



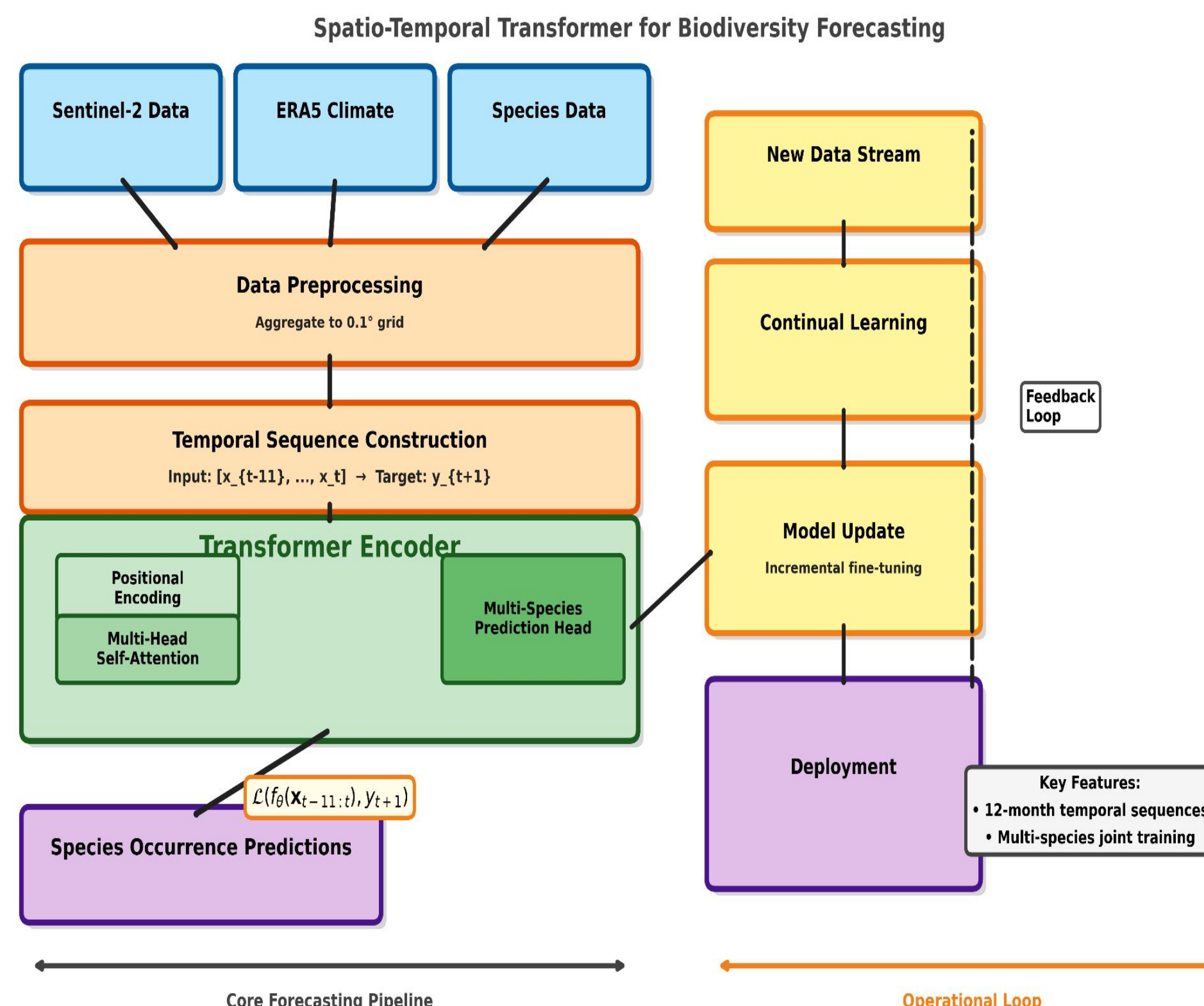
EcoCast: A Spatio-Temporal Model for Continual Biodiversity and Climate Risk Forecasting

