Modeling and simulating the socio-ecological system of the rivers of South Korea.

Insta Innovación, S.C.

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Storytelling & Learning Lab

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"Resilience and Sustainability in a Changing World"

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Simulate on iPad, Android and cell pone
https://exchange.iseesystems.com/public/instainnovacion/rivers-of-south-korea/index.html

March 15, 2019

Video https://youtu.be/VDZuQ9mq7c8

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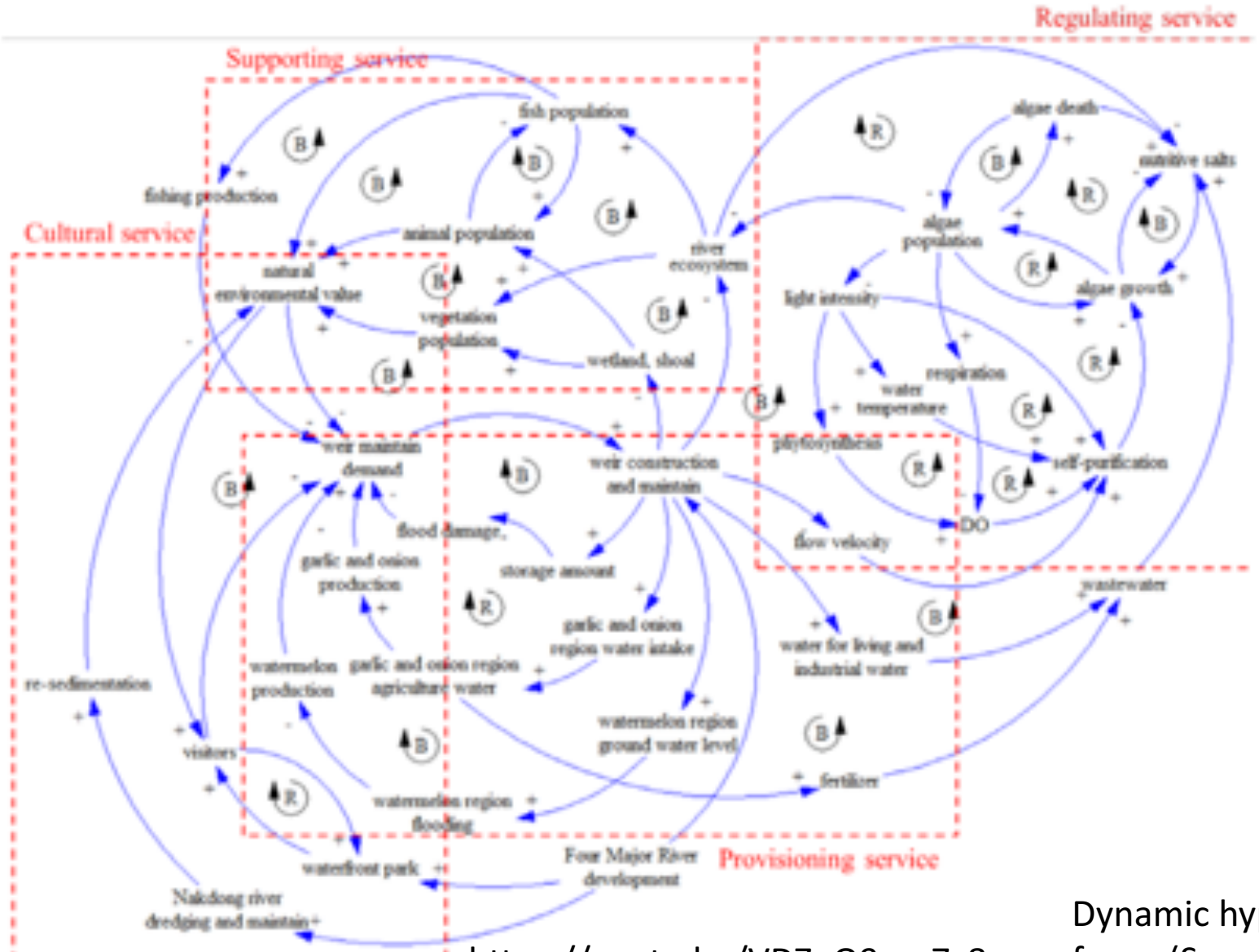
Abstract

