SPATIAL DYNAMICS OF AGRICULTURAL LANDS IN REGIONS WITH HIGH PRESSURE LAND USE CHANGE (Case Study of Purwakarta Regency)

- Irman Firmansyah
- Dewi Nurhayati Yusuf
- Agustin Betty Arumasmawati

LoCARNet 7th Annual Meeting Program



System Dynamics Center

Center for Internasional System Dynamics Research

Universitas Haluoleo - Kendari

Background

Rapid development has caused changes in land use patterns

The conversion of paddy fields into non-paddy fields continues to increase and it can threaten the stability of food security in the future

Rice field is a producer of staple food for the people of Indonesia therefore it must be maintained and utilized for the welfare of the community

Paddy fields have a wider function, including maintaining the stability of hydrological functions of watersheds (DAS) and reducing erosion

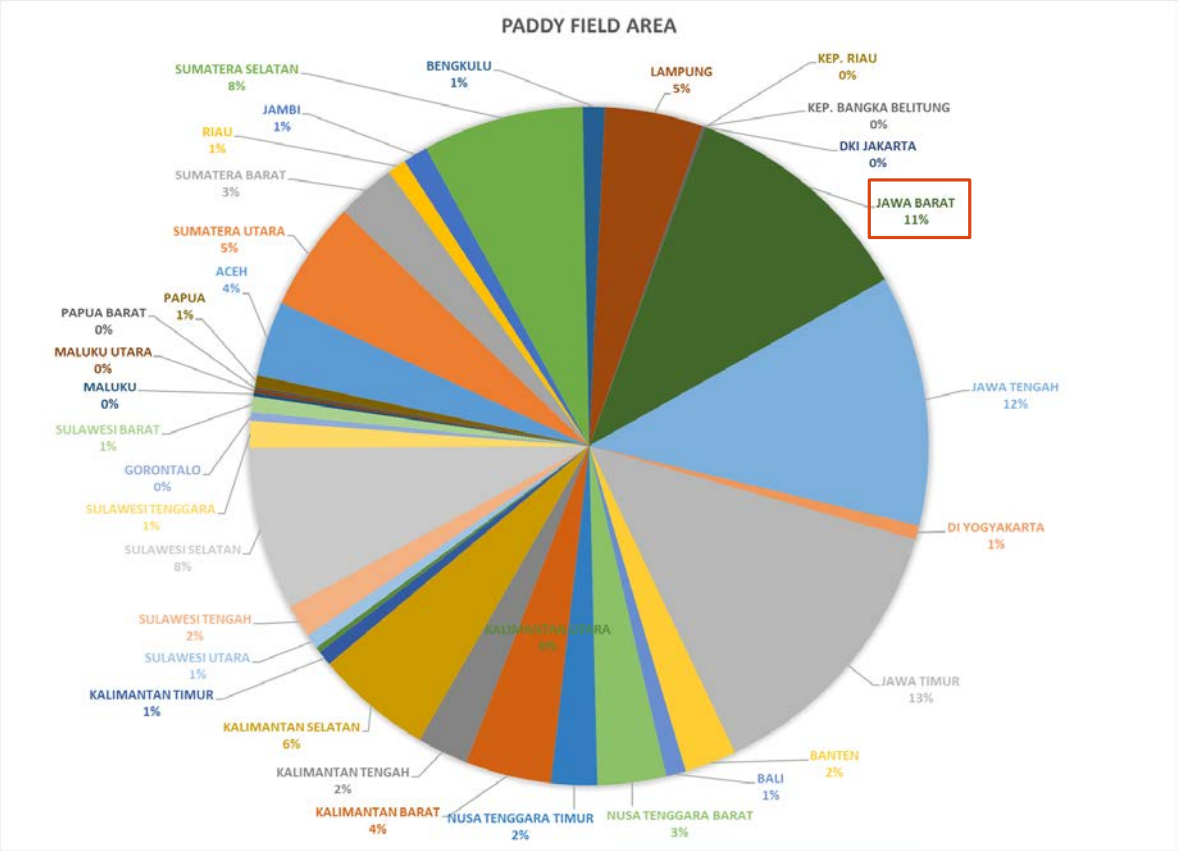
The uncontrolled land use change can threaten food supply capacity, even in the long term it could be a social and national disaster

