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INVESTMENT MANAGEMENT

Forecasting the Future

How AI is reshaping farmland investment in a changing climate

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FOR PROFESSIONAL INVESTORS ONLY

Climate is no longer a backdrop to agricultural investment, it is the main character. As weather patterns shift and volatility rises, investors face a new frontier: not just managing risk, but navigating opportunity.

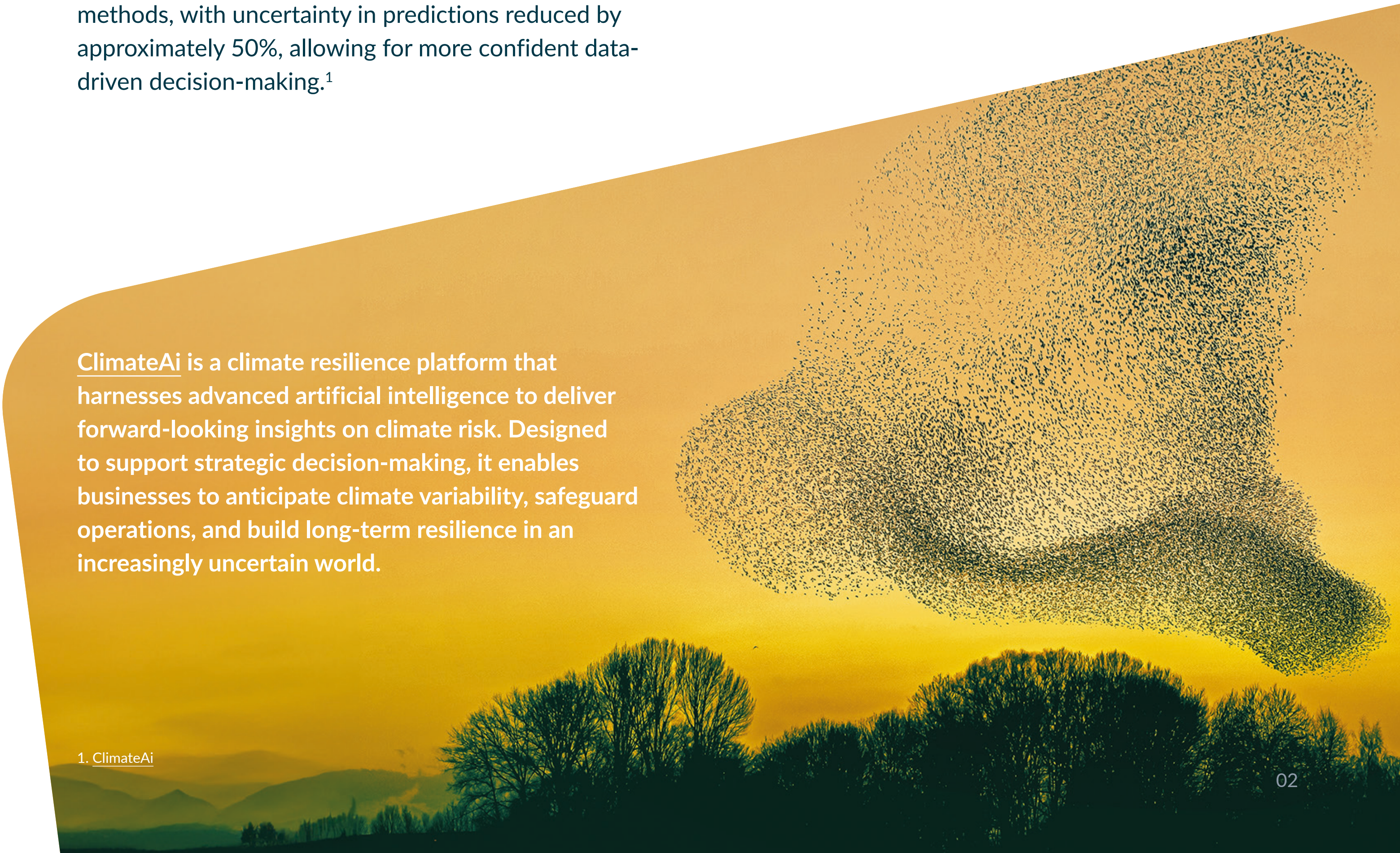
In this new reality, the question isn’t whether climate change will affect farmland, it’s how we prepare for it, and who will thrive because of it. The answer lies in foresight. And increasingly, that foresight is powered by artificial intelligence (AI). This paper explores how advanced climate modelling, driven by AI, is helping investors move from reactive to proactive, identifying not just where the risks lie, but where the next generation of resilient, high-performing farmland will be found.

