INTEGRATING TIME SERIES REMOTE SENSING INFORMATION IN SUITABILITY ANALYSIS FOR LAND USE PLANNING

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INTRODUCTION

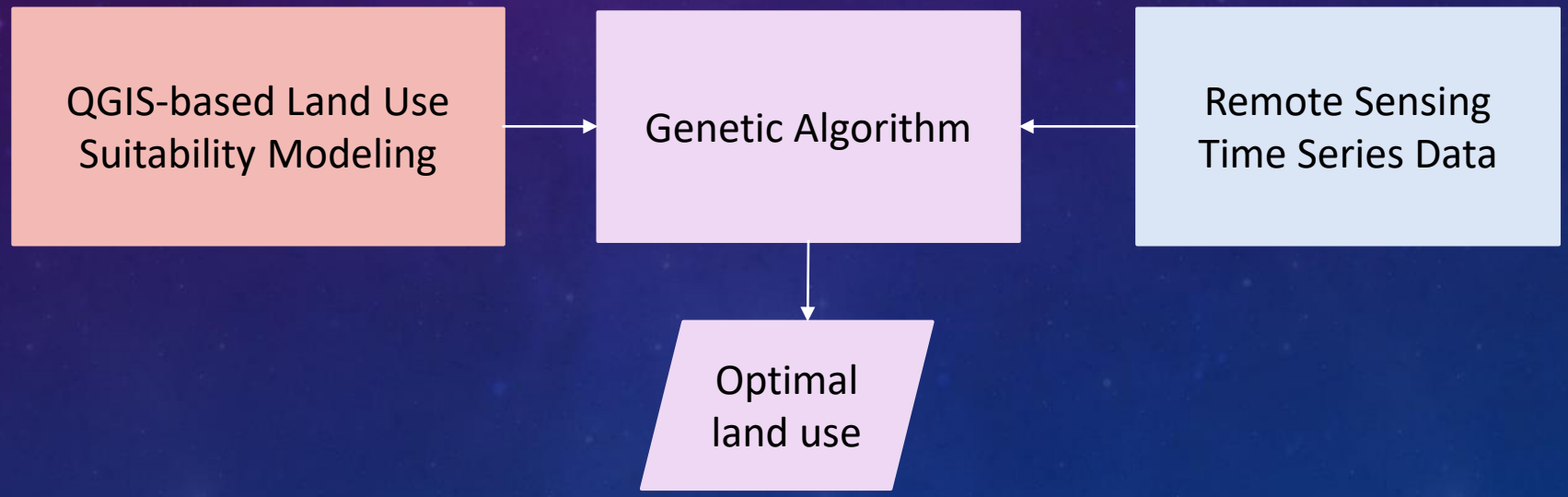
- Rapid urbanization
  - Causes
  - Implications
- Suitability in Land use planning (LUP)
  - Conflict
- Remote sensing applications

Kumasi, a major urban center in Ghana [3]

Deforestation in Ghana [2]

GOAL

The **goal** of this study was to understand the integration of remote sensing and suitability analyses to inform LUP decisions.



