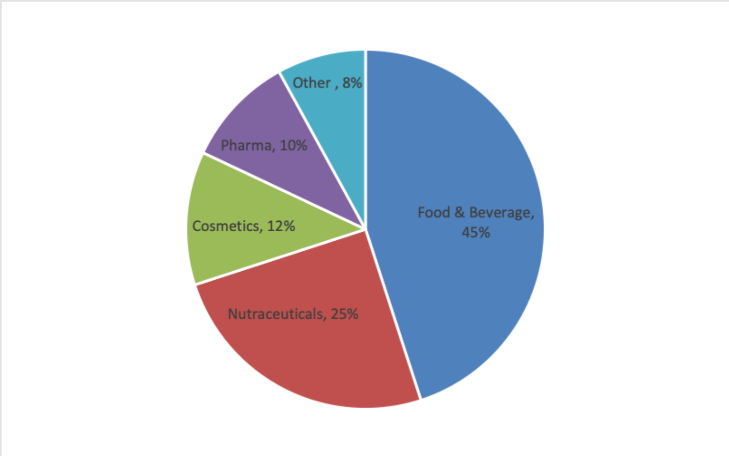


Figure 1. Estimated market segmentation of the global huckleberry market. Source: Own elaboration based on data from Global Market Insights (2024).

What distinguishes huckleberries in this rapidly growing space is their rarity. Because they are not yet widely cultivated and depend on wild ecosystems for propagation, supply cannot simply scale to meet demand. This scarcity keeps prices high and fuels competition for access.

III. The Core Challenge

The huckleberry (*Vaccinium membranaceum*) stands out as a rare and highly prized wild berry, known for its distinctive flavor and nutritional value. However, it presents significant challenges from a commercial standpoint. With a seven-year growth cycle and a natural resistance to cultivation, huckleberries grow almost exclusively in the wild. Their development is highly dependent on specific environmental conditions - such as elevation, soil type, and microclimate - which are extremely difficult to replicate in agricultural systems.

These limitations are further exacerbated by climate change, which continues to disrupt historical growth patterns and render traditional harvesting knowledge increasingly unreliable. As a result, there is currently a lack of scalable, data-driven methods for predicting huckleberry availability and planning sustainable sourcing. Addressing this gap represents a key opportunity for innovation, leveraging technology and ecological data to unlock the commercial potential of this exceptional species while supporting long-term environmental stewardship.

IV. The Biological Backbone

North America is home to over a dozen huckleberry species, yet only a few play meaningful roles in the commercial and cultural landscape. Two species dominate both the wild harvest and market relevance: Vaccinium membranaceum (black or mountain huckleberry) and Vaccinium ovatum (evergreen huckleberry). Others, like *Gaylussacia baccata* (eastern black huckleberry), are more localized and contribute minimally to broader economic or ecological systems due to limited range, lower yields, or lack of cultural significance.

Species	Region	Commercial Use	Unique Role
Vaccinium membranaceum	Pacific Northwest & Rockies	Dominant wild-harvest species; used in nearly all high-value products	Culturally sacred; post-fire regenerator
Vaccinium ovatum	Pacific Coast (CA–BC)	Minor food and floral industry (cut foliage)	Shade-tolerant evergreen
Vaccinium deliciosum	Cascades, Sierra Nevada	Occasionally foraged; sweeter berries	Alpine habitat niche
Gaylussacia baccata	Appalachians, Great Lakes	Limited local use; low commercial value	Different genus, similar name

Figure 2. Species Snapshot. Source: Own elaboration based on data USDA Plant Guide and USDA Forest Service FEIS , and Flora of North America.

The Commercial and Ecological Star: Vaccinium membranaceum

Of all native species, *Vaccinium membranaceum* is by far the most commercially harvested and culturally significant in the western United States. It thrives in high-elevation conifer forests across Montana, Idaho, Washington, Oregon, and parts of British Columbia, and is the principal source for nearly all high-value huckleberry products. This species has several unique biological characteristics that contribute to its dominance across western huckleberry ecosystems:

- **Growth**: Shrub up to 6 feet tall; spreads via underground rhizomes
- **Fruiting window**: July through August (timing varies by elevation)

The dominance of *V. membranaceum* is not incidental, it is the result of millennia of ecological adaptation and cultural land management. This species grow especially well in areas that have been disturbed by wildfire or logging, thanks to its ability to regrow from underground roots. Indigenous communities have long used controlled burning to encourage huckleberry growth, creating berry-rich habitats that still exist today.

Because it is rarely cultivated and difficult to transplant, naturally growing berry patches remain the only source of nearly all commercial and artisanal products: from frozen berries and jam to syrups, confections, and beverages. This has created a paradoxical situation: *V. membranaceum* is one of the most in-demand wild fruits in North America, yet the supply chain remains informal, decentralized, and ecologically sensitive.

V. Implications for Market Innovation

Understanding the species breakdown is essential for any intervention in the huckleberry value chain. While *V. ovatum*and *V. deliciosum* hold niche potential, only *V. membranaceum* presents a viable case for regional-scale optimization using predictive analytics.

Its wide range, strong cultural protections, and ecological dependency make it the ideal candidate for tools that help:

- Landowners identify productive stands
- Tribal nations monitor habitat change
- Businesses predict yield potential in a warming climate

In short, *V. membranaceum* is not only the species with the greatest economic leverage**,** but also the one with the most urgent need for data-informed conservation and management, positioning it at the core of any huckleberry sustainability and commercialization strategy.

Part Two: Market Exploration

I. Harvesting and Regulatory Landscape

As we have addressed, huckleberries are predominantly wild-harvested due to cultivation challenges. In 2024, the U.S. Forest Service issued over 900 commercial permits for huckleberry picking in the Gifford Pinchot National Forest, where commercial pickers harvest between 50,000 to 70,000 gallons of berries annually (Gorge County Media).

However, concerns over sustainability and Indigenous rights have led to regulatory changes. In 2025, the Forest Service temporarily halted commercial huckleberry picking in the Gifford Pinchot National Forest to address these issues.

While the 2025 suspension of commercial huckleberry harvesting in the Gifford Pinchot National Forest may seem like a constraint, it actually underscores the need for smarter, more sustainable approaches to managing wild huckleberry resources. These regulatory shifts highlight the growing tension between ecological sustainability, commercial demand, and Indigenous rights: the exact space predictive tools are designed to navigate. These permit dynamics and increasing regulatory scrutiny make the economics of huckleberry harvesting, both in pricing and profitability, more relevant than ever.