This time we start with a powerful hypothesis developed by a group of researchers from South Korea, to intervene an ecosystem of complex rivers in their country, on which depends the sustainable development of their community, in this hypothesis they relate the behavior of four sectors that connect the algae growth regulation service, with the care of the environment, the health of the ecosystem, wetlands and sandy areas, the population dynamics of the fish, the fishing production, the animals and the vegetation that develops in that ecosystem, that also favors the spiritual and cultural development of people, its visitor attraction parks, and the improvement of the aesthetic value of the area, and the dredging and maintenance of its rivers, and manages in a better way the maintenance and construction of dams , the management of floods and the level of groundwater in terms of balance and redundancy, water management for living Go, the water for industrial development and the use of fertilizers for your crops of watermelons, garlic and onions, as you can see, a powerful and complex real-world history, perhaps also can be seen as a national security problem, for which Social science will have to be applied for the development of policies that give light in the long-term sustainability path.

Original Hypothesis



https://youtu.be/VDZuQ9mq7c8

[Video]

Dynamic hypothesis taken from: (Song ET. AL. 2018)

Main sectors

Supporting service

Regulating service

Provisioning service

Cultural service

Regulating service

Supporting service

Regulating service

Population dynamics of algae.
Controlling algal bloom propagation

Provisioning service

Cultural service

Supporting service

Supporting service

Care or environment, river ecosystem, wetlands & shoal.

Population dynamics of fish, animals & vegetation.

Regulating service

Population dynamics of algae. Controlling algal bloom propagation

Cultural service

Provisioning service

Cultural service

Supporting service

Care or environment, river ecosystem, wetlands & shoal.

Population dynamics of fish, animals & vegetation.

Regulating service

Population dynamics of algae. Controlling algal bloom propagation

Cultural service

Development of waterfront park to atract visitors, improve aesthetic value, river dredging & maintain.

Provisioning service

Provisionin service

Supporting service

Care or environment, river ecosystem, wetlands & shoal.

Population dynamics of fish, animals & vegetation.

Regulating service

Population dynamics of algae. Controlling algal bloom propagation

Cultural service

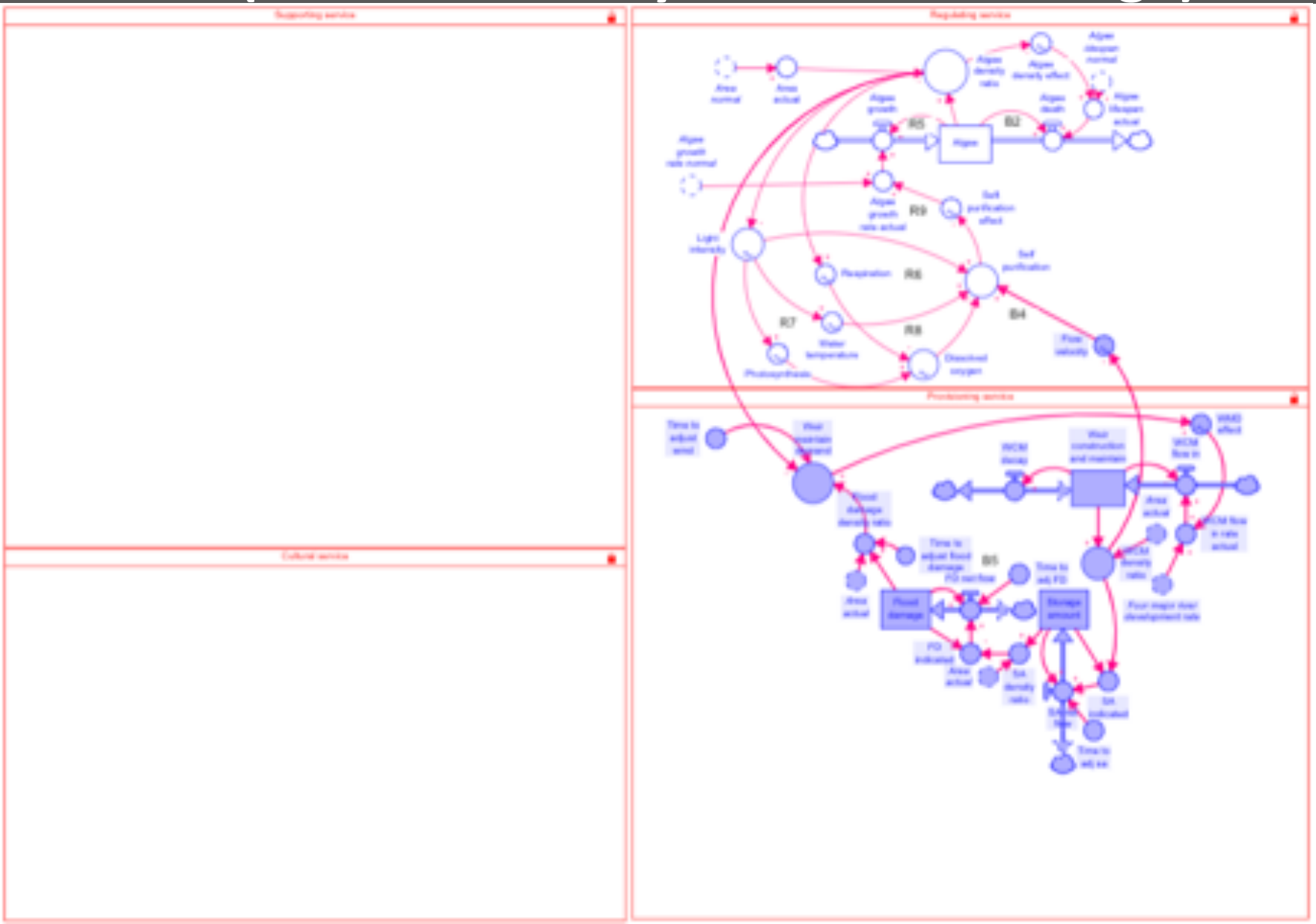
Development of waterfront park to atract visitors, improve aesthetic value, river dredging & maintain.