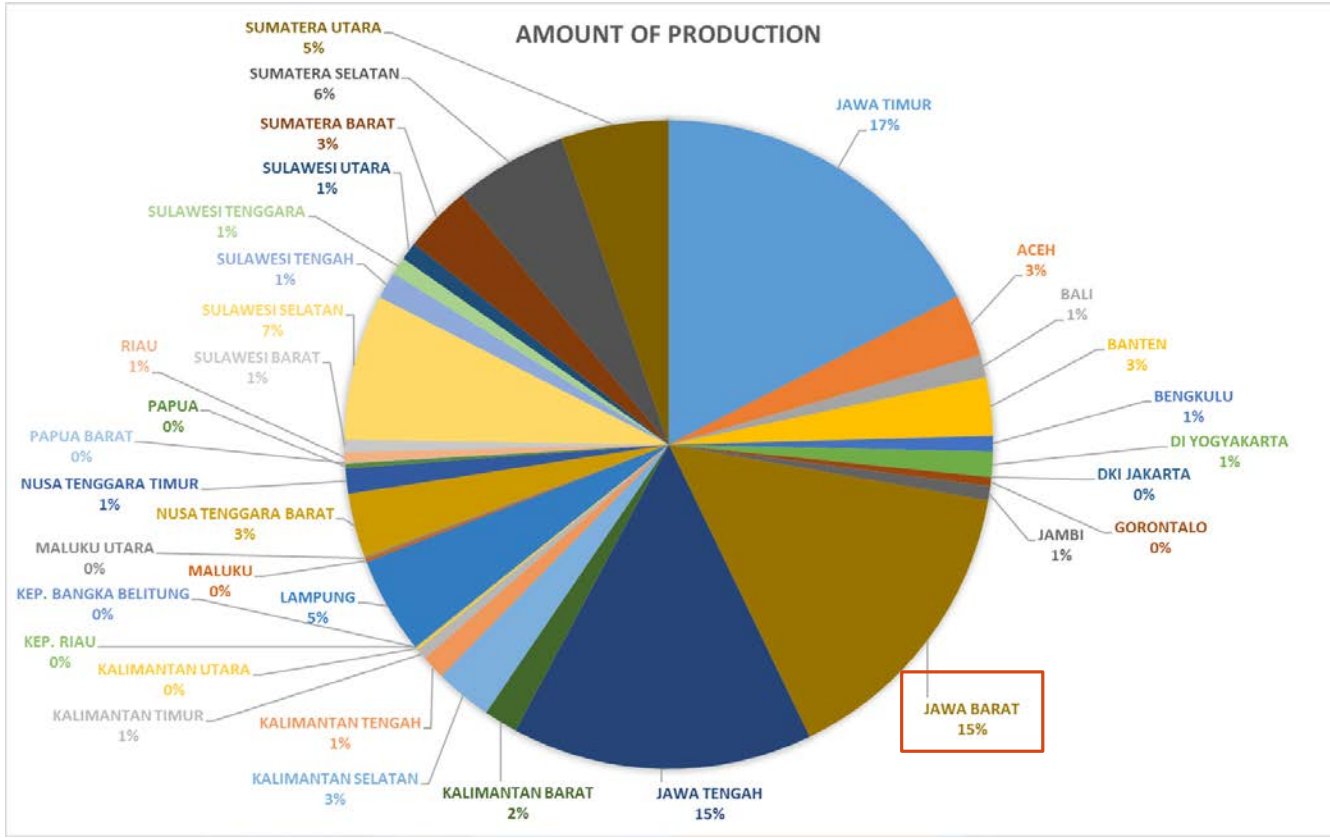
The Purwakarta Regency area is about 97,172 ha, which 62,398 ha of Purwakarta regency are part of the Citarum watershed area which has high pressure on agricultural land, especially rice fields.