II. Market Economics and Key Players

Economic Value and Pricing

Due to their scarcity and high demand, huckleberries command premium prices:

- $11 to $50 per pound, depending on quality and market. (Cascade Forest Conservancy, 2024; High Country News, 2023)
- · Value-Added Products: Products like jams, syrups, and confections further increase profitability, with jam jars selling for $8–$15 each.
- · Export/Import Prices: While most huckleberries are sold domestically, global export prices offer a benchmark for value and illustrate broader market pressures. In 2023, export/import prices ranged from $10.02 to $16.77 per kg, stabilizing around $10/kg in 2024 (Tridge, 2024).

This high market value underscores the economic potential of sustainable harvesting and supply chain optimization.

Key Market Players

The wild huckleberry supply chain is composed primarily of small-to-medium regional businesses that buy from foragers and produce high-value products such as jams, syrups, frozen berries, and confections. Prominent companies in the huckleberry market include:

Company	**Location**	**Role**	**Annual Revenue**
Huckleberry Haven Inc.	Montana	Major buyer and producer of jams, syrups, candies; widely distributed in Northwest gift shops.	$1.15 million
Northwest Wild Foods	Washington	Buys wild berries (especially from Mount St. Helens and Idaho); offers frozen berries nationwide.	$334,774

Larchwood Farms	Montana & Oregon	Family-run business specializing in wild berry jams and syrups; markets "wilderness-sourced" products.	$569,838
Huckleberry Patch	Montana	Tourism-focused brand offering jams, gifts, and desserts; operates both physical and online retail.	$540,000
Wyman's of Maine	Maine	Known for wild blueberries but also markets huckleberries and related products in frozen packs.	$70 million
Hidden Springs Maple	Vermont	Offers huckleberry syrup as part of a broader artisanal syrup and jam portfolio.	$500,000

Figure 3. Key Market Players. Source: Own elaboration based on data from High Country News (2025). Revenue figures are approximate and based on publicly available data

While these companies anchor the supply chain, the strength of the market lies in the consistent willingness of both individuals and institutions to pay for access to huckleberries, and that's where the opportunity becomes clear.

Buyer Behavior and Willingness to Pay

The combination of scarcity, cultural appeal, and price elasticity makes huckleberry harvesting a highly profitable activity. According to the U.S. Forest Service, experienced pickers can collect 25 to 75 pounds of huckleberries per day, depending on terrain and berry density. Over a season, this equates to hundreds of pounds per forager. At conservative retail values (e.g., $20/lb), a forager could earn $500 to $1,500 per day, or $5,000 to $15,000 over a modest 10-day season. This makes wild huckleberry foraging one of the most lucrative seasonal harvests in North America for small-scale participants. For these users, having information about huckleberry locations is not just desirable, but financially advantageous. Even a modest monthly subscription (e.g., $10-$15/month) pays for itself if a user finds just one good huckleberry area during the season. Beyond profitability, we cannot forget that many foragers are also driven by cultural or recreational motives, particularly in huckleberry-rich states like Idaho, Montana, and Washington.

Landowners, land managers, government conservation agencies, and Indigenous nations, as well as commercial buyers such as berry processors, rely heavily on stable wild harvests. These stakeholders manage or depend on wild huckleberry production for economic, cultural, or ecological purposes, yet all face the same core issue: unpredictability.

Predictive analytics platforms empower these clients to assess growing potential based on data-driven factors like microclimate, elevation, and soil, without requiring any alteration to the wild landscape. For commercial operators, even a modest improvement in harvest consistency or volume justifies contract prices ranging from $5,000 to $50,000, depending on scale and services provided.

This is particularly relevant as market dynamics shift: according to Tridge, global huckleberry export and import prices fell from $10.02–$16.77 per kg in 2023 to just $10/kg in 2024. While huckleberries remain a premium product, global pricing pressures have begun to squeeze processor margins, making it more critical than ever to invest strategically in high-yield zones. In this context, clients avoiding trial-and-error and investing in smarter land use and yield prediction tools is no longer optional, it is necessary to remain competitive and profitable in a more price-sensitive environment.

Our Door Into the Market - Project Goals

In response to the challenges and opportunities posed by the huckleberry's unique ecological requirements, this project aims to forecast suitable habitats, which with forecasted weather patterns, can in turn lead to future habitat predictions. Whereas today we present a model that pinpoints the right climate for huckleberry growth and effectively converts the finding into a probability of finding huckleberries in a predetermined location, the long-term objective is to enable data-driven forecasting of wild huckleberry availability future climate scenarios by combining our model with a predictive climate model. Leveraging Microsoft's GRIDMET climate dataset along with complementary environmental datasets, the ML model will integrate key variables such as temperature, precipitation, elevation, and soil characteristics to generate predictive habitat maps. These maps will indicate where wild huckleberries are most likely to grow, now and under future climate scenarios, by identifying optimal environmental conditions across both time and geography. This spatial forecasting capability will offer a powerful tool for visualizing habitat shifts, guiding sustainable harvesting strategies, and supporting data-driven decision-making across the supply chain.

In the long term, this approach opens the door to broader applications across other climate-sensitive wild crops, while also positioning the project for partnership with research institutions, conservation bodies, and climate-tech investors.

III. Background research on huckleberries

Attempts at Mass Cultivation and Commercialization

Huckleberries have long been regarded as a "mountain goldmine", thanks to their high market value and rarity. However, efforts to cultivate *Vaccinium membranaceum* outside of their native environment have largely failed. As previously discussed, wild huckleberries require a complex combination of factors, cool temperatures, moist conditions, acidic soils, forest canopy cover, and microbial symbiosis, that are extremely difficult to replicate in conventional agricultural settings.

Microbial Dependencies and Environmental Constraints

Studies from the University of Idaho have identified critical barriers to cultivation. For example, researchers have noted that "there's some sort of microbial connection that we miss when we try to grow them outside of a forest." Indeed, huckleberries evolved in close symbiosis with soil fungi and microorganisms commonly found in undisturbed coniferous ecosystems. The ideal "growing zone" for huckleberries mimics a cool, moist, acidic mountain forest, conditions that are rarely, if ever, found on lowland farms.

High Mortality and Slow Growth

Even when the correct soil is replicated, growers face significant challenges:

- High seedling mortality and slow maturation rates
- Transplant failures due to the plant's deep and delicate root system (reaching up to 1 meter)
- Sensitivity to transplant shock, poor soil chemistry, or lack of winter chill
- Need for years of careful soil and canopy management to establish a single plant

Despite small-scale successes in backyard or experimental plots, *Vaccinium membranaceum* has not been commercially cultivated in any conventional farm system to date.