Provisioning service

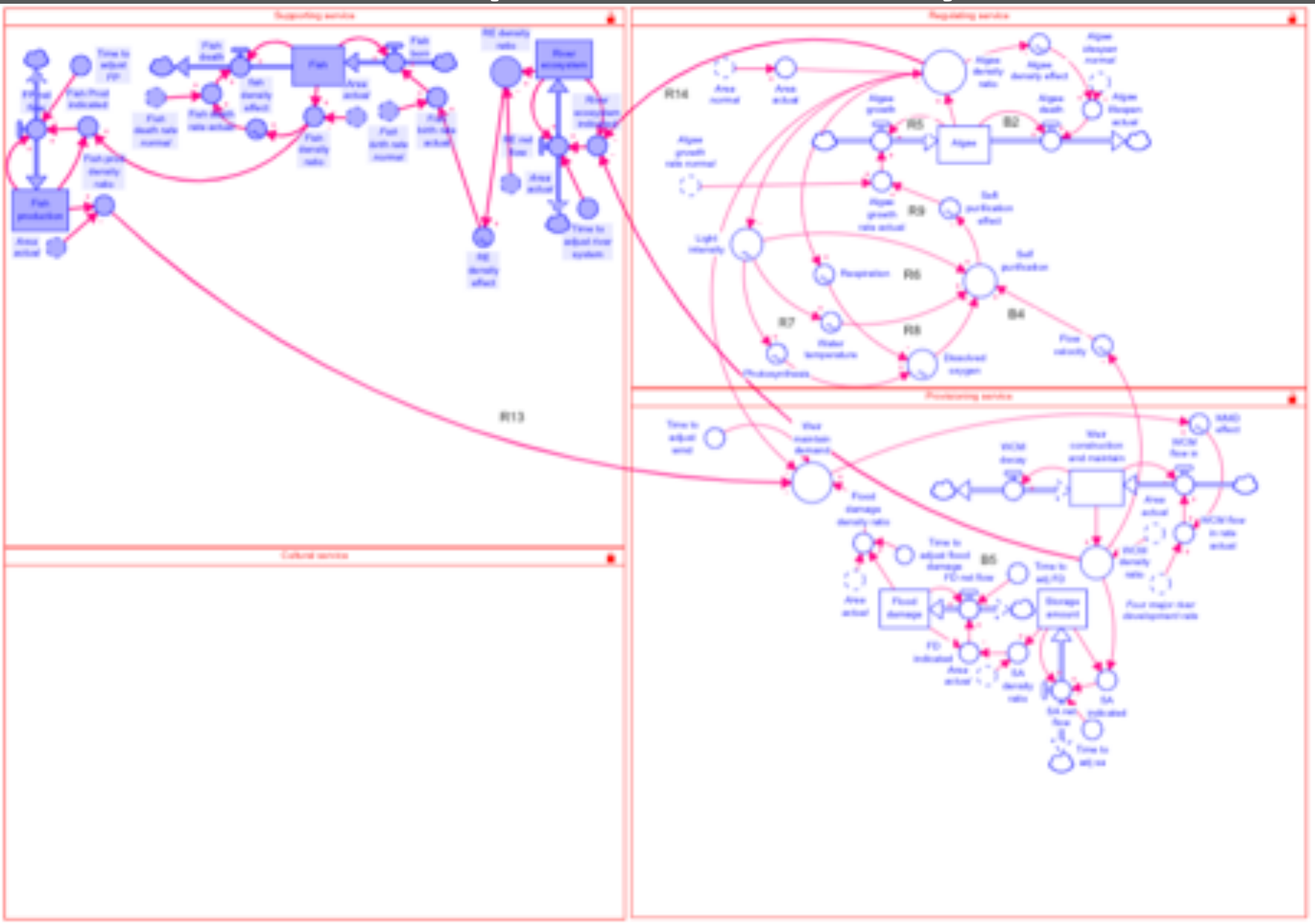
Weir construction and maintain, agricultural production, manage flooding or groundwater level in terms of balance or redundancy. Manage water for living & industrial water and use of fertilizers.