At present and in the future, paddy fields will continue to experience pressure from various factors such as population growth and pressures on the livelihoods of farmers that cause rice fields to be traded

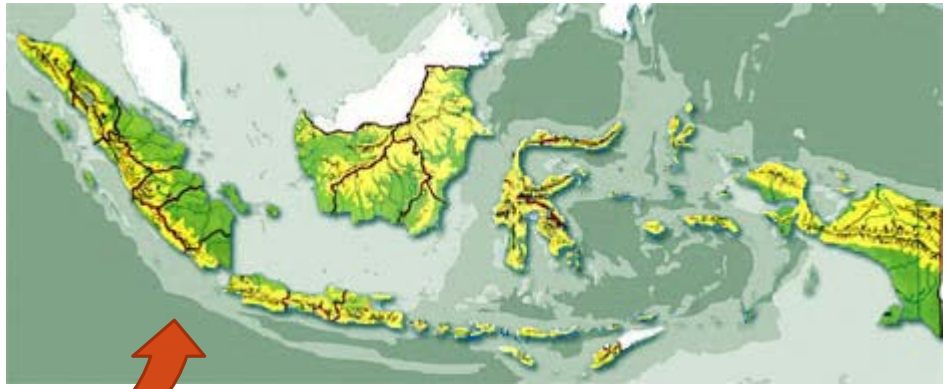
This study aims to look at changes in paddy fields from other land use pressures and formulate policy solutions on land conversion control

Background


PADDY FIELD AREA
SUMATERA SELATAN 8%
BENGKULU 1%
LAMPUNG 5%
KEP. RIAU 0%
KEP. BANGKA BELITUNG 0%
DKI JAKARTA 0%
JAMBI 1%
RIAU 1%
SUMATERA BARAT 3%
JAWA BARAT 11%
SUMATERA UTARA 5%
ACEH 4%
PAPUA 1%
PAPUA BARAT 0%
MALUKU UTARA 0%
MALUKU 0%
SULAWESI BARAT 1%
GORONTALO 0%
SULAWESI TENGGARA 1%
SULAWESI SELATAN 8%
JAWA TENGAH 12%
DI YOGYAKARTA 1%
JAWA TIMUR 13%
BANTEN 2%
BALI 1%
NUSA TENGGARA BARAT 3%
NUSA TENGGARA TIMUR 2%
KALIMANTAN BARAT 4%
KALIMANTAN TENGAH 2%
KALIMANTAN SELATAN 6%
KALIMANTAN TIMUR 1%
SULAWESI UTARA 1%
SULAWESI TENGAH 2%
KALIMANTAN UTARA 3%


AMOUNT OF PRODUCTION
SUMATERA UTARA 5%
SUMATERA SELATAN 6%
SUMATERA BARAT 3%
SULAWESI UTARA 1%
SULAWESI TENGGARA 1%
SULAWESI TENGAH 1%
SULAWESI SELATAN 7%
SULAWESI BARAT 1%
RIAU 1%
PAPUA 0%
PAPUA BARAT 0%
NUSA TENGGARA TIMUR 1%
NUSA TENGGARA BARAT 3%
MALUKU UTARA 0%
MALUKU 0%
KEP. BANGKA BELITUNG 0%
KEP. RIAU 0%
KALIMANTAN UTARA 0%
KALIMANTAN TIMUR 1%
KALIMANTAN TENGAH 1%
KALIMANTAN SELATAN 3%
KALIMANTAN BARAT 2%
JAWA TENGAH 15%
JAWA BARAT 15%
JAWA TIMUR 17%
ACEH 3%
BALI 1%
BANTEN 3%
BENGKULU 1%
DI YOGYAKARTA 1%
DKI JAKARTA 0%
JAMBI 1%
GORONTALO 0%
LAMPUNG 5%

DAS Citarum Constribution for Indonesia (Production)