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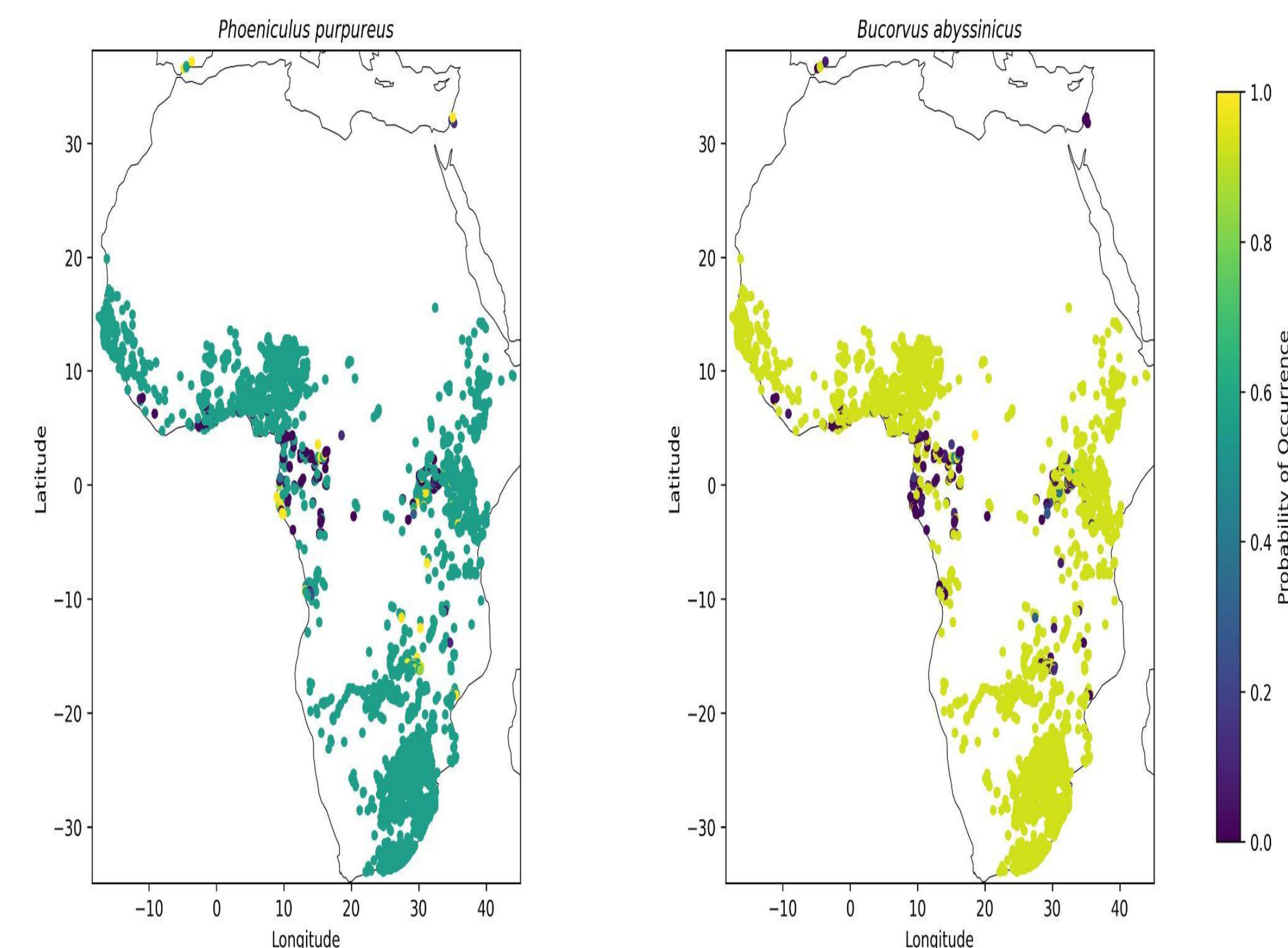
INTRODUCTION & RESEARCH OBJECTIVES

- Climate change and habitat loss are driving unprecedented shifts in species distributions across Africa, threatening biodiversity and ecosystem services.
- Bird species serve as early warning indicators of ecosystem health, yet conservation professionals lack timely, fine-grained forecasts of changing species distributions.
- Traditional Species Distribution Models (SDMs) are static and require projected future climate scenarios (RCP4.5, RCP8.5) for decades-ahead forecasts. They cannot keep pace with rapidly changing environmental conditions.
- EcoCast bridges ecology and machine learning by using transformer-based architecture for operational near-term forecasting without requiring future climate projections.