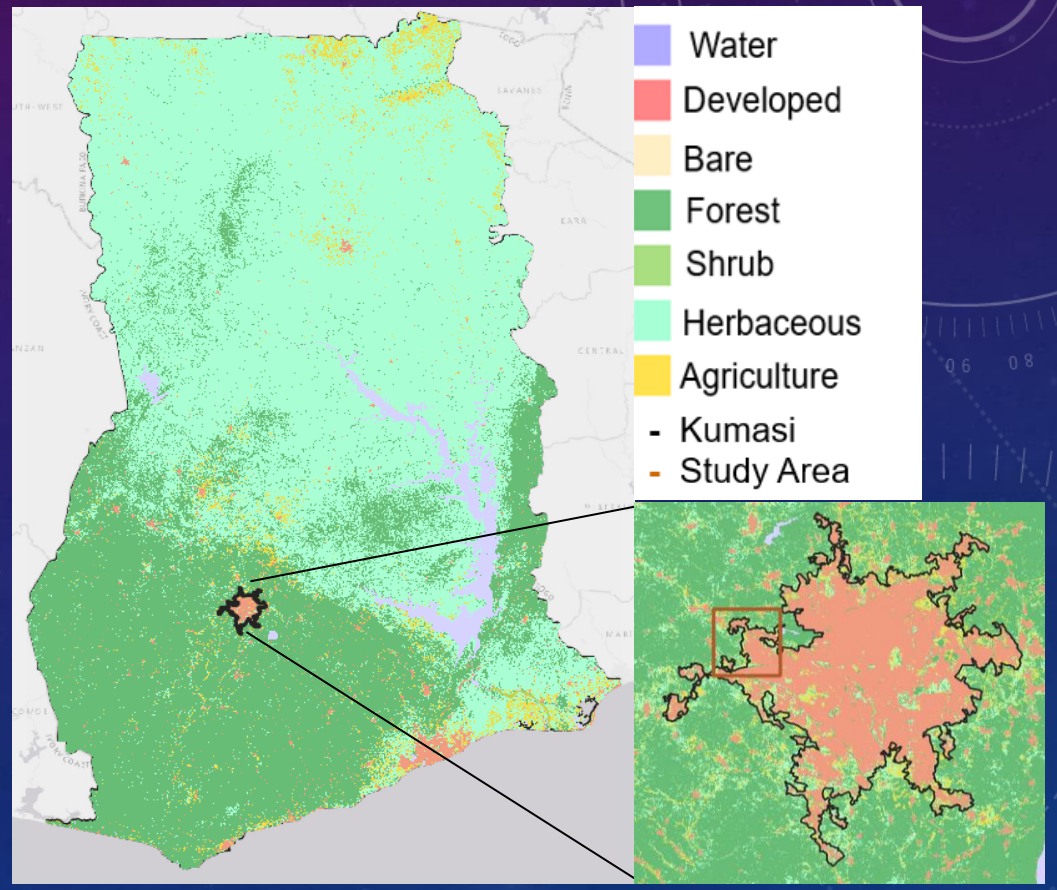
STUDY AREA AND DATASETS

Kumasi

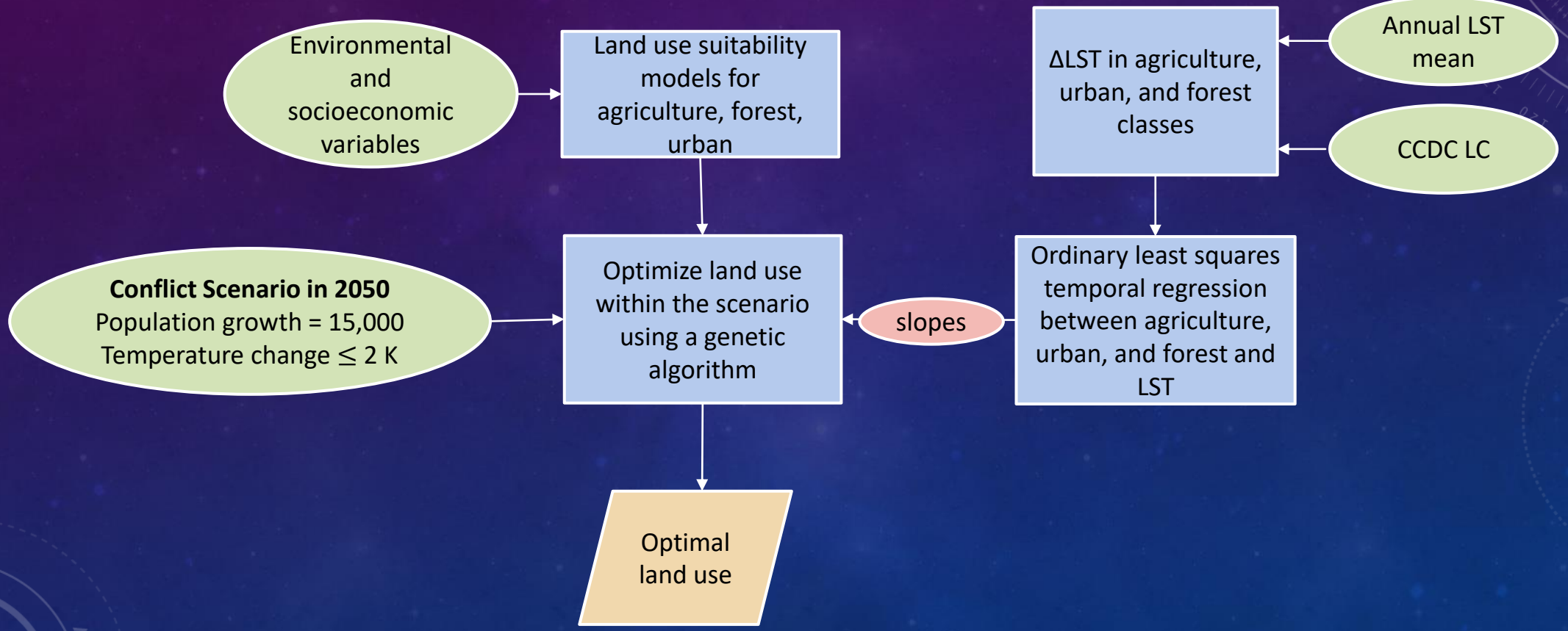
- **Time period**: 2000-2019
- **Population**: 3.6 million [5]
- **Resolution**: 250m