The role of AI in climate prediction

To support more informed decision making, we draw on advanced climate modelling powered by AI. We work with a leading climate resilience technology platform which employs sophisticated machine learning algorithms to analyse over 100 global climate models and weight them based on their historical accuracy and relevance to specific climate parameters. This determines the best fit for each region and climate variable, such as temperature and precipitation.

This approach has led to a meaningful improvement in forecasts reducing uncertainty. In some cases, AI-enhanced models have demonstrated an 80% improvement in accuracy compared to traditional methods, with uncertainty in predictions reduced by approximately 50%, allowing for more confident data-driven decision-making.[1]

> *Together, with ClimateAi, we’ve developed sophisticated models that seek to provide exceptionally accurate and detailed projections of climate conditions for the next five to six decades.*



ClimateAi is a climate resilience platform that harnesses advanced artificial intelligence to deliver forward-looking insights on climate risk. Designed to support strategic decision-making, it enables businesses to anticipate climate variability, safeguard operations, and build long-term resilience in an increasingly uncertain world.

1. ClimateAi

From forecasts to practical insights

Working closely with our agronomists on the ground, we translate these climate projections into real-world crop insights, aligned with the specific challenges of growing certain crops in particular regions. Take frost during the flowering period, for example: a single poorly timed event can severely impact yields for many permanent crops. We identify these critical pressure points, quantify their future likelihood, and map them against long-term climate scenarios.

> *It's not just about having the data – it's about how we apply it to real-world decisions on the ground.*

The climate model methodology

Machine learning and AI are used to calibrate the models and improve accuracy through three key steps:

Bias correction

Known errors in the models are corrected to improve reliability. These adjustments are based on historical performance and observed discrepancies.

Model selection

The process begins by selecting the most appropriate models for each location. Global climate models developed by the Intergovernmental Panel on Climate Change (IPCC), are designed to capture broad climate trends. Machine learning is used to determine which models perform best for specific variables, such as temperature and precipitation, at any given point in the world.

Downscaling

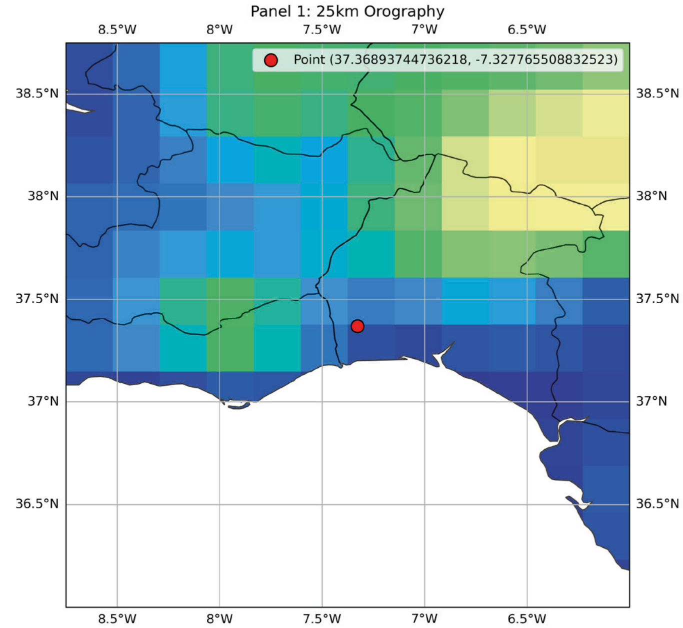
To capture local climate dynamics, the resolution of the models is increased to better capture microclimates. This is achieved by comparing the model results with higher resolution ground or satellite data covering much smaller areas. By establishing mathematical relationships between higher-level models and lower-level points, the accuracy and utility of the models is improved.

This leads to a more accurate weighting of models and the emergence of more precise predictions.