Low Yields and Economic Barriers

Even if cultivation succeeds, productivity remains a key obstacle. Compared to its relative, the cultivated blueberry, huckleberries yield very few berries per plant. Without selective breeding to improve yield, commercial-scale production is economically unviable, as current output levels fall far below industry expectations.

Past Efforts and Their Limitations

Attempts to overcome these issues have included:

- Dr. Daniel Barney's hybridization research, which explored crossing huckleberries with more adaptable berry varieties. However, breeding gains have been slow, and no commercial cultivar has emerged.
- Field studies and transplant trials, which have largely struggled with environmental mismatch and plant loss.
- Forest farming, considered the most promising approach to date. This method involves planting huckleberry seedlings within existing forest stands, mimicking natural conditions by:
    - Mulching with pine needles or woody debris
    - Avoiding over-clearing to retain a mixed canopy
    - Allowing for natural microbial activity to support plant development

Even so, success rates remain low and largely experimental.

Why Ecological Modeling Is Essential

Given the biological complexity and environmental sensitivity of wild huckleberries, traditional agricultural approaches alone are insufficient. A predictive, data-driven approach is necessary to:

- Identify ecologically suitable habitats for natural or assisted growth
- Predict how climate change may shift viable zones over time
- Inform sustainable forest management practices that can support wild harvesting

These insights will not only guide conservation and harvesting but also support future efforts in forest-based cultivation and habitat restoration.

In summary, cultivation of black huckleberry remains experimental, pursued by a handful of researchers and passionate growers. Wild harvesting ("wildcrafting") continues to be the primary source of supply. Ongoing projects, such as hybridization with blueberry or selection of high-yielding wild clones, offer hope for future cultivation potential. However, until such breakthroughs materialize, the most effective agronomic strategy may be habitat management: thinning timber, applying controlled burns, or encouraging natural regrowth to boost wild yields.

This approach blurs the line between agriculture and forest stewardship, highlighting that the future of huckleberry production may lie in a partnership between traditional ecological knowledge and modern scientific modeling.

IV. Supply Chain and Business Model

Current Supply Chain Structure: From Mountain to Market

The wild huckleberry supply chain follows a multi-stage path with distinct actors, many of whom operate informally or seasonally:

Stage 1: Foraging (Pickers)

- Actors: Local families, seasonal laborers, Native American gatherers, and independent "mountain pickers."
- Activity: Manual harvesting by hand or rake during peak season (July–September).

- Logistics: Remote mountain locations, limited infrastructure; berries often transported daily to collection points.

Stage 2: Aggregation (Field Buyers / Brokers)

- Actors: Mobile buyers who set up roadside tents or operate from rural towns.
- Function: Buy berries directly from foragers, enforce quality standards, clean/sort berries, and freeze them.
- Mobility: Follow the harvest by region, moving between elevation bands or states.
- Connections: May sell to distributors, processors, or local businesses.

Stage 3: Distribution (Wholesalers / Consolidators)

- Actors: Companies such as Mikuni Wild Harvest, Northwest Wild Foods, and Hannah & Perry Inc.
- Function: Purchase large volumes from field buyers, manage cold storage, packaging, and national shipping.
- Clients: Chefs, retailers, processors, and online customers.
- Channel type: B2B distribution with premium pricing; some operate direct-to-consumer online.

Stage 4: Processing (Value-Added Producers)

- Actors: Huckleberry Haven, Wildbeary, Wild Huckleberry Magic, and smaller food artisans.
- Products: Jams, syrups, sauces, candies, beverages, concentrates.
- Sourcing: Purchase frozen berries or concentrate from distributors or directly from foragers/brokers.

Stage 5: Retail & Foodservice

- Channels:
    - Fresh/Frozen Sales: Farmers' markets, gift shops, online orders.
    - Processed Products: Gourmet stores, tourist shops, national park stores.
    - Foodservice: Restaurants, breweries, distilleries, and hotels using huckleberries in seasonal dishes, cocktails, or desserts.

Economics and Value Capture

The value of huckleberries increases significantly as they move through the supply chain:
Price Escalation (Typical per lb, 2022–2024 data):

Actor	Average Price Received	% of Final Retail Price (e.g., $25/lb)
Harvester (Picker)	$5.50–$8.00	22–32%
Field Buyer / Broker	~$6.00–$12.00	~2–15% (small markup or commission)
Distributor / Wholesaler	$15.00–$40.00	30–60%
Retailer (if separate)	Final price = $25–$40	Remaining share (10–30%)

Part Three: Business Opportunities

I. Market Opportunity & Business Model - Narrative update

Recalibrating Our Go-to-Market

Early drafts of this report described a "one business, two equal models" strategy: a paid consumer app for weekend foragers and a bespoke analytics service for institutions. Field interviews and financial modelling now show that the structured money in the huckleberry economy sits squarely with landholders and public agencies, not individual pickers. We therefore pivot the consumer tool into a data-gathering sidecar and focus the core business on **(1) private-land intelligence contracts** and **(2) government-plus-conservation programmes**. This shift aligns with the report's own revenue sensitivity analysis, which found that even modest improvements in wild yield justify fees of $5,000 – $50,000 per engagement for commercial operators and that federal grants such as USDA-CIG routinely land in the $100 k – $500 k range .

Private-Land Intelligence: Turning "Unfarmable" into Investable

Two-thirds of U.S. acreage is privately owned, yet most productive huckleberry habitat remains on public land. Our species-distribution engine converts forty-five years of GRIDMET climate, elevation and canopy data into 4-km habitat-suitability rasters and site-specific management blueprints that show exactly where thinning, understory burns or micro-irrigation will lift berry density . A 95 % accuracy / 0.94 F1 random-forest model underpins these outputs, giving landowners the confidence to invest in "wild farming" improvements rather than gambling on conventional cultivation .

At retail prices of $11–$50 lb, a five-per-cent yield bump on a 500-acre holding repays a mid-tier contract within two seasons. Because the same pipeline can appraise almonds or viticulture simply by swapping the training data, this service positions clients ahead of broader climate-driven land-use shifts.

Government & Conservation Partnerships: Funding Stewardship at Scale

Federal and state agencies, together with tribal resource offices, urgently need spatial foresight to balance cultural access, ecological health and commercial permits. Our platform supplies region-wide suitability mosaics plus a quarterly yield-outlook API for quota setting and restoration planning. Programs such as NRCS Conservation Innovation Grants and Energy Savings Performance Contracts routinely back data-driven habitat projects at six-figure levels, with 50 % cost-share clauses that our landowner engagements can satisfy in kind .