16,89%
•DAS Citarum for West Java

16,95%
•West Jawa to Indonesia

2017

Convertion

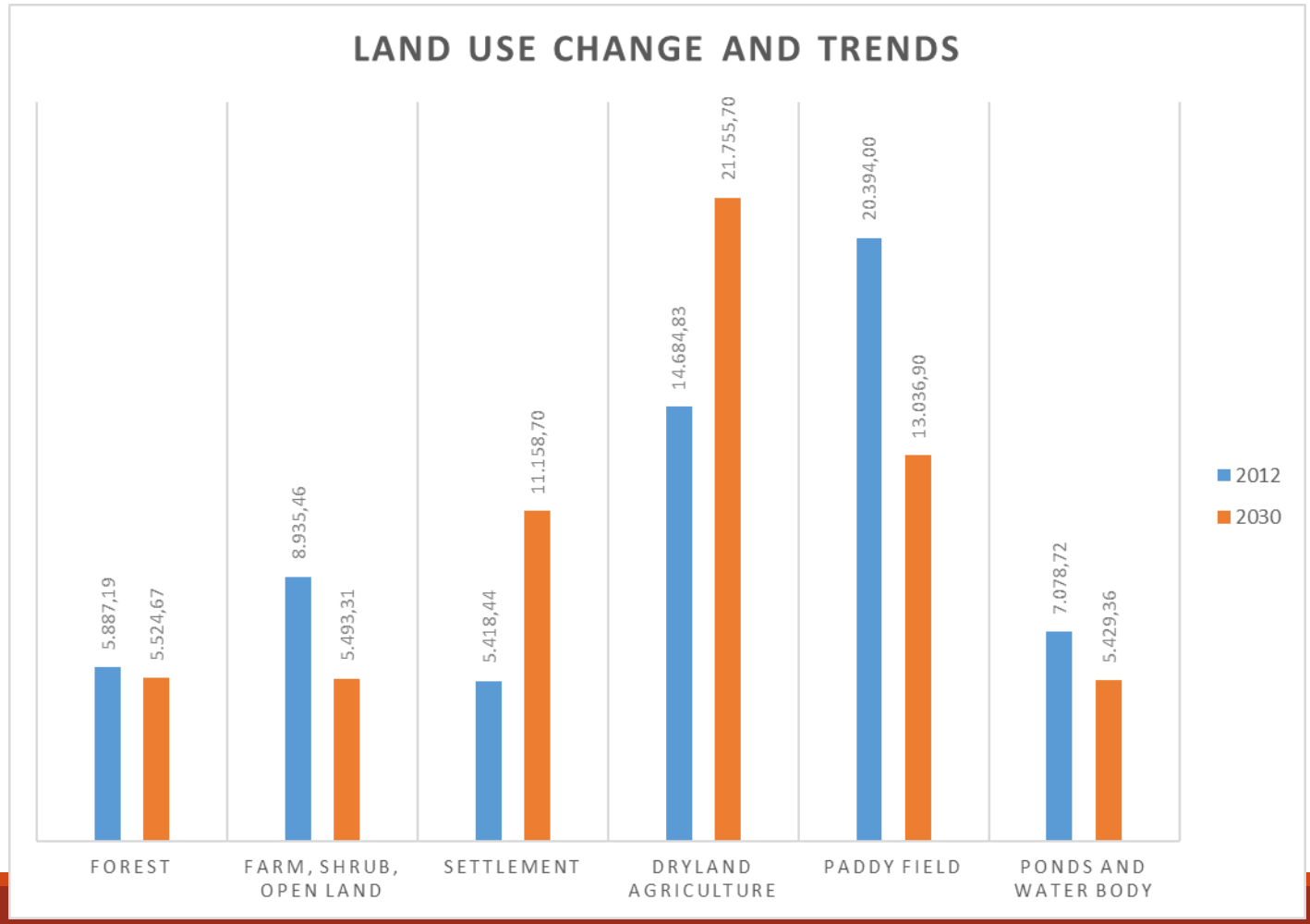
Extensifivation

•High pressure Landuse Change in West Java

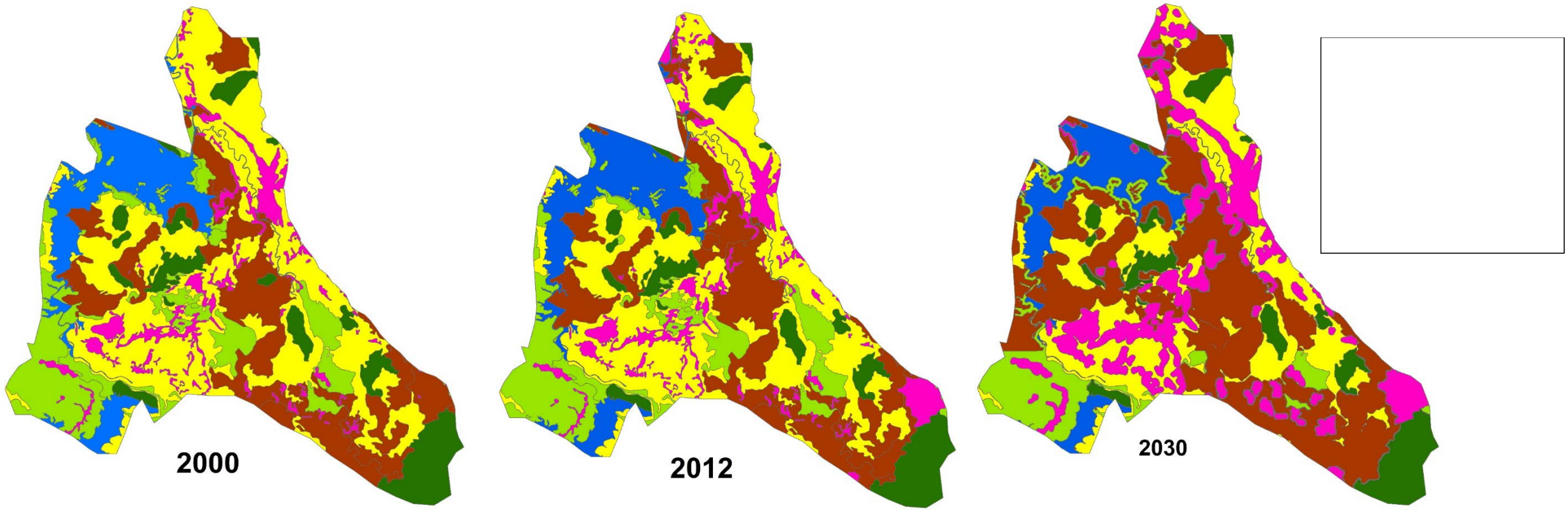
Methods

Spatial Analysis	• A spatial approach was used by digitizing the map of Purwakarta Regency land use which is included in the Citarum watershed area. • Spatial analysis was carried out using ArcGIS software to see changes in land use in the study area.
Spatial Dynamic	• Spatial dynamics analysis was conducted to predict land use area in 2030 and predict the variables of food sufficiency and economic value to prevent temperature increase, using Powersim Studio and TerrSet software
Micro Climate Improvement	• Calculation of prevention of increase in temperature was using the results of the calculation of the average change in paddy fields into settlements, the average use of cooling in housing and the comparison of the results of the economic valuation calculation.