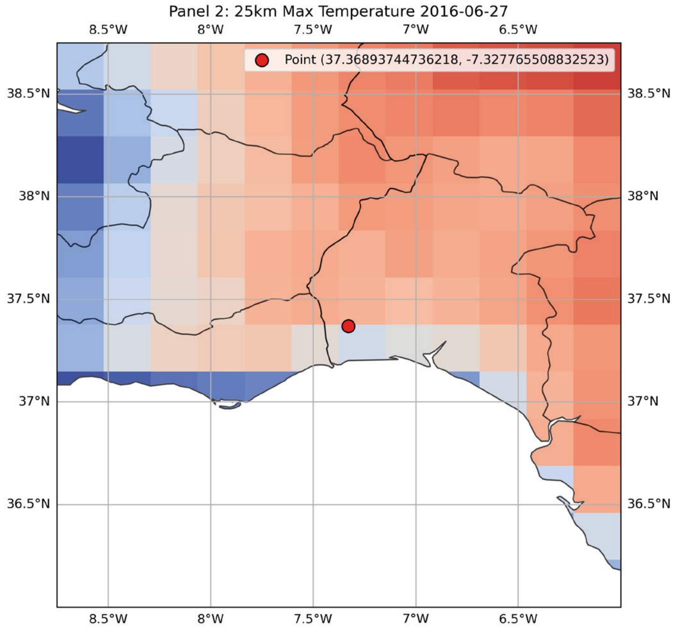
Figure 1: resolution comparison for orography and temperature fields

Panel 1 below shows orography and temperature outputs at a coarse 25 km resolution. The bottom row presents the same variables at a high-resolution 1 km scale, highlighting the enhanced spatial detail achieved through the downscaling process.

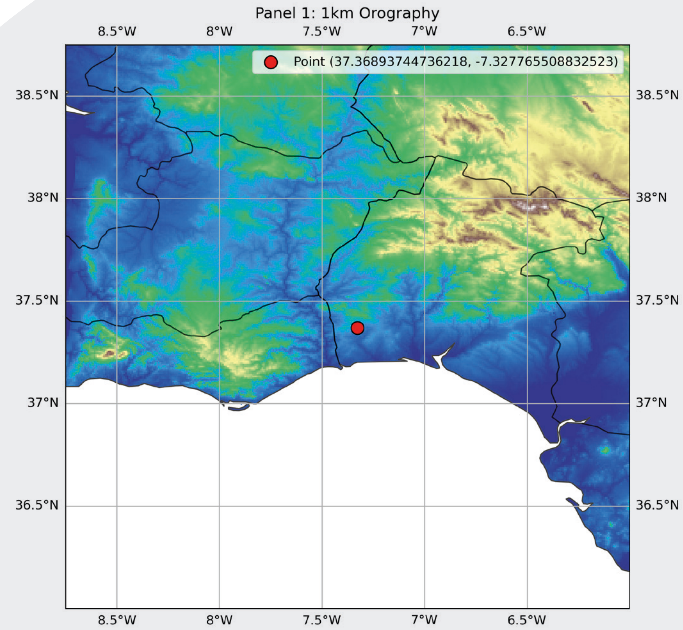
Orography 25 km



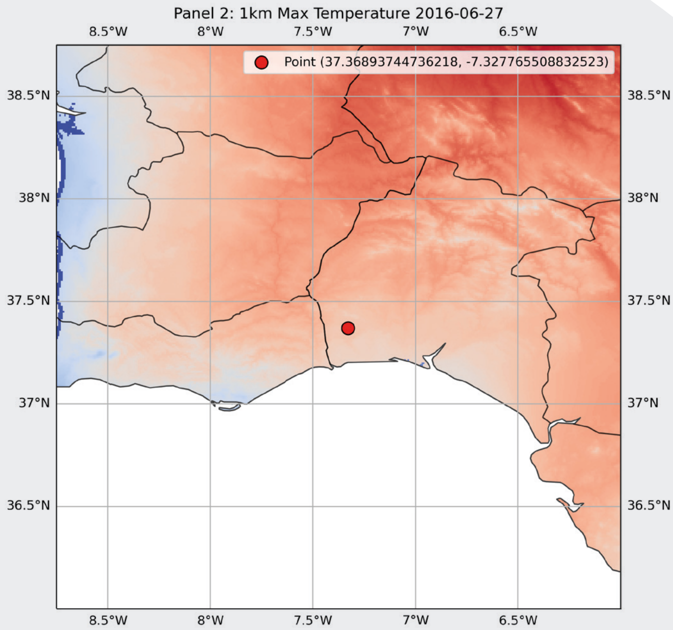
Temperature25 km



Orography 1 km



Temperature1 km



Source: ClimateAi, 2025. For illustrative purposes only.