Agencies must show measurable ecological ROI and compliance with co-management commitments; the same spatial tiles that guide private ROI also document conservation benefits, creating a single evidentiary backbone for multiple funding streams.

"Find My Huckleberry" – The Support Act

The consumer heat-map app remains live but repositions as a freemium community platform. Paid features (offline maps, season alerts) at ≈ $12 month merely cover infrastructure, yet every geotagged sighting it crowdsources feeds back into model retraining, sharpening predictions for our paying B2B clients. In short, the app is now the flywheel, not the profit centre.

Flywheel Economics and Future Lift

1. **Data loop.** Crowd points enhance model recall → better B2B accuracy → more land under contract → more public trust and app usage.

2. **Contract economics.** Commercial fees finance the fixed cost of maintaining the climate-data pipeline; grant dollars underwrite regional expansions.

3. **Crop-agnostic runway.** Because the inference stack is species-agnostic, each new specialty crop—from morel mushrooms to climate-migrating almonds—drops into an already amortised workflow, multiplying total addressable market without duplicating R&D .

Strategic Fit with Report Objectives

This pivot fulfills the report's stated aim of "bringing structure to a niche, unstructured market" while directly answering its call for scalable, data-driven solutions to climate volatility . By anchoring revenue in land-management contracts and grant-funded stewardship—yet keeping the consumer interface alive as a perpetual data source—we transform an elusive berry into the launchpad for a climate-intelligence SaaS-plus-services firm poised to serve the broader frontier of climate-sensitive agriculture.

II. Financial Projections

Client Market

In 2024, the U.S. Forest Service issued over 900 commercial huckleberry harvesting permits, and that was just in a single forest. Given the fruit's popularity in states like Montana, Idaho, Washington, and Oregon, and the fact that these permits are issued across multiple forests, we conservatively estimated the following:

900 permits × 50 similar forests nationwide ≈ 45,000 commercial permit holders

Adding non-commercial foragers, we estimate the total number of serious huckleberry foragers in the U.S. could exceed 60,000 people.

Revenue Projections

Based on this potential market:

- We assume 500 paid subscribers in Year 1 for "*Find My Huckleberry*" (less than 1% of the total market)
- Subscribers grow ~30% annually through marketing, word-of-mouth, and proof of value
- Price per user starts at $144/year ($12/month) and increases slightly each year

Regarding the Wild Crop Intelligence Service, we estimate 6 commercial contracts in Year 1 (e.g. berry processors, landowners), increasing to 15 by Year 5. Each contract is valued at $15,000.

Also for this same product line, our project is supported by a $300,000 per year contract from the USDA's Conservation Innovation Grants (CIG) program, which will run for five years. Each year, the USDA provides $300,000 in funding to help us build and expand our project. As part of the program, we are required to match this amount with $300,000 of our own contributions and internal resources. In total, the project will receive $1.5 million from the USDA, matched by $1.5 million from us, resulting in a combined project budget of $3 million over five years. Based on USDA CIG award history, we conservatively model a $300,000/year contract to fund our huckleberry forecasting platform. This amount aligns with average CIG award levels ($250K–$500K), and our project directly supports USDA goals in sustainable land use, climate resilience, and native species management. (USDA NRCS, 2025)

Total Revenue **$2.959.812**

Total Revenue	Year 1	Year2	Year 3	Year 4	Year 5
B2B + B2C	$462.000	$513.600	$576.750	$651.288	$756.174

B2C **$694.812**

Year	Year 1	Year2	Year 3	Year 4	Year 5
Subcribers	500	650	845	1098	1427
Pirce/User/Year	$144	$144	$150	$156	$162
Total Revenue	$72.000	$93.600	$126.750	$171.288	$231.174

B2B **$765.000**

Year	Year 1	Year2	Year 3	Year 4	Year 5
Contracts	6	8	10	12	15
Price/Contract	15000	15000	15000	15000	15000
Total Revenue	$90.000	$120.000	$150.000	$180.000	$225.000

Government **$1.500.000**

Year	Year 1	Year2	Year 3	Year 4	Year 5
Grants	1	1	1	1	1
Contract Value	$300.000	$300.000	$300.000	$300.000	$300.000
Revenue	$300.000	$300.000	$300.000	$300.000	$300.000

Expenses

In the "Expenses" sheet, we model costs in 4 categories (not including data acquisition since we work with a free API):

- Platform maintenance
- Staff salaries
- Marketing
- Legal/administrative

Below there is a breakdown of our expenses, which start at realistic base values based on what is proposed by the USDA guidelines, and increase by 10% per year to reflect business growth:

Expense Category	Year 1	Year2	Year 3	Year 4	Year 5
Platform mainteinance	$20.000	$22.000	$24.200	$26.620	$29.282
Staff salaries (data scientist, developer, support)	$210.000	$231.000	$254.100	$279.510	$307.461
Marketing and outreach	$50.000	$55.000	$60.500	$66.550	$73.205
Legal/admin/overhead	$25.000	$27.500	$30.250	$33.275	$36.603
Total	**$305.000**	**$335.500**	**$369.050**	**$405.955**	**$446.551**

5-Year Projection Sheet

Total Revenue	Year 1	Year2	Year 3	Year 4	Year 5
Revenue	$462.000	$513.600	$576.750	$651.288	$756.174
Expenses (self funds)	$305.000	$335.500	$369.050	$405.955	$446.551
Net Profit	**$157.000**	**$178.100**	**$207.700**	**$245.333**	**$309.624**
Cumulative Profit	$157.000	$335.100	$542.800	$788.133	$1.097.757
ROI	**51,48%**	**53,08%**	**56,28%**	**60,43%**	**69,34%**

The table above presents a 5-year financial outlook for our huckleberry forecasting platform, highlighting revenue growth, profitability, and return on investment. Annual revenues increased from $462,000 in Year 1 to over $756,000 by Year 5, as we saw earlier, driven by both subscription income and B2B habitat prediction contracts, leaving positive net profit for all periods.

Expenses reflect the self-funded portion of the project, which are internal resources needed to fulfil the USDA's requirement for a 50% non-federal cost share under the CIG program. Since CIG grant operates as a performance-based contract, ROI is calculated using the self-funded expenses as the denominator, to evaluate how efficiently our own contributions generate profit. Net profit increases steadily over time, and ROI grows from 51.48% in Year 1 to 69.34% in Year 5.