Analysis of Land Use and its Trends



Changes in Land Use in 2000, 2012 and 2030

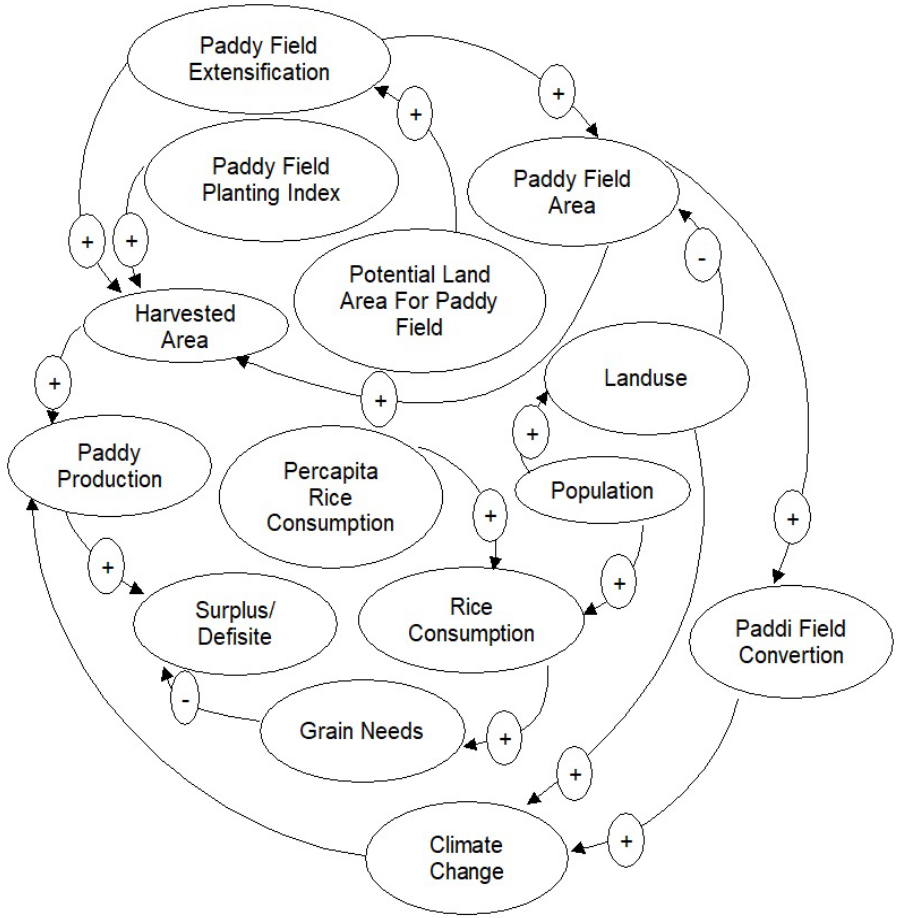


System Dynamics in Food Security in Purwakarta Regency

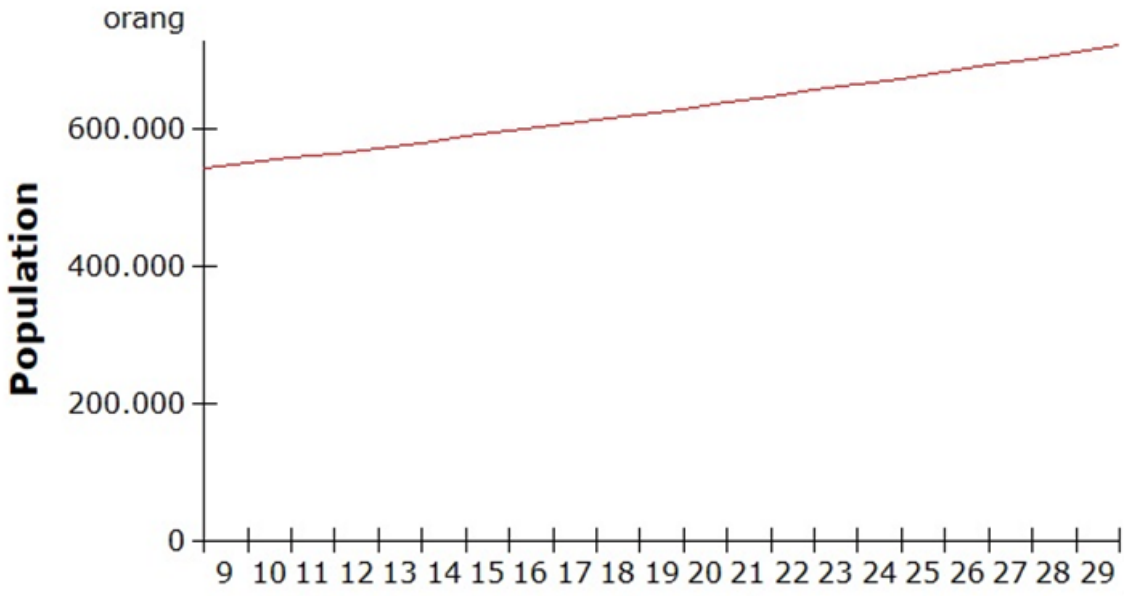
Causal loops were used to look at the relationships between variables that affect changes in land use paddy fields in Purwakarta Regency.