Regulating services (population dynamics for algae)

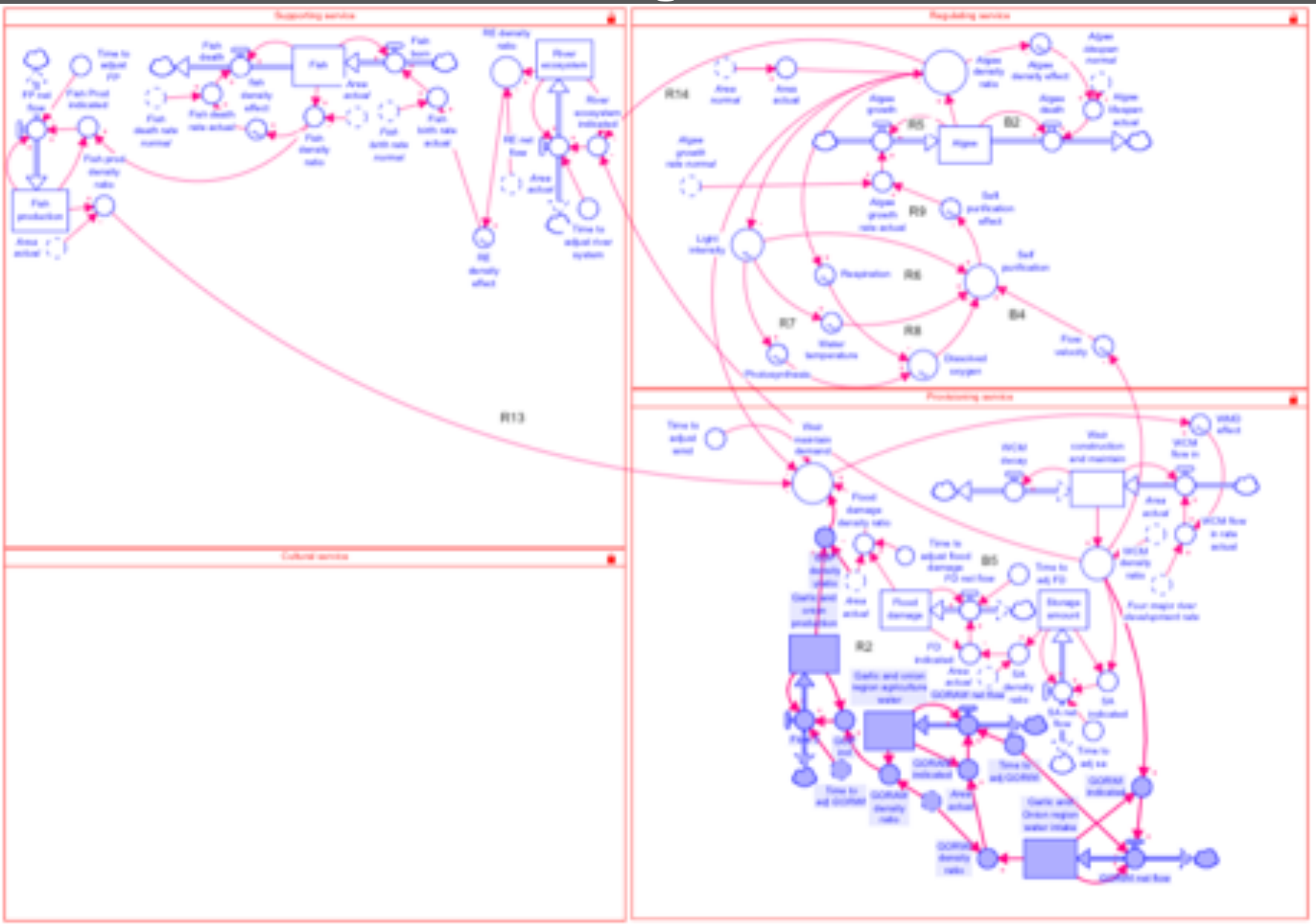
Feedback loops
(B4 flow velocity & B5 flow damage)