Recognizing the constraints of relying solely on huckleberry-based revenue, we are broadening the platform's scope to support additional high-value trending crops, a key step toward unlocking our full potential to achieve commercial sustainability and higher profits.

Part Four: Exploring Our Data and Building Our Model

I. Huckleberry Patterns - What's Already Known

Geographic and Climatic Range

Huckleberries are native to the western United States, thriving in cool, moist mountain environments. Their natural distribution is largely confined to high-elevation areas such as subalpine slopes and coniferous forests. These regions generally align with USDA hardiness zones 4 to 7, areas characterized by cold winters and mild summers.

Elevation

The species requires higher elevation sites to thrive, with an estimated growing range between 2,000 and 11,000 feet (~600 to 3,350 meters). Experts identify the lower elevation threshold for *V. membranaceum* at 2,500 to 3,000 feet (~750–900 meters), below which temperatures are often too warm for healthy development.

Soil Requirements

The species depends on very specific soil conditions:

- pH: Acidic soils with a pH of 4.5 to 5.5, similar to those preferred by blueberries.
- Drainage: Well-drained soils, typically sandy or rocky, are essential to prevent water retention.
- Organic matter: Soils must be rich in humus, supporting both moisture retention and nutrient availability.
- Microbial symbiosis: Huckleberries are thought to rely on symbiotic relationships with native soil microbes, especially ericoid mycorrhizal fungi, which help facilitate nutrient uptake. These relationships are unique to conifer forest ecosystems and are difficult to replicate artificially.

Light and Forest Canopy

Huckleberries prefer partial shade conditions rather than full sun or dense canopy. Ideal environments include north-facing slopes or areas beneath scattered conifer trees, which provide a balance of sunlight and cover, mimicking the species' natural forest habitat.

Role of Wildfire

Wildfires play a crucial ecological role in supporting huckleberry regeneration. By reducing overstory canopy, fires create open-canopy conditions that improve the light-to-shade ratio, fostering new growth and maintaining healthy colonies. These periodic disturbances help preserve the microenvironments huckleberries need to thrive.

Growth Patterns and Climate Sensitivity

Huckleberries grow in dense colonies, with multiple shrubs clustering in favorable microhabitats rather than dispersing broadly. They are also highly sensitive to year-to-year climate variation, and long-term climate change is expected to significantly impact their natural range. These factors make traditional forecasting unreliable and underscore the need for data-driven predictive models to guide harvesting, conservation, and potential commercialization strategies.

II. Our Innovative Approach: AI-Powered Forecasting

GitHub Repository

https://github.com/BOYSABIO/Huckleberry-Habitat-Suitability-Model

What Sets Our Approach Apart

The challenge of modeling huckleberry distribution, given the species' rare ecological niche, resistance to cultivation, and strong climate dependencies, demands more than a standard analytical solution. Our project innovates by blending comprehensive environmental coverage, ecological insight, and cutting-edge AI techniques into a unified predictive system. It not only forecasts where huckleberries grow today but also, with predicted variables, has the potential to anticipate where they could thrive tomorrow under changing environmental conditions.

Unprecedented Data Coverage: Modeling Long-Term, Real-World Dynamics

At the core of our model is Microsoft's GRIDMET dataset, which provides 45+ years of daily gridded climate variables, including precipitation, humidity, temperature, solar radiation, and vapor pressure deficit, at a high 4km resolution. This time span is essential for several reasons:

- Full Growth Cycle Representation: Huckleberries follow a multi-year growth and regeneration cycle, often taking up to seven years from sprouting to full fruit production. Short-term or static datasets are blind to these long-lag effects.
- Seasonal and Temporal Signals: The long-term coverage allows us to extract rolling climate metrics, and encode interannual patterns such as drought cycles, late frosts, and heatwave timing, each of which can significantly affect berry development.
- Capturing Climate Memory and Projecting Forward: By training our model on these historical climate patterns, we can better understand how past conditions have shaped present huckleberry suitability. Crucially, with access to current and forecasted climate data, our approach dynamically adapts, enabling robust projections of habitat suitability into the future—forecasting not just based on what has been, but on what is likely to come.

By combining this climate data with static variables such as elevation, soil pH, and seasonal encoding, we create a dataset that's both rich in breadth and fine-grained in resolution.

Elevation-Driven Microclimates: A Core Ecological Driver

Rather than relying on simplistic or binary ecological markers like fire history, our model focuses on fine-scale environmental gradients, especially elevation, as the foundation of habitat prediction for Vaccinium membranaceum.

Huckleberries are known to thrive in high-elevation zones where temperature, soil moisture, and snowpack retention create unique microclimates not easily replicated at lower altitudes. Our approach elevates this nuance from an observational insight into a quantitative modeling asset.

- **Elevation as a Proxy for Complex Environmental Interactions**: Elevation isn't just a physical measure, it serves as a stand-in for a range of other difficult-to-measure ecological processes, such as:
  - Shorter growing seasons
  - Delayed snowmelt and longer moisture retention
  - Increased solar exposure above the tree line
- **Integration with High-Resolution Climate Data**: By combining elevation data from the Open-Elevation API with daily climate features from GRIDMET, we enable the model to capture the synergistic effects of height and weather, how, for instance, high-altitude locations stay cooler and wetter longer into the summer season.
- **Avoiding Oversimplified Drivers**: While other studies may use presence of wildfire as a blunt proxy for habitat reset, our model recognizes that huckleberry suitability is more strongly influenced by consistent, elevation-governed microclimates than by rare and stochastic events. This allows us to forecast stability and change in core growth areas more realistically.