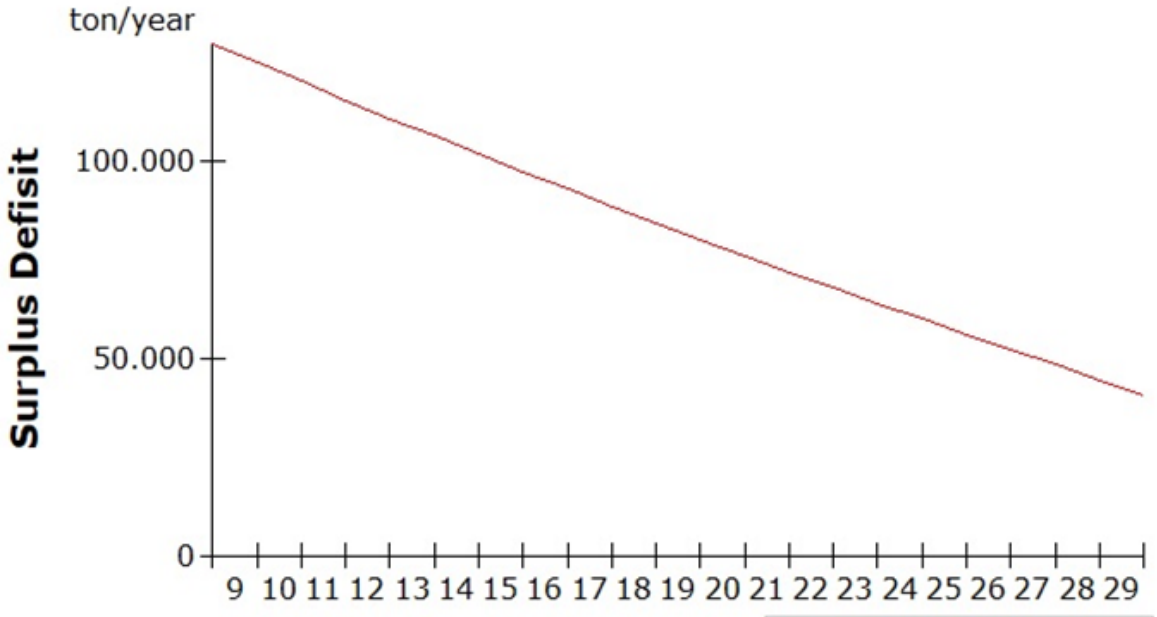
Agricultural lands, especially paddy fields, will experience pressures to be converted due to increasing of population from year to year, so that the needs of residential land will also increase

Another rise in growth is the increase in clothing, food and shelter needs, so that regional economic activities will emerge which lead to increased road networks and increased land rent