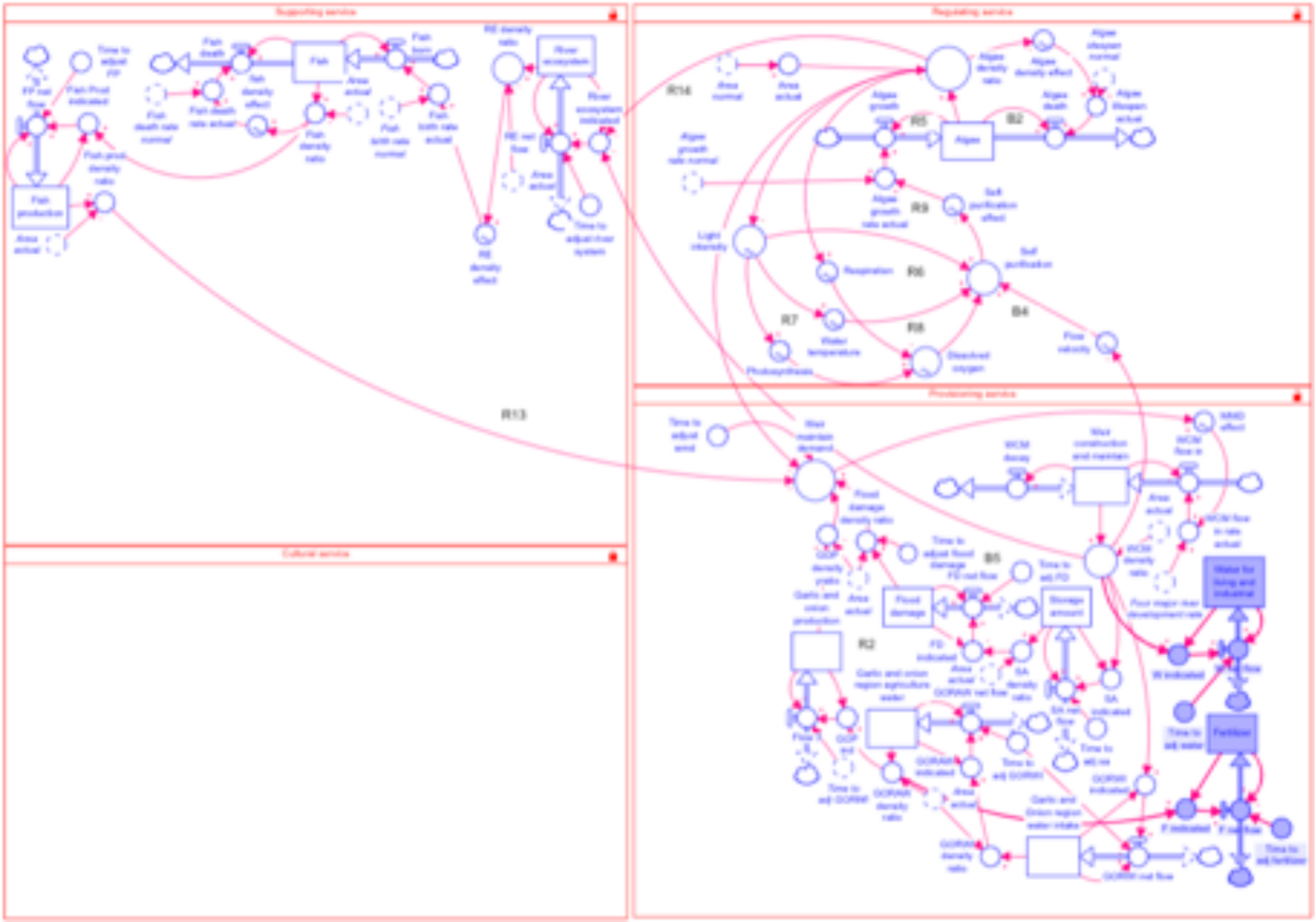
Fish population R14 & fish production R13 cycles