- **Classes of Interest**: Agriculture, Forest, Urban

Datasets

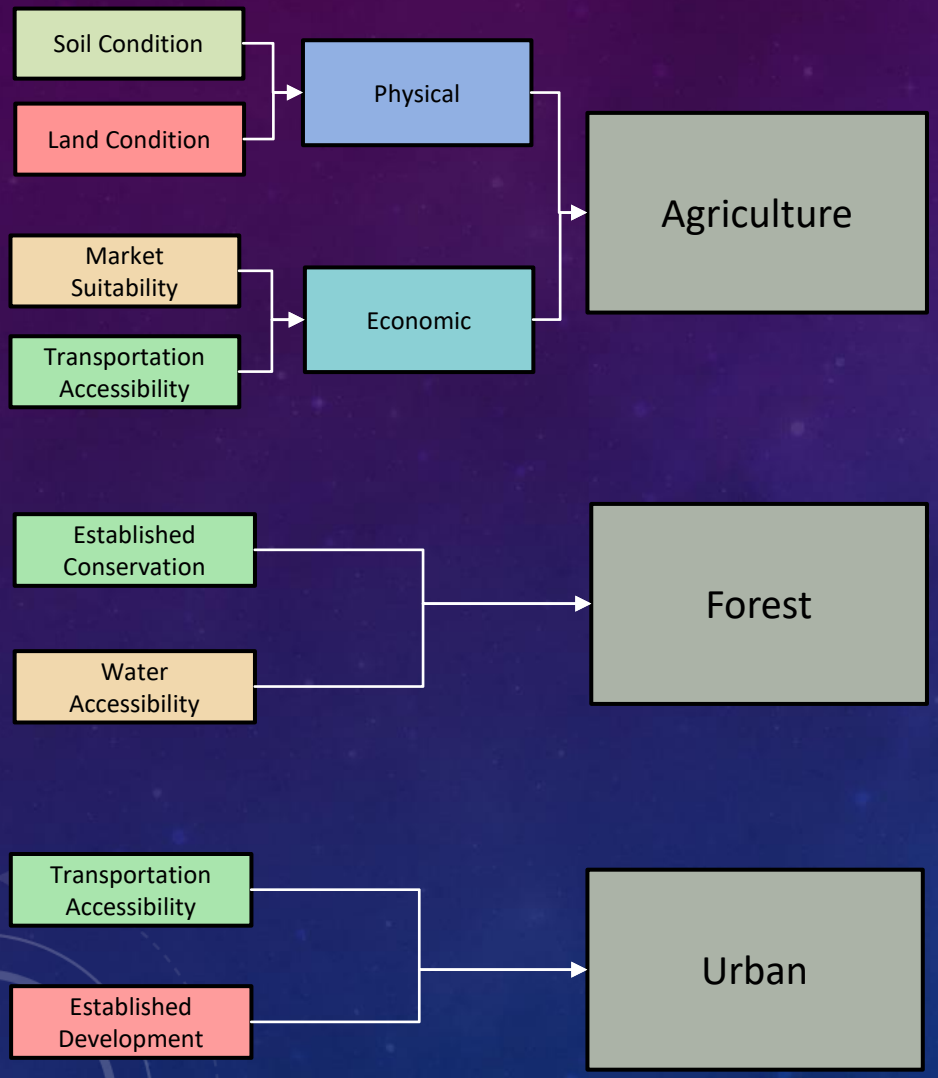
- MODIS land surface temperature (LST)
- GLanCE land cover (LC)
- Soil condition
- Conservation
- Development