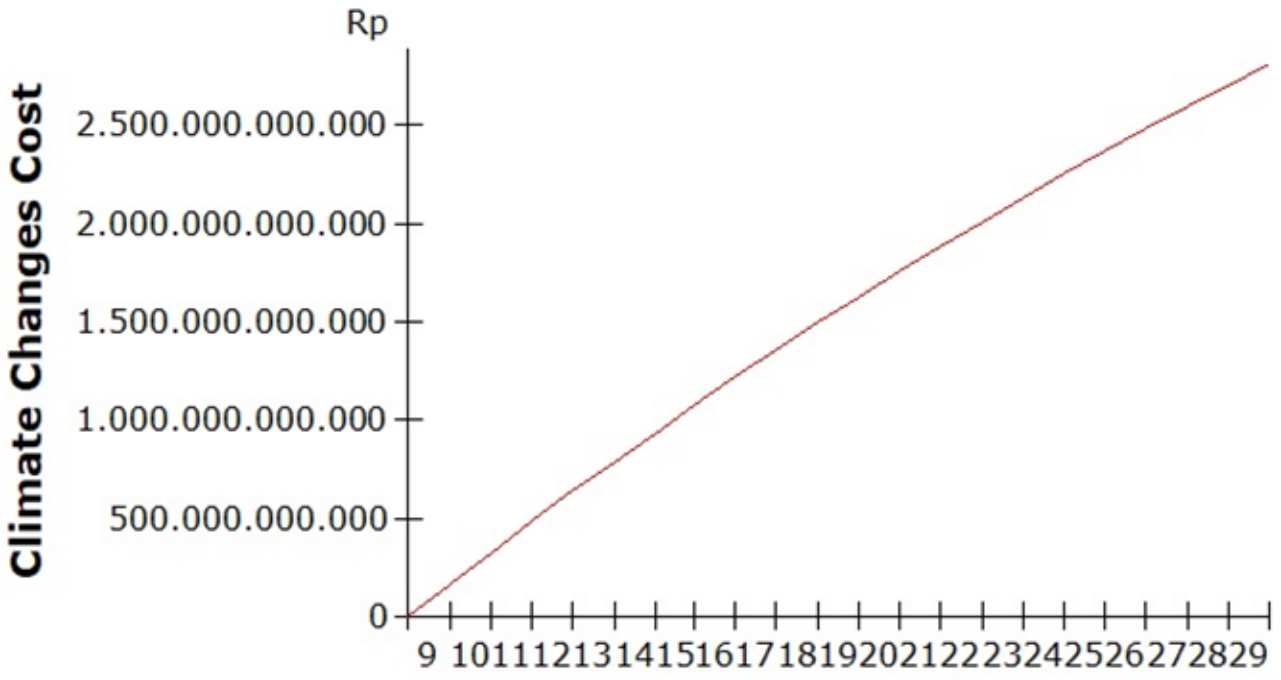


System Dynamics in Food Security in Purwakarta Regency





Micro Climate Improvement as Environmental Services in Convertible Paddy Fields



The conversion of paddy fields per hectare where the assumption of changes in paddy fields into settlements will lead to an increase in microclimate so that the need for a cooling process in the settlements built in paddy fields with an average preventive value of temperature is Rp. 383,445,866 per ha, so that with the loss of paddy fields covering an area of 8,668.21 ha from 2009 to 2030, it will have an economic value to prevent an increase in local temperature of Rp. 2,812,240,804,033 (Firmansyah, 2016)

The direction of Policy Strategy for Paddy Fields Conversion Control Model

Spatial Assertiveness as a Long-Term Paddy Field Management Concept	• Government support in the long run is very important so that the operation of government LP2B is based on empowering farmers. • Planning with a focus on farmers' needs is a priority so that protected paddy fields are sustainable.
Paddy Field Protection through the Establishment of Government LP2B Institutions	• The community continues to manage it as a land of livelihood with all conditions being the responsibility of the manager because the results obtained are indeed for managing farmers. • The implementation of the policy of protecting paddy fields, among others, can be proposed with the implementation of the land banking system.
Utilization of Waste as Added Value	• Policy directives for mainstreaming regional economic development need to be synchronized with the aim of meeting farmers' needs, as well as more directed at optimizing agricultural products and developing derivative products. • Improving the welfare of farmers through the use of waste is expected to contribute to reducing the conversion rate of paddy fields.

Conclusion

Conversion of paddy fields in Purwakarta Regency between 2012 - 2030 is quite significant, the decreased of paddy fields by 36.07%, whereas land use that has increased is settlements of 105.94% and dryland agriculture of 48.15%

The supply of food needs still has a surplus even though it has decreased from 2017 with a surplus of 92,973 tons and in 2030 it will become a surplus of 40,824 tons

Increasing the temperature of the microclimate as an environmental service for paddy fields, the loss of paddy fields from 2009 to 2030 covering an area of 8,668.21 ha would have an economic value in preventing an increase in local temperature of Rp. 2,812,240,804,033

THANK YOU

Correspondency :
Dr. Irman Firmansyah, M.Si
E-mail : irman_f@yahoo.com; Phone : +62 815 83 600 15

SYSTEM DYNAMICS CENTER
www.sistemdinamik.com