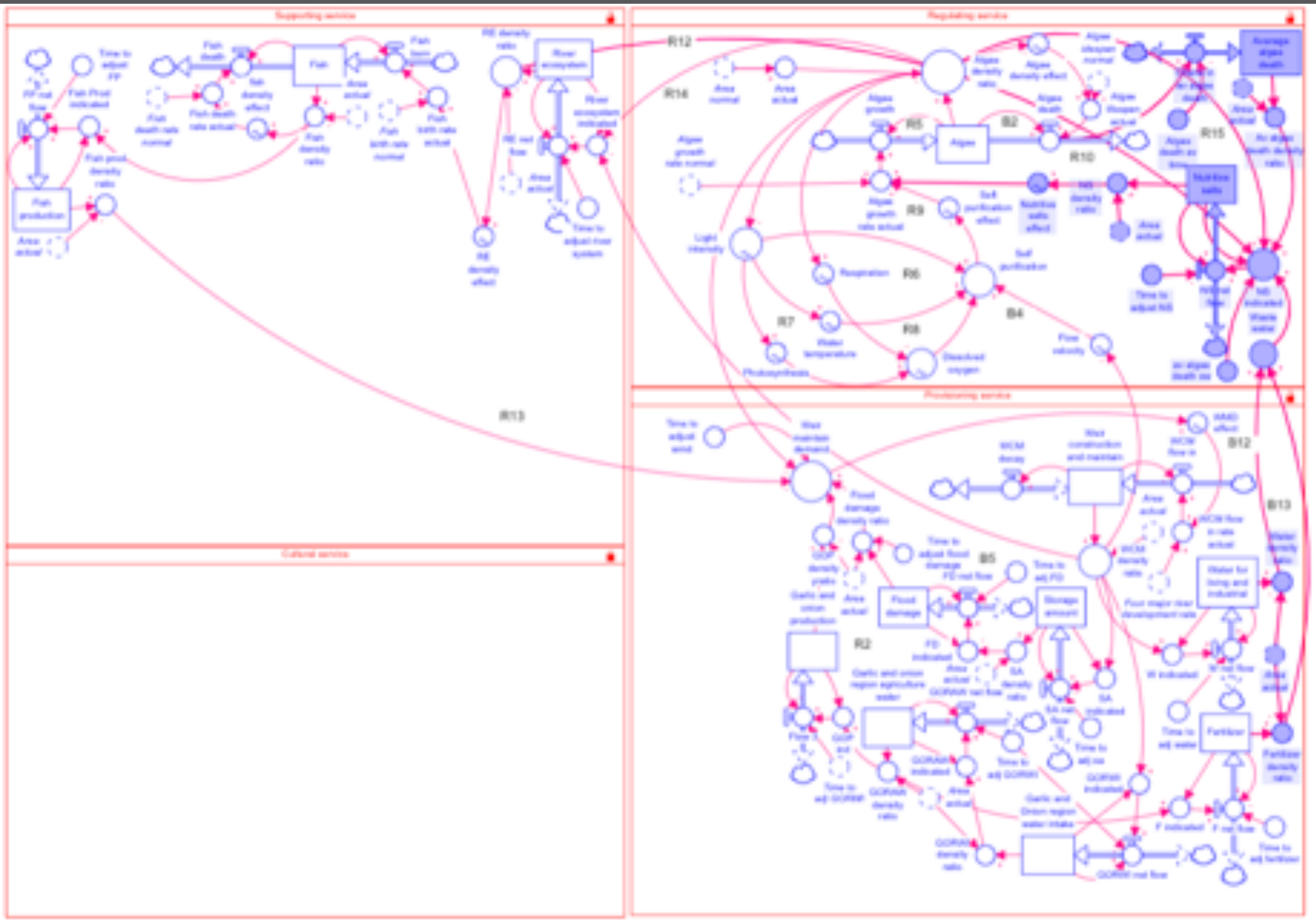
Feedback loop (R2)
to Harvest garlic and onion