EcoCast Architecture



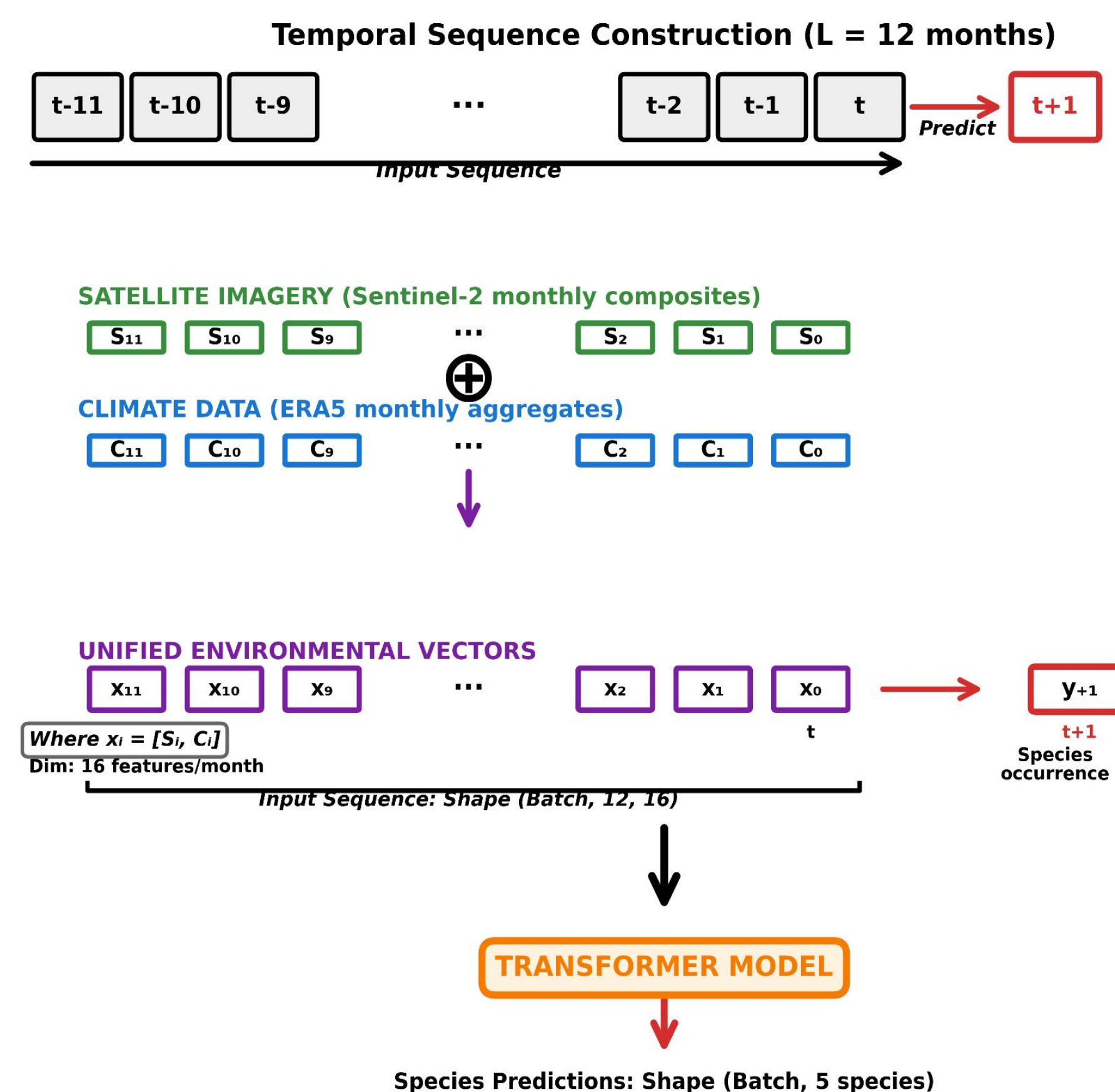
Results



Key Contributions

- Operational Forecasting: Predicts next month based on observed 12-month environmental sequences
- Multi-Modal Integration: Satellite imagery (Sentinel-2) + Climate data (ERA5) + Citizen science (GBIF)
- Transformer Architecture: Captures long-range temporal dependencies and seasonal patterns
- Continual Learning: Designed to adapt to new data without catastrophic forgetting

EcoCast Temporal Alignment: Unified Processing of Satellite and Climate Data



CONCLUSIONS & FUTURE WORK

- We introduce the first transformer model for operational African biodiversity forecasting
- EcoCast includes continual learning design for non-stationary environments
- Real-time forecasts of biodiversity hotspots at risk

Future Directions:

- Expand coverage: More species, regions, and taxa beyond birds
- Enhanced continual learning: Real-time model updates
- API development: Enable local data integration

Comparative Performance

Model	F1 (macro)	PR-AUC (macro)
Baseline (Random Forest)	0.31	0.29
EcoCast forecast	0.65	0.72
Improvement	+34 pp	+43 pp

ACKNOWLEDGEMENTS

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