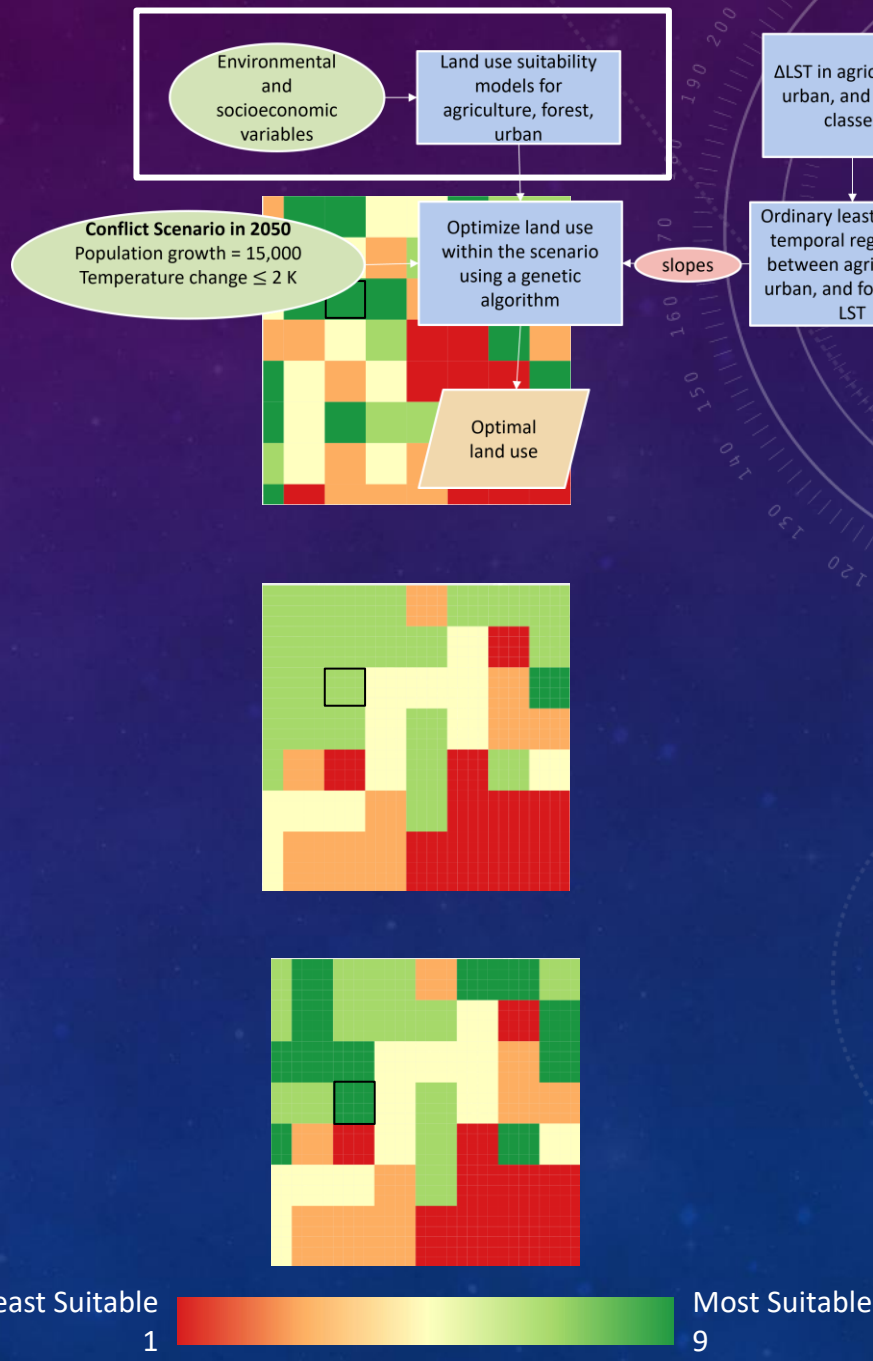


INTEGRATION OF REMOTE SENSING WITH SUITABILITY ANALYSIS



LAND USE SUITABILITY MODELS





LAND USE CONFLICT

A	F	U
7	4	7

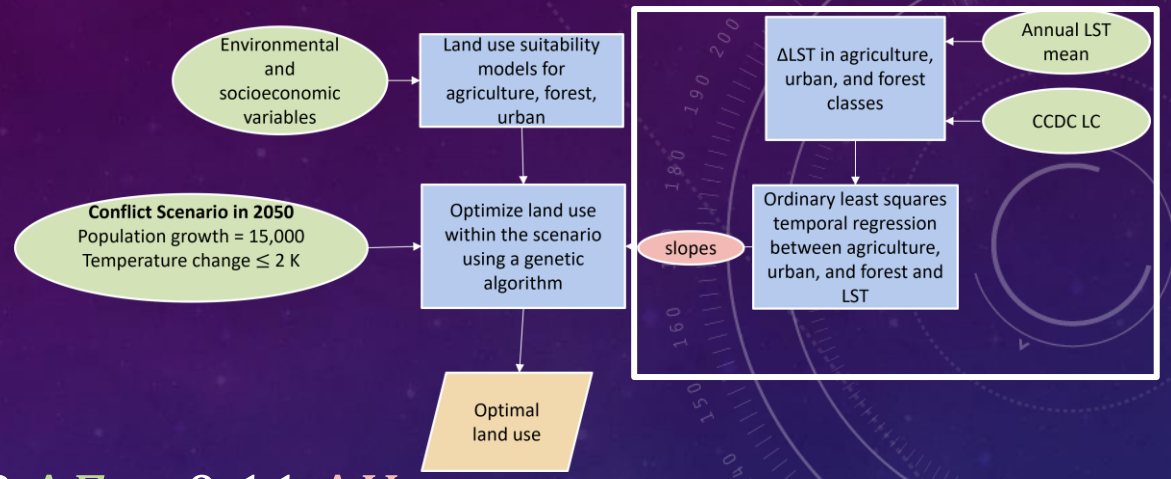
Suitability values

3	2	3

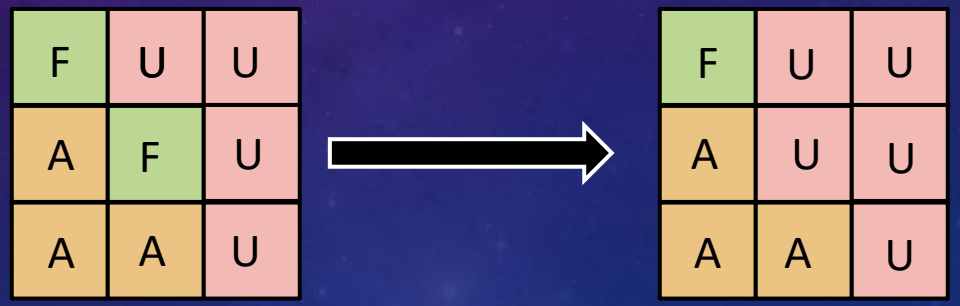
Land use preferences: low (1), medium (2), high (3)