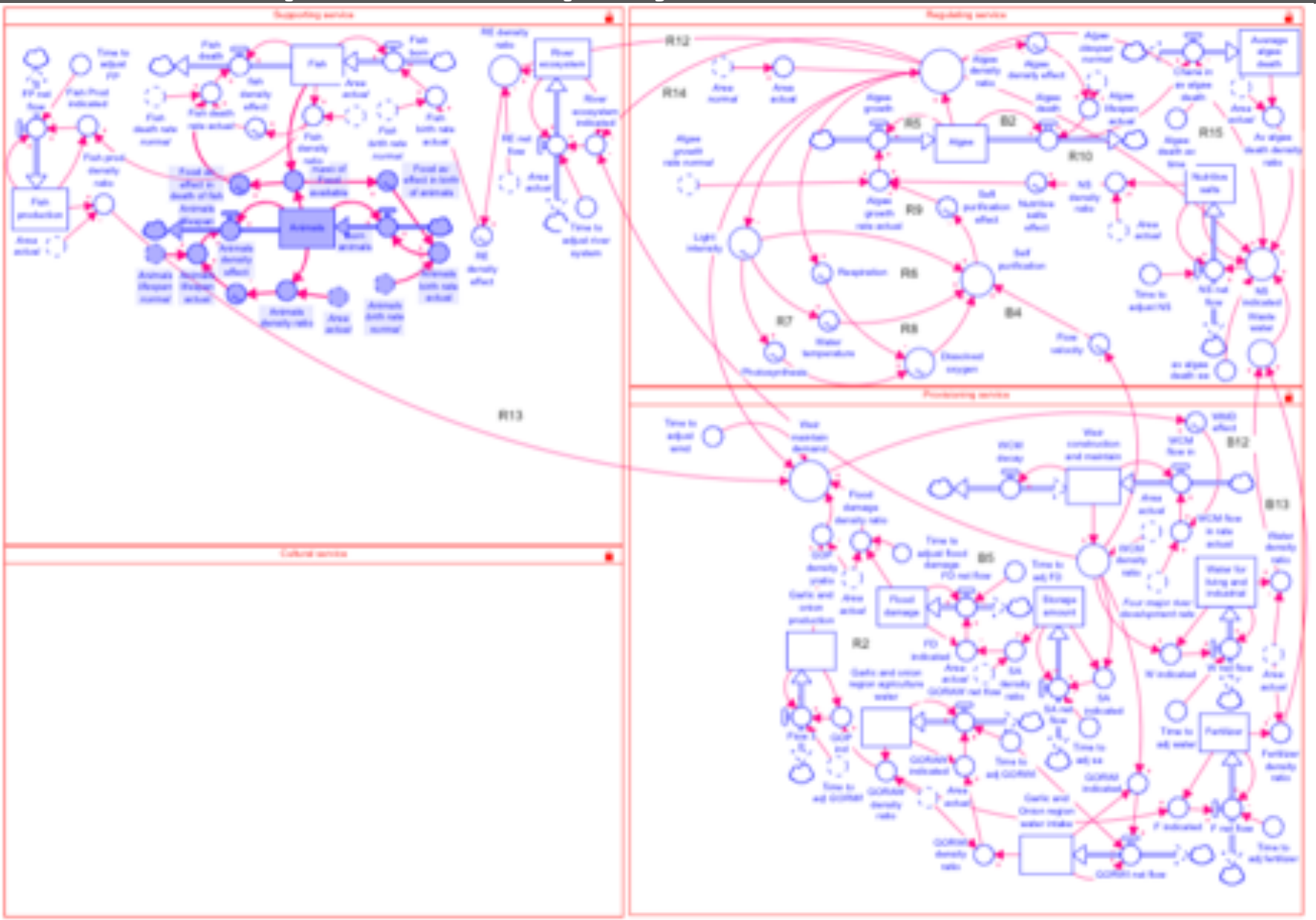
Water for living & industrial water and use of fertilizers to harvest garlic and onions