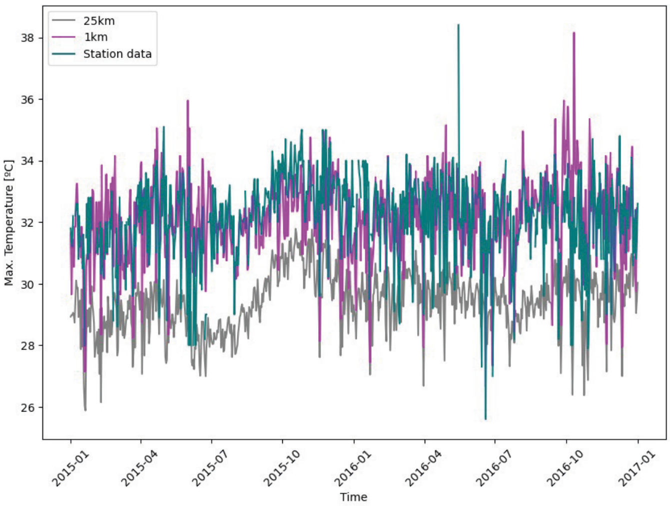
Figure 2: Model validation against observed station data

Here we present two complementary views of model validation for maximum temperature:

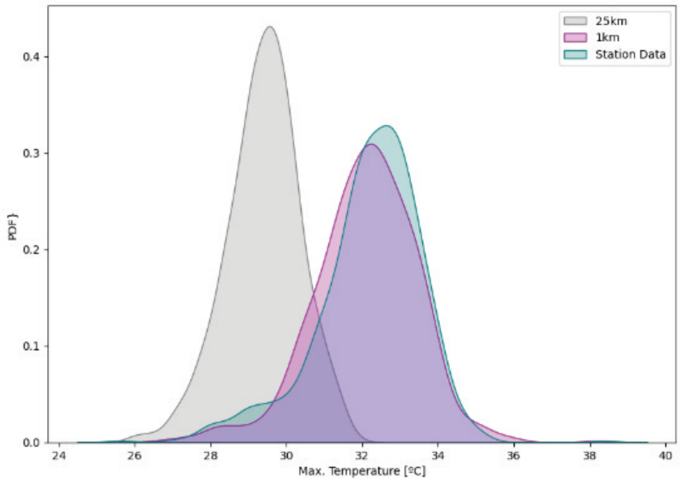
This time series comparison of maximum temperature predictions from coarse (25 km) and high-resolution (1 km) models against observed station data from January 2015 to January 2017. The high-resolution model shows improved alignment with observed values.

The probability density functions (pdf) of maximum temperature distributions for the same period, comparing the 25 km and 1 km model outputs with station data. The 1 km model more closely matches the observed distribution, indicating improved accuracy in capturing local temperature variability.

Time series comparison



Probability density functions



Source: ClimateAi, 2025. For illustrative purposes only.

Validation and practical application

To further ensure reliability, the models undergo extensive validation and backtesting. This involves comparing model predictions with historical climate data to assess accuracy, using metrics such as Continuous Ranked Probability Score (CRPS) to quantify prediction accuracy and uncertainty. Case studies are also conducted to demonstrate the practical application and benefits of the technology in real-world agricultural scenarios.

Benefits of AI-Driven Climate Predictions

AI-driven climate predictions enhances our ability to make more forward-looking informed decisions, optimising crop yields and reducing risks. The precision of models translates into actionable business insights, such as yield impacts and water management strategies. By anticipating climate impacts more accurately, we can promote sustainable practices that ensure long-term viability and deliver positive environmental outcomes. This approach aligns with the United Nations Sustainable Development Goals (SDGs) and promotes responsible investment in farmland.

Applying climate intelligence to farmland investing

In farmland investing, one of the most important investment decisions is where to invest. As climate change reshapes agricultural viability across the globe, understanding and anticipating these shifts is essential for long-term success.

Strategic farmland investing today requires more than just local knowledge, it demands a forward-looking view of climate resilience, water security, and long-term productivity.