Conflict $= norm * frequency = \sqrt{3^2 + 2^2 + 3^2} * 2 =$ **9.38**

ORDINARY LEAST SQUARES (OLS) REGRESSION

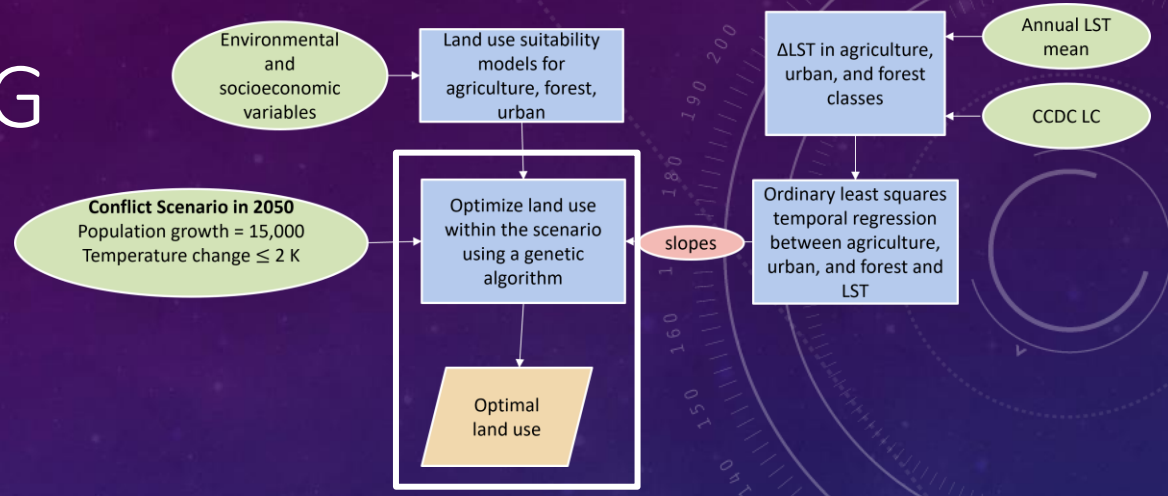


$$\Delta \boldsymbol{LST} = 0.06\,\Delta A - 0.03\,\Delta F + 0.11\,\Delta U$$



$$\Delta \boldsymbol{LST} = 0.06(0) - 0.03(-1) + 0.11(1) = \mathbf{0.41\ K}$$

INTEGRATION OF REMOTE SENSING AND LAND USE SUITABILITY



A F U

$$\begin{pmatrix} 7 & 4 & 7 \end{pmatrix}$$

Suitability values

$$\begin{pmatrix} 3 & 2 & 3 \end{pmatrix}$$

Suitability categories: low (1), medium (2), high (3)

Optimize the conflict using 5,000 iterations of a genetic algorithm to minimize the total fitness.

$$conflict\ fitness = \left(\frac{conflict - \min conflict}{\max conflict\ - \min conflict}\right)^4$$