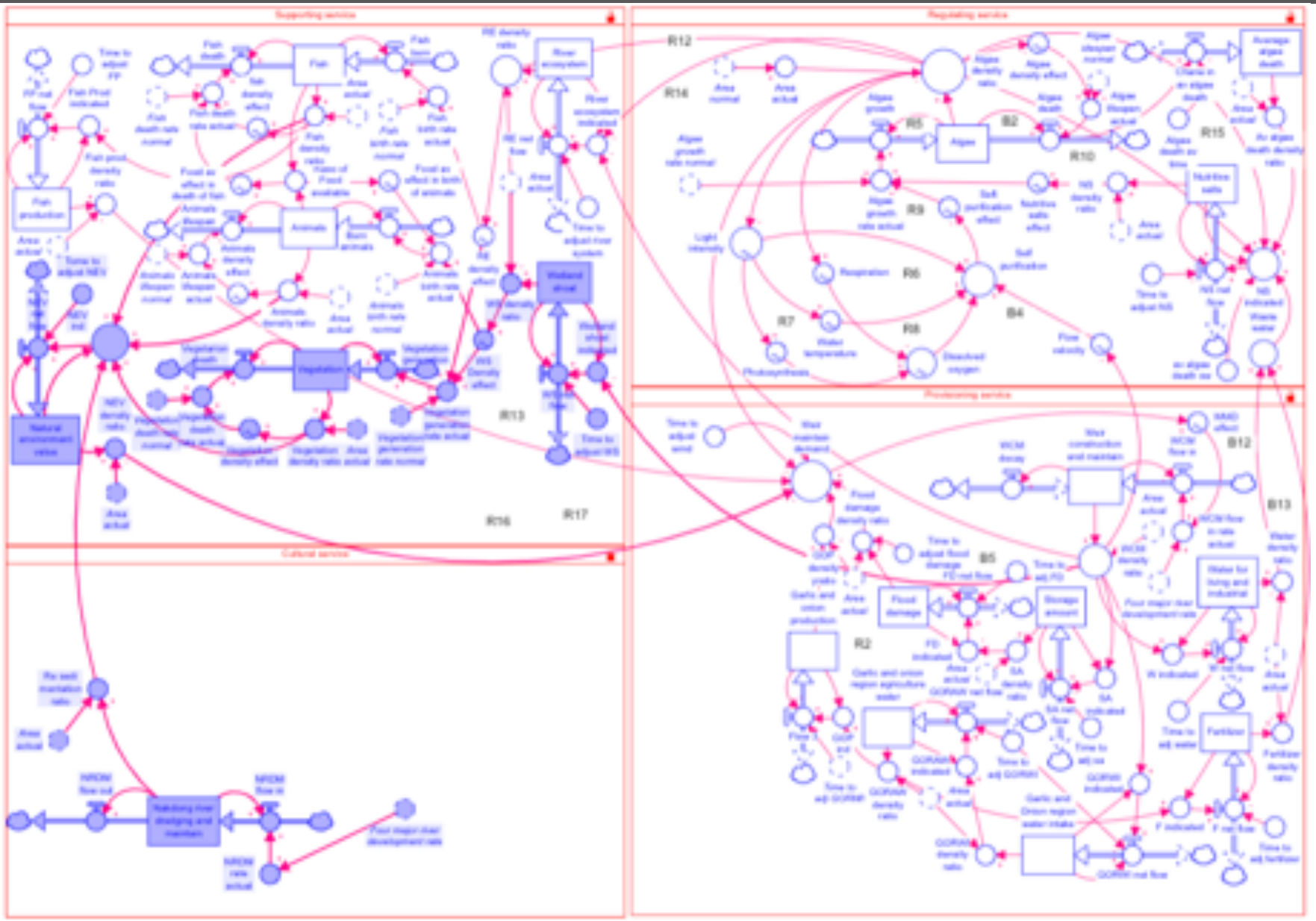
Feedback loops for waste water (B12, B13) & nutritious salts that feed the algae population (F10).