> *The real innovation isn't the technology; it's how we use it to stay ahead of change.*

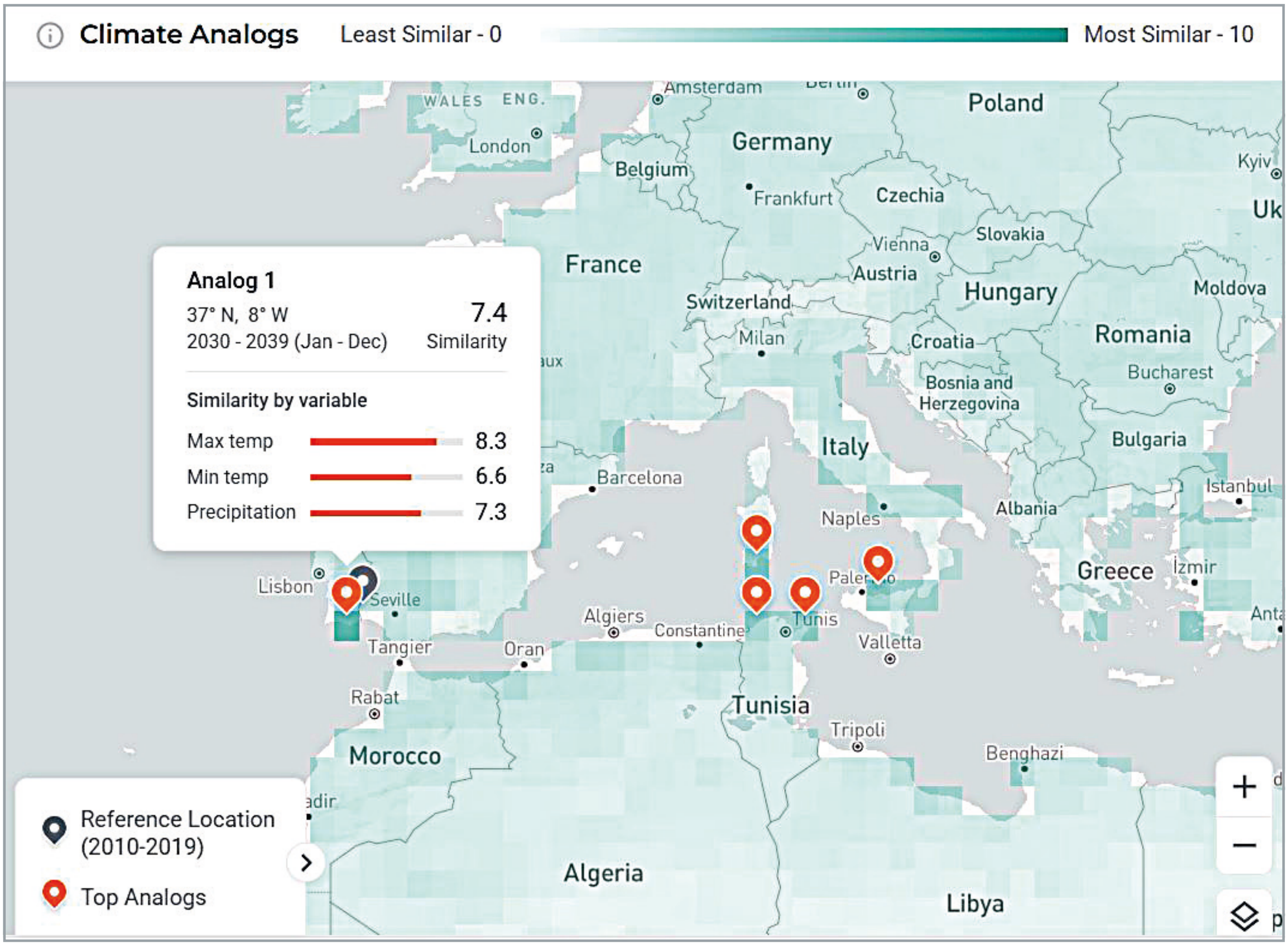
Our approach integrates climate intelligence to support decision-making across three key dimensions:

- **Tailored Risk Mitigation** Strategies developed to mitigate risks specific to each crop and location, such as extreme heat, low precipitation and frost.
- **Water Resource Evaluation** A comprehensive evaluation of water availability across local, groundwater and surface water sources, ensures long-term viability.
- **Future Focused Site Selection** Climate analogues are used to identify new areas for investments by matching future climate conditions with current climates in other regions.