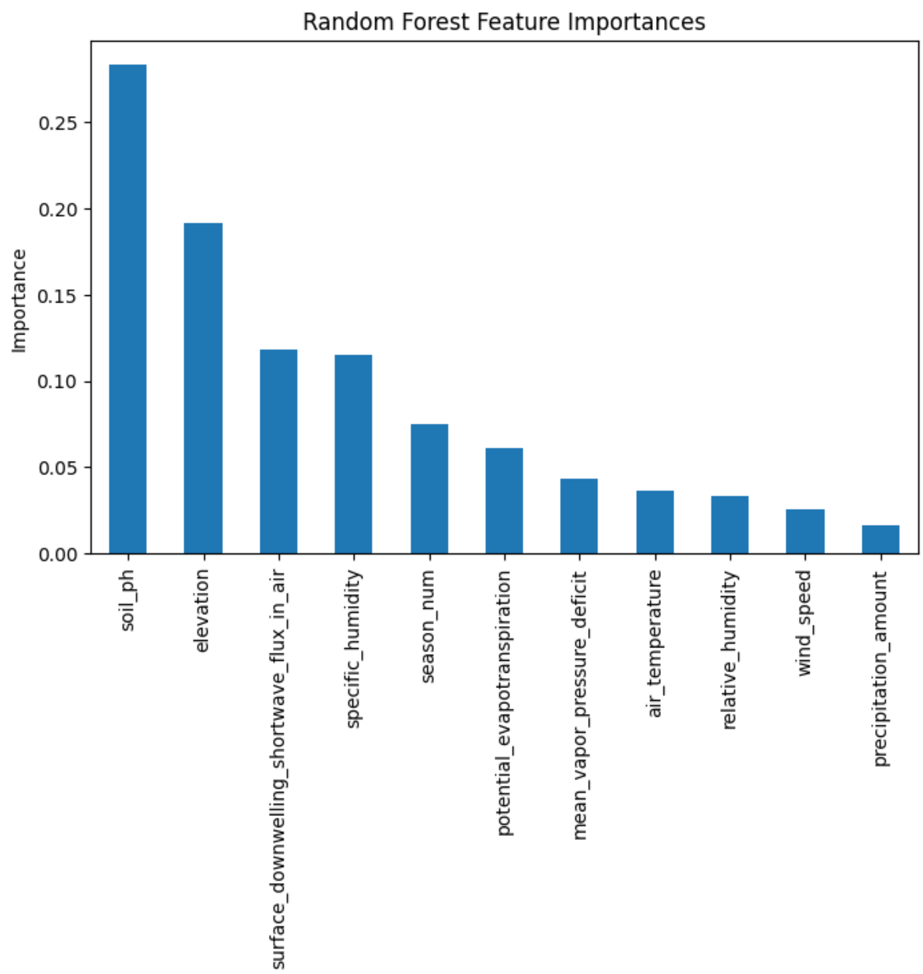
In short, rather than overfitting to historical disturbances, our system embraces predictive continuity, understanding where huckleberries are most likely to persist based on topographic and climate fundamentals. This strategy not only reflects ecological reality but improves the model's generalizability under future climate scenarios.

Harnessing the Power of Modern AI and Machine Learning

Ecological forecasting often involves complex, non-linear relationships and interactions that traditional statistical models struggle to capture. We address this challenge through a hybrid AI framework built for both performance and interpretability.

- Random Forest Classifier: After evaluating several models, including logistic regression and neural networks, we selected a Random Forest due to its ability to generalize well, remain interpretable, and avoid overfitting despite a complex feature space. With a 95% accuracy and 0.94 macro F1 score, it provides strong performance across diverse regions and seasons.
- Time-Aware Feature Engineering: We extract lagging and rolling metrics from the climate time series, capturing long-term moisture patterns, heat stress, and seasonal transitions. This temporal context allows the model to learn that, for example, a cold spring followed by a dry summer may be detrimental even if the current temperature is ideal.
- Geospatial AI Readiness: While our current system uses tabular modeling, it is designed to evolve. We are building toward future versions that support deep learning architectures capable of learning directly from raster data, satellite imagery, and terrain maps.

Key Insights from Feature Importance



Soil pH and Elevation Lead the Way

The model confirms that soil pH is the single most important variable for predicting huckleberry presence, accounting for nearly 28% of feature importance. This aligns with ecological literature showing that *Vaccinium membranaceum* thrives in acidic soils typically found in high-altitude forested regions.

Elevation follows closely behind, contributing ~19% of predictive power. Elevation influences a cascade of other environmental factors, such as temperature, snowpack duration, and sunlight exposure, making it a reliable proxy for microclimate suitability.

GRIDMET Climate Variables are Crucial

Several climate variables from GRIDMET contribute substantially to the model, proving their critical role in forecasting huckleberry habitat:

- Specific humidity and shortwave solar radiation are both among the top five features. These reflect the moisture availability and energy input that drive plant physiology during growing seasons.
- Potential evapotranspiration and vapor pressure deficit also rank highly. These variables measure water loss from soil and plant surfaces, essential indicators of drought stress, which strongly impacts berry yield and survival.
- Even lower-ranked variables like wind speed, air temperature, and precipitation amount still contribute to model accuracy, demonstrating the multidimensional influence of climate on huckleberry distribution.

In summary, the chart highlights that no single climate variable alone is decisive, but together, GRIDMET's rich environmental features allow the model to capture the complex interplay between temperature, moisture, and radiation, exactly the conditions that define huckleberry habitat.

The Final Product

Our approach captures complexity without sacrificing usability, enabling both domain experts and non-technical stakeholders to understand and trust the model outputs. Our forecasting system operates on a simple but powerful principle: identify the environmental fingerprints of thriving huckleberry habitats, then scan the map for similar conditions. This is made possible by:

- Integrating Diverse Data Sources: We combine historical climate records (temperature, precipitation, humidity) with spatial context (elevation, soil pH, fire history) and temporal markers (year, season, lag windows) to form a holistic ecological profile.
- Predicting Optimal Growth Regions: The trained model evaluates new coordinates (with optional time inputs) to predict the habitat suitability score, a confidence value representing the likelihood of supporting wild huckleberry growth.
- Delivering Actionable Outputs:
    - Interactive maps for visual exploration and planning
    - CSV exports for integration with harvesting and land use systems
    - Summary statistics for scenario planning (for example, comparing current vs. future suitability under warming trends)

This system is not a static prediction engine, it is a flexible decision-support tool. Land managers can assess conservation priorities. Harvesters can identify new collection zones. Agricultural researchers can investigate microclimates for potential cultivation. And businesses downstream, from food to nutraceuticals, can use the forecasts to plan sourcing and product pipelines more intelligently.

Ultimately, this is more than a species distribution model. It's a new way of seeing ecological potential through the lens of data science, turning climate pressure into predictive power and helping to unlock sustainable value from the wild.

Data Pipeline Overview: From Raw Records to Scalable Predictions

Our system is structured as a modular pipeline that transforms noisy, heterogeneous biodiversity data into actionable, production-ready habitat suitability predictions. The architecture is divided into two key workflows: **training** and **inference**.

The Nitty-Gritty: Details on How We Built Our Pipeline

Training Pipeline: From GBIF to Model

1. Data Ingestion & Initial Cleaning

We begin with raw occurrence records of *Vaccinium membranaceum* from the Global Biodiversity Information Facility (GBIF). These records are aggregated from 69 datasets across 57 publishers, totaling 7,240 entries. However, the raw data is far from model-ready:

- Many records lack coordinates,
- Others include vague textual descriptions (e.g., "4 mi. E of Stevens Pass"),
- Some have outdated administrative units or malformed location formats.

