Rice Yield Monitoring Using Satellite Data and AI for Food Security and Sustainable Landscapes in Burma

The highland states in Myanmar are high food producing areas with maize as the dominant crop while the Ayeyarwady Region is dominant for rice. The decline in agricultural production highlights the critical need for accurate crop production data for effective food security assessments. Satellite remote sensing offers a viable solution for monitoring cropland changes, providing consistent, quality-controlled data. Satellite missions like Landsat, MODIS, Sentinel-1, Sentinel-2, and Planet are essential for understanding environmental variables and improving crop yield forecasting.

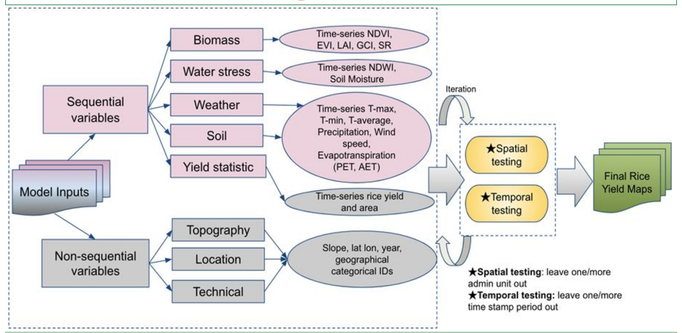
Partners & Collaborators

USAID/Burma

Users

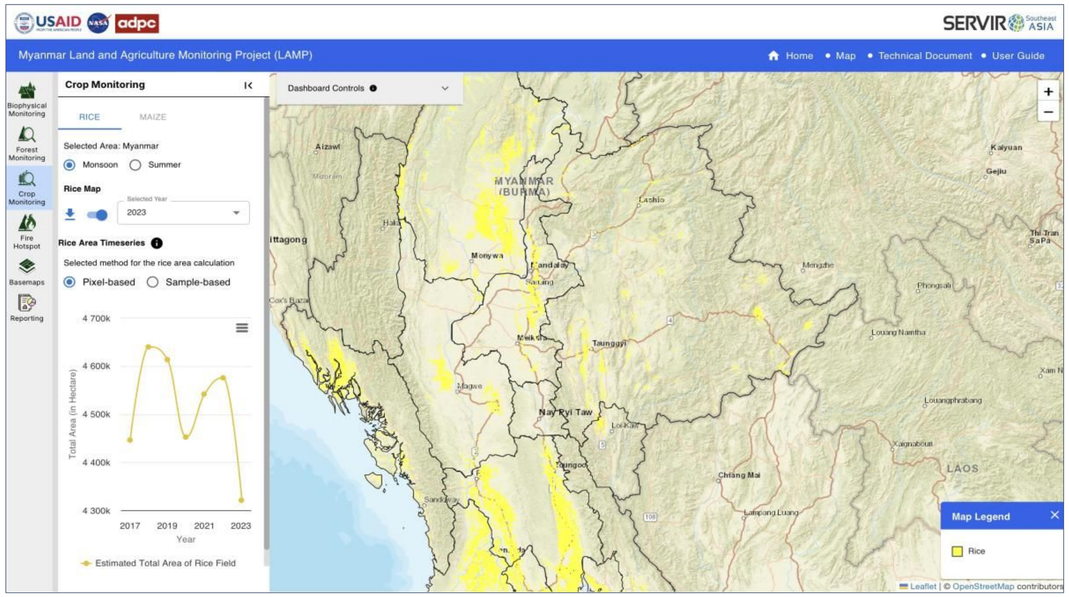
This tool allows users to visualize, explore, and export maps and charts for informed decision-making by decision-makers, environmental activists, policymakers, NGOs, donors, government officials, and other stakeholders.

Modeling Framework

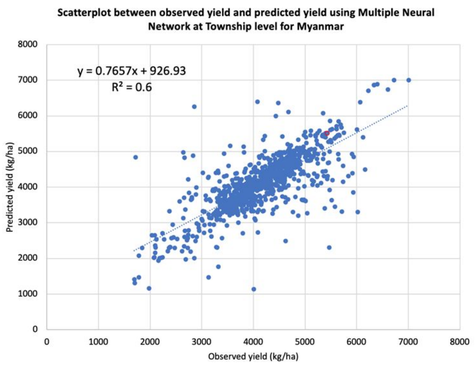


Flowchart showing the overall methodology employed to estimate rice yield in Burma

The modeling framework included several steps: developing a prototype rice yield estimation model using remote sensing and machine learning at township and provincial levels, followed by using DSSAT for dynamic crop growth simulations. A comparative analysis identified the most effective approach for further iterations. The final step involved implementing the generalization method to evaluate model performance using reference region data. Various modeling techniques, from simple regression to advanced methods like random forest and deep learning models, were employed.



User interface of the Burma Land and Agriculture Monitoring Project (LAMP) tool where all crop yield related information is accessible.



Sr No.	Model Type	Avergae R square value
1	Simple Regression Model	0.4
2	Random Forest	0.6
3	ANN with hidden layer 1	0.63
4	ANN with hidden layer 2	0.67
5	ANN with hidden layer 3	0.68
6	ANN with hidden layer 4	0.7

(Left) MLP-NN model performance showing Scatterplot of observed rice yield (from government statistical department) at X-axis and predicted rice yield from this study at township level predictions. (Right) Comparisons between different yield models (Phalke et al., 2024)

Outcomes & Impacts:

- The versatile simple and advanced modeling techniques allow decision makers to **monitor rice yield in Burma** from national to field scales, providing valuable insights for future applications.
- Leveraging EO data and AI-based models to **addresses challenges** posed by limited granular reference yield data.
- International organizations can provide a **more accurate humanitarian response** to food crises by having such data and insights.
- This tool is being used for improved management for improved **food security**.
- **USAID Indicators**: 3.2-7, 3.2-25 (Improved management practices or technologies)

Next Steps:

1. Although some uncertainties remain, particularly concerning distinct agroecosystems and the DSSAT model's limitations in simulating monsoon rice failures, this foundational work sets the stage for future improvements. Enhanced satellite data and refined modeling techniques will be crucial in addressing these challenges.
2. Refining management practice definitions and sensitivity analyses to better understand and address crop failures, ensuring a more robust and generalizable model.
3. Publish the results in a user-friendly web tool that provides essential information to help people in Burma make informed decisions

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