We use AI tools to test ideas, with the aim of more accurately predicting the impact of certain threats in specific regions. This allows us to take a close look at a particular farm or crop and create statistical models based on future climate scenarios at the farm or crop level. AI also helps identify new investment areas by matching future climate conditions with current climates in other regions, thus identifying suitable investment locations.

Figure 3: Climate analogues for future investment site selection

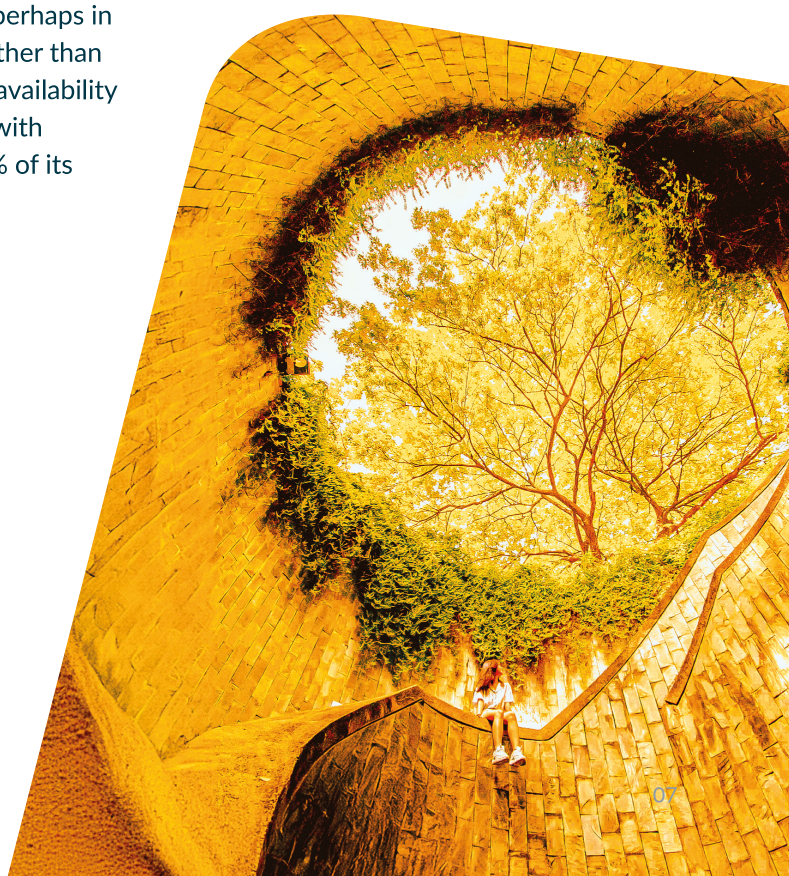
This figure illustrates how climate analogues are used to identify future investment locations by matching projected climate conditions with current climates in other regions.



Source: ClimateAi, 2025. For illustrative purposes only.

We prioritise regions that are relatively resilient to climate change or may even benefit from it and have ample water resources perhaps in cooler northern zones for example Ontario or Denmark, rather than Germany, or in the southern areas of New Zealand. Water availability is also a key factor. In Uruguay, one of our farms operates with its own reservoir and dam, utilising only approximately 10% of its annual water available for agricultural purposes.

> *By embedding climate intelligence into our investment process, we aim to contribute to a more resilient agricultural future - one that balances productivity with long-term environmental stewardship.*



Case Study
Covodonga, Southern Spain

Location overview

We conducted a detailed climate risk assessment for our Covadonga farm, situated near Huelva in the southwest of Spain. This case revealed that by adopting a differentiated perspective on risk, and identifying pockets of opportunity in areas deemed to have significant climate risk by others, and therefore overlooked, we can potentially generate significant returns.

