# Section 4: Weather System – Extension Documentation

## 1. Introduction

The Weather System was added as a big improvement to base functions in Section 4 of the SimFarm project. Random nature-based threats are added by this feature to make it more like real-life farming situations, such as storms, droughts, and crop plagues. The Weather System was made to improve the depth and complexity of the simulation while also meeting the project requirements for unique functionality, which was worth 15% of the total grade.

## 2. Purpose and Design Goals

The Weather System's main job is to change the conditions of game fields and the growth of crops by using random natural factors. Random effects will force players to deal with things that don't go as planned, which will push them towards smart resource management.

The system fulfills the purpose through implementation of these features:

* Policymakers have isolated this subsystem from core gameplay elements yet they made it possible to trigger after every player action within the Farm.run() loop.
* The Farm.run() loop triggers the system execution following every move of the players.
* The implementation remains unobtrusive to existing Sections 1 through 3 code within the game.
* Easily extendable for future development (e.g., seasonal changes, crop insurance)

## 3. Implementation

The Weather System is implemented as a separate class called WeatherSystem, which has methods for changing the weather conditions of Field objects. The solution didn't need many changes to the code in the weatherSystem. The call to triggerWeather(field) that came after field.tick() in the game loop.

The weather system picks random events that change the field area and what's in it in certain ways. Three events can happen with this system:

* In the Flood **event Soil** tiles randomly transform into unplantable Weeds thus reducing the planting area.
* The **drought** event elevates the maturation age of all food items which results in delayed farm productions.
* The **plague** event causes the destruction of all food items which results in their replacement by untended fields.

The programme shows these affects right away during gaming, both on the machine and through pictures on the field.

## 4. Integration and Compatibility

The makers added the Weather System to the main game without changing how past sections worked after they were finished. The integration happens on its own, and it doesn't change features that have already been tried, like how long an item lasts, how to plant and collect crops, or how to make a report.

This compatibility was verified through:

* Isolated testing in Marker.java using a test Field
* Interactive gameplay testing within Farm.run()

At the end of each turn, weather effects are applied automatically, before the software sends them through specific command messages (e.g., "🌊 Flood triggered!").

## 5. Gameplay Impact

Adding weather events to the game makes the conditions more uncertain, which makes the game more difficult. The gamers need to think about both how they farm and how their games might affect the environment. The difficult method correctly shows the risks that farmers face in their farming operations, forcing them to come up with ways to change.   
The game is more fun because weather events change how the game is played every time a new session starts, based on how often they show up.

## 6. Future Enhancements

The Weather System is built with flexible parts that make it easy to add on. Possible improvements in the future include:

* The system design supports additional event addition like Fire alongside Winter Frost.
* Introducing player choices (e.g., purchase crop insurance)
* Implementing weather forecasting tools
* Weather effects within the simulation will differ depending on the seasonal cycle which is dynamically generated.

These add-ons would work on top of the current game features and wouldn't change how they work.

# Conclusion

In conclusion, the Weather System has a well-thought-out feature that meets the specific needs of the task. The system adds new challenges while also making the game play better. It does this by using a flexible structure that works well and integrating worship growth and game features. This improvement makes the game scenario more fun while still staying true to the game's main goals.