Initial cleaning includes:

- Dropping clearly invalid records
- Normalizing column formats and values
- Filtering for records within the U.S.
- Limiting to dates between 1979–2020 to align with GridMET data availability

After cleaning, roughly 1,600 valid records remain — each representing a likely huckleberry presence, spatially and temporally bounded.

2. Advanced Geocoding: Multi-Stage, Fallback-Resilient

Unlike typical pipelines that assume clean coordinates, our system is built to recover meaningfully from vague or partial location data. We implemented a multi-stage geocoding approach:

- **Direct Coordinate Use**: Retain trusted entries with accurate lat/lon data.
- **Standard Geocoding**: Apply external APIs to entries with full locality, state, and country fields.
- **Context-Aware Parsing**: Reconstruct approximate locations using fragmented fields (e.g., locality + county).
- **LLM-Assisted Landmark Extraction**: For entries with unstructured natural language descriptions (e.g., "1 mile up Quartz Creek Trail"), we use a local instance of LLaMA3-8b to extract identifiable geographic landmarks.
- **Manual Fallback Layer**: Maintains a curated list of common ambiguous entries with verified coordinates.
- **Boundary Filtering**: Ensures all resolved points fall within the valid bounds of GridMET climate coverage.

This process is both automated and extensible, allowing the system to handle legacy biological data that would otherwise be unusable — a key enabler for scalable ecological prediction.

3. Pseudo-Absence Generation

Presence-only data requires synthetic negative samples to enable binary classification. Our system uses a BallTree-based spatial algorithm to generate pseudo-absences with ecological

plausibility:
- Ensures a minimum 5 km buffer from all known presence points
- Matches temporal distribution to the presence data
- Maintains a 3:1 absence-to-presence ratio for balance
- Bounds generation to the same geographic envelope as the presence data

This creates a clean, well-structured dataset of over 6,000 labeled entries for model training.

4. Environmental Feature Extraction

Each record is enriched with environmental features via:
- **Microsoft GridMET** (via STAC API + xarray): Includes 8 climate variables
- **Open-Elevation API**: Provides high-resolution elevation
- **SoilGrids API**: Adds soil pH, a major predictor
- **Temporal Features**: Extracts date-based fields like year, month, and season

These variables are spatially snapped to their nearest 4km grid cell and temporally matched to the occurrence date or specified season.

5. Data Validation & Versioning

The enriched dataset undergoes strict validation:
- Type and range checks on all features
- Completeness enforcement
- Required column verification

Final datasets are saved with:
- **Version control**
- **Hash-based integrity checks**
- **Lineage metadata** linking raw data to final models

6. Model Training & Registry

We train a Random Forest classifier with stratified splitting and cross-validation. Key performance metrics:
- Accuracy: 95%
- F1 macro avg: 0.94
- 5-fold CV avg: 0.948 ± 0.008

The model and its configuration (features, hyperparameters, importance scores) are saved to a model registry with full metadata and reproducibility guarantees.

Inference Pipeline: Real-Time Habitat Predictions

The inference workflow takes in new geographic coordinates and optionally, date inputs, and follows a parallel but lightweight path:
1. **Input Validation**
    - Checks coordinate format, location bounds, and input structure
2. **Feature Extraction**
    - Pulls climate data (latest or specified date) from GridMET
    - Adds elevation, soil pH, and temporal encodings
3. **Prediction Execution**
    - Loads model from registry
    - Applies consistent feature prep
    - Outputs suitability predictions and probability/confidence scores
4. **Output Delivery**
    - Generates CSV prediction tables
    - Creates interactive HTML maps (via Folium)

  - Provides summary statistics and confidence distributions

Key Technologies

- **Languages & Frameworks**: Python, scikit-learn, pandas, joblib
- **Climate/Environmental Data**: GridMET via pystac-client, xarray, zarr
- **Geospatial Tools**: BallTree (scikit-learn), geopandas, Folium
- **Data Quality & Config**: YAML environments, structured logs, custom validators
- **Language Models**: Local LLaMA3-8b (for landmark parsing from free-text)

Part Five: Future Expansion and Conclusion

I. Future Expansion and Adaptation

Agriculture in the United States is entering a period of profound transformation. As global temperatures rise and climate volatility increases, the traditional boundaries of crop viability are shifting. Crops that once thrived in specific regions are now facing ecological pressures, while new geographic zones are emerging as unexpectedly fertile alternatives. A striking example of this phenomenon can be found in the United Kingdom, where regions previously considered too cold or wet are now producing award-winning wines. This same trend, driven by long-term climate change, is poised to disrupt U.S. agriculture as well, particularly in high-value crop sectors like almonds.

The almond industry is a cornerstone of American agriculture, with the U.S. accounting for more than 80% of global production. In 2025, the domestic almond market is projected to reach $8.63 billion, up from $8.23 billion in 2024, and is expected to grow at a healthy compound annual growth rate of 5.7% through the end of the decade. California's Central Valley, which currently accounts for the vast majority of this production, is under mounting pressure. Almonds are a climate-sensitive crop requiring a precise balance of chill hours, rainfall, and dry heat—conditions that are increasingly inconsistent due to climate change. With California suffering from intensifying drought, declining winter chill hours, and worsening wildfires, almond farmers are facing existential questions about long-term viability and land value.

At present, mature almond orchards in the Central Valley can sell for $25,000 to $42,000 per acre. However, this value is beginning to decline as climate risks become harder to ignore. In contrast, undeveloped arable land in the same region trades at a significantly lower price of $5,000 to $6,000 per acre, reflecting both opportunity and risk. Meanwhile, regions in Oregon and Washington—once overlooked for almond production—are beginning to resemble California's historic climate conditions, making them potential future hubs for almond cultivation.

The numbers paint a compelling picture. Oregon farmland, for instance, averages $3,700 to $4,000 per acre as of 2022, with some premium areas like the Willamette Valley approaching $20,000 per acre. Washington's farmland averages are lower, with some plots available at just $650 to $3,000 per acre depending on location and development. These discrepancies create significant arbitrage opportunities for forward-thinking investors and growers. If climate patterns continue as projected, farmland in the Pacific Northwest could become the next frontier for almonds and other high-value crops, offering massive returns for those who invest early.

Our team has already built a successful predictive model to track the hyper-specific growing conditions for wild huckleberries, incorporating over 40 years of data related to temperature, precipitation, elevation, and fire history. While huckleberries themselves are not widely cultivated, the strength of our modeling framework lies in its transferability. This system is capable of forecasting future crop viability by region, under different climate scenarios, over a 5-to-10-year horizon.

