# LSTM Model with FireCCI Predictors - Results Summary

## 1. Overview

This report summarizes the performance of two LSTM models trained to predict weekly Chlorophyll-a (CHLA) concentrations across lakes. The first model (LSTM\_NoFire) was trained only on lakes without fire history, using environmental and lake physical predictors. The second model (LSTM2\_Combined) was trained using a balanced set of fire-affected and no-fire lakes and included five selected FireCCI land cover classes as additional predictors.

## 2. Methodology

Each model used lake-specific embeddings and temporal sequences of weekly predictor values. Models were evaluated separately on lakes with and without fire exposure. Performance metrics include Root Mean Squared Error (RMSE), Relative RMSE (rRMSE), and Coefficient of Determination (R²). We also computed per-lake R² to observe local generalization capacity.

## 3. Results and Discussion

Results for each model and test group are summarized below.

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| --- | --- | --- | --- | --- |
| Model | Test Group | RMSE | R² | rRMSE |
| LSTM\_NoFire | No-Fire | 6.90 | 0.48 (avg 0.13) | 52.9% |
| LSTM\_NoFire | Fire | 11.54 | -0.15 (avg -3.99) | 75.5% |
| LSTM2\_Combined | No-Fire | 7.22 | 0.44 (avg 0.08) | 55.9% |
| LSTM2\_Combined | Fire | 7.25 | 0.55 (avg 0.12) | 48.2% |

The first model (LSTM\_NoFire) showed strong performance on no-fire lakes, but poor generalization to fire-affected lakes, as evidenced by negative R² values and higher RMSE. This confirms that excluding fire-related predictors leads to a performance drop on such lakes.

The second model (LSTM2\_Combined), trained with both groups and FireCCI predictors, shows improved performance on fire-affected lakes and similar performance on no-fire lakes. This demonstrates the relevance of fire-affected land cover types for CHLA prediction.

## 4. Conclusion

Incorporating fire history through land cover predictors significantly improves CHLA prediction in fire-affected lakes, without degrading performance on unaffected lakes. A combined training strategy with lake embeddings provides a robust approach to learning cross-lake temporal patterns.