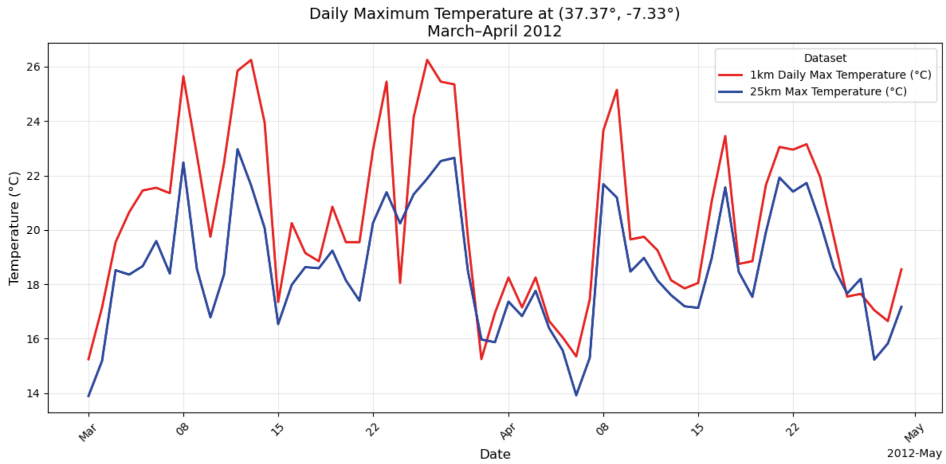
Climate modelling & risk analysis

Using advanced climate modelling tools, we developed a 30-year projection for this farm. Our local agronomists, supported by these tools, identified several critical stressors for citrus growth, such as periods of extreme heat and precipitation. These stressors were cross-referenced with the climate model to assess their predicted frequency over time. Interestingly, for Covadonga, the analysis showed that the number of risk events remains relatively stable into the 2050s.

Figure 4: Variation in temperature predictions by model resolution

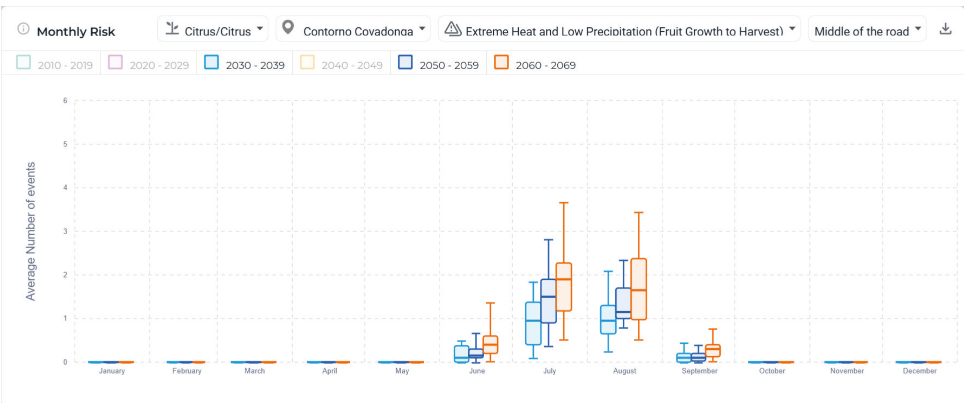
Comparison of temperature estimates using a coarse 25 km model versus a high-resolution 1 km model. The high-resolution output reveals greater spatial detail and localised variability.

Source: ClimateAi, 2025.
For illustrative purposes only.



Water resource evaluation

A parallel study was conducted to assess water availability. On the demand side, we considered the development of the plantation, water rights and their quality, even during drier years, and the agronomic intensity of the area. On the supply side, we examined long-term precipitation patterns to assess future water availability.



Source: ClimateAi, 2025. For illustrative purposes only.

Figure 5: Projected risk events: extreme heat and low precipitation at Covadonga

This figure shows the projected frequency of extreme heat and low precipitation events at the Covadonga farm, based on long-term climate modelling.

Strategic Implications

Selecting optimal location and crops aligned with future climate conditions can enhance both yield and profitability. Similarly, implementing efficient irrigation and water storage solutions based on an accurate water risk analysis can help to support resilient, sustainable and profitable agricultural practices.

Tim van den Pol
Portfolio Manager

Chris Windeatt
Director, Distribution

From risk to resilience

The integration of AI in climate prediction represents a significant advancement in farmland investing. Our use of AI technology exemplifies how accurate, data-driven insights can enhance decision-making, mitigate risks, and promote sustainable agricultural practices. As climate change continues to pose challenges, leveraging AI will be crucial for securing the future of global agriculture.

However, technology alone is not the answer. The real opportunity lies in how we use it, not just to adapt to change, but to anticipate it. By combining AI-driven foresight with deep agricultural understanding and long-term thinking, we can help shape a more resilient and regenerative food system. This is not simply about managing risk. It is about reimagining what responsible investment looks like in a world defined by climate uncertainty and acting on that vision today.

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