Applying this same system to almonds allows us to map out the shifting climate suitability zones across the western U.S., identifying new regions where almond cultivation could thrive. By doing so, we create a valuable decision-support tool for farmers, investors, agricultural lenders, and land developers. Our model not only identifies these future zones—it can also quantify the associated land value gap, highlight infrastructure needs, and offer recommendations for when and how to transition.

This opens up several monetization opportunities. We anticipate selling predictive reports and location analyses for as much as $5,000 per client, targeting growers looking to relocate, investors scouting underpriced farmland, and institutions aiming to mitigate climate risk in agricultural lending portfolios. If we serve just 100 clients in our first year, this would result in $500,000 in revenue. As we expand into additional crops—such as apples, grapes, and avocados—the model's scalability will allow us to multiply our reach and impact.

In short, climate change is rapidly altering the agricultural landscape, and those who are able to anticipate these shifts stand to gain significantly. Our predictive modeling system offers the tools to do just that: revalue land, de-risk agricultural investments, and plan ahead for a very different farming future. The success of our huckleberry model has demonstrated the power of this approach. Now, with almonds and beyond, we are ready to help reshape the future of agriculture—one data point at a time.

A. Conclusion

We chose huckleberries precisely because they are both economically coveted and ecologically stubborn. Mountain huckleberry (*Vaccinium membranaceum*) trades at $50–80 kg in a market expected to reach $1.84 billion by 2032, yet its seven-year growth cycle, dependence on fire-cleared, high-elevation forests, and symbiosis with native soil microbes make cultivation nearly impossible. This combination of high value, cultural importance, and supply-side uncertainty created the perfect "hard case" for testing an AI-driven species-distribution model.

Built on 45 years of Microsoft GRIDMET climate data and layered with elevation, canopy, and fire indices, our model ingests daily meteorological variables and learns the non-linear links that govern berry abundance. The result is a geospatial forecast that tells users where huckleberries will thrive now—and where shifting climate will move them next.

From that engine flow two complementary businesses. For consumers, the "Find My Huckleberry" mobile map monetises curiosity through a subscription that turns weekend foragers into efficient harvesters. For institutions, the B2B service packages deeper analytics—yield scores, habitat-enhancement guidance, and licence-allocation advice—sold via tailored contracts to cooperatives, tribal nations, private landowners, and regulators.

Most importantly, the same pipeline generalises beyond a single wild berry. By swapping huckleberry training data for crop-specific variables, we can predict future almond suitability as California's chill hours dwindle, or spotlight emerging viticultural zones as Britain's climate warms. Pairing those forecasts with county-level land prices lets us re-rate undervalued acreage and sell early-mover insight to growers, lenders, and ag-investors—turning a niche foraging tool into a jackpot land-valuation platform.

Bibliography

OPB (2025). Huckleberries are an important cultural food, but commercial picking is causing problems for Pacific Northwest tribes. Oregon Public Broadcasting. Retrieved from https://www.opb.org/article/2025/03/14/huckleberry-picking-tribal-food/

Global Market Insights (2024). Huckleberry Market Size & Share | Forecasts Report 2024–2032. Retrieved from https://www.gminsights.com/industry-analysis/huckleberry-market

High Country News. (2025, April 3). Forest Service pauses commercial huckleberry picking in Gifford Pinchot National Forest. Retrieved from https://www.hcn.org/articles/forest-services-pauses-commercial-huckleberry-picking-in-gifford-pinchot-national-forest

High Country News. (2025, February 25). The true cost of the huckleberry industry. Retrieved from https://www.hcn.org/issues/57-3/the-true-cost-of-the-huckleberry-industry

Gorge News Center. (2025, April 3). Commercial huckleberry picking temporarily halted in Gifford Pinchot National Forest. Retrieved from https://gorgenewscenter.com/2025/04/03/commercial-huckleberry-picking-temporarily-halted-in-gifford-pinchot-national-forest

Cascade Forest Conservancy. (2024, August 15). Huckleberry harvest: A delicate balance. Retrieved from https://www.cascadeforest.org/2024/08/15/12113

U.S. Department of Agriculture, Forest Service. (n.d.). Vaccinium membranaceum. Fire Effects Information System (FEIS). Retrieved from https://www.fs.usda.gov/database/feis/plants/shrub/vacmem/all.html

U.S. Department of Agriculture, Forest Service. (n.d.). Vaccinium ovatum. Fire Effects Information System (FEIS). Retrieved from https://www.fs.usda.gov/database/feis/plants/shrub/vacova/all.html

U.S. Department of Agriculture, Natural Resources Conservation Service. (n.d.). Plant Guide: Gaylussacia baccata. USDA Plants Database. Retrieved from https://plants.usda.gov/DocumentLibrary/plantguide/pdf/cs_gaba4.pdf

Flora of North America Editorial Committee. (n.d.). Vaccinium membranaceum. Flora of North America. Retrieved from https://floranorthamerica.org/Vaccinium_membranaceum

Flora of North America Editorial Committee. (n.d.). Gaylussacia baccata. Flora of North America. Retrieved from https://floranorthamerica.org/Gaylussacia_baccata

Native Plant Trust. (n.d.). Gaylussacia baccata – Black huckleberry. Go Botany. Retrieved from https://gobotany.nativeplanttrust.org/species/gaylussacia/baccata/

LeRoy, P. (2016). Mountain Huckleberry (Vaccinium membranaceum). Native Plants PNW. Retrieved from https://nativeplantspnw.com/mountain-huckleberry-vaccinium-membranaceum/

Minore, D., Smart, A. W., & Dubrasich, M. E. (2004). Ecology and culture of Montana huckleberries: A literature review(Gen. Tech. Rep. PNW-GTR-657). U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. https://www.fs.usda.gov/pnw/pubs/pnw_gtr657.pdf

Tridge. (2024). Fresh Huckleberry Global Price Overview. Retrieved from https://dir.tridge.com/prices/product/fresh-huckleberry

United States Department of Agriculture, Natural Resources Conservation Service. Conservation Innovation Grants (CIG). 2023. https://www.nrcs.usda.gov/programs-initiatives/cig-conservation-innovation-grants

Acknowledgment of AI Assistance

Portions of this report, including but not limited to editing, summarization, and phrasing suggestions, were supported by the use of AI platforms including ChatGPT and Gemini. All final content was reviewed and curated by the authors, and responsibility for the ideas and conclusions presented remains solely our own.