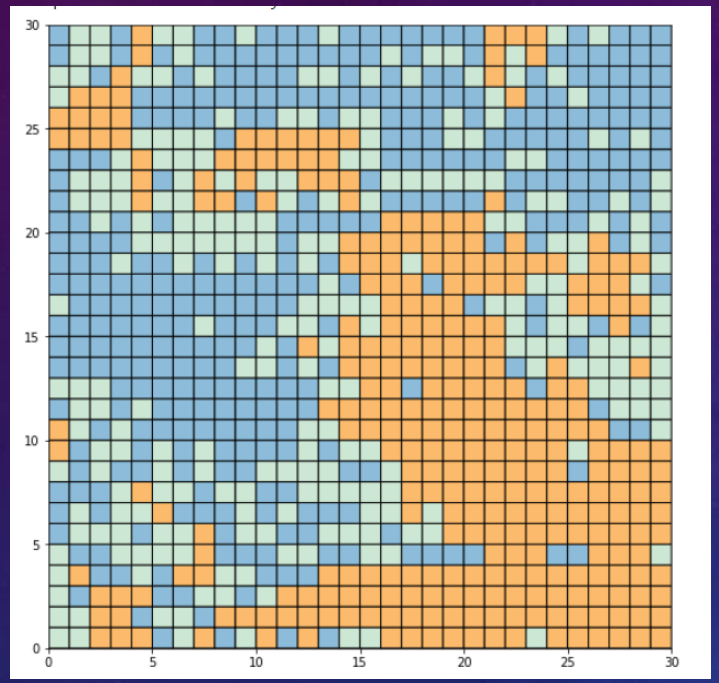
$$temperature\ fitness = (target\ \Delta LST - \ \Delta LST)^2$$

$$population\ fitness = (target\ \#\ urban\ pixels\ - \#\ urban\ pixels)^2$$

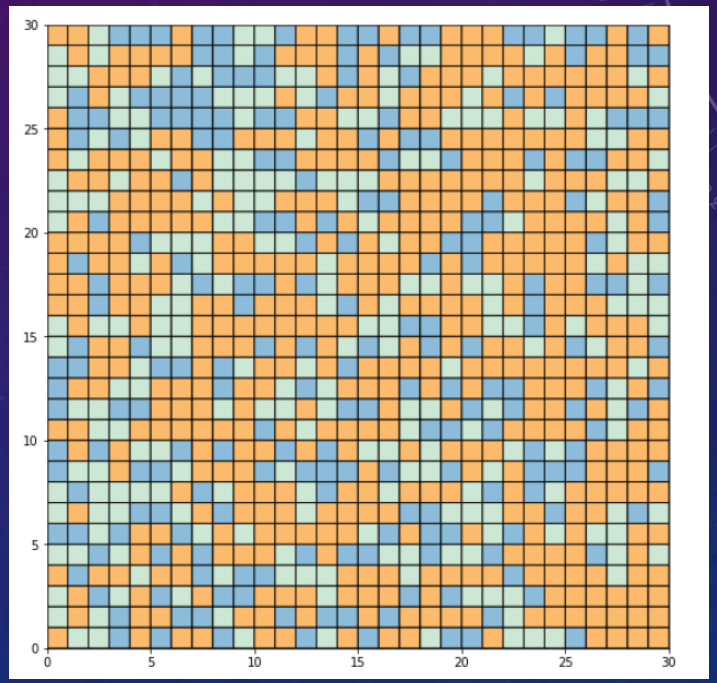
Conflict $= norm * frequency = \sqrt{3^2 + 2^2 + 3^2} * 2 =$ **9.38**

OPTIMIZATION RESULTS

- Urban
- Forest
- Agriculture



initial fitness: 20170.6



optimized fitness: 7.0

SUMMARY

Remote sensing offers a novel method for optimizing land use decisions through integration with land use suitability models.

- Land use Discontinuity
  - Additional constraints
- Trial Area Size
  - High Performance Computing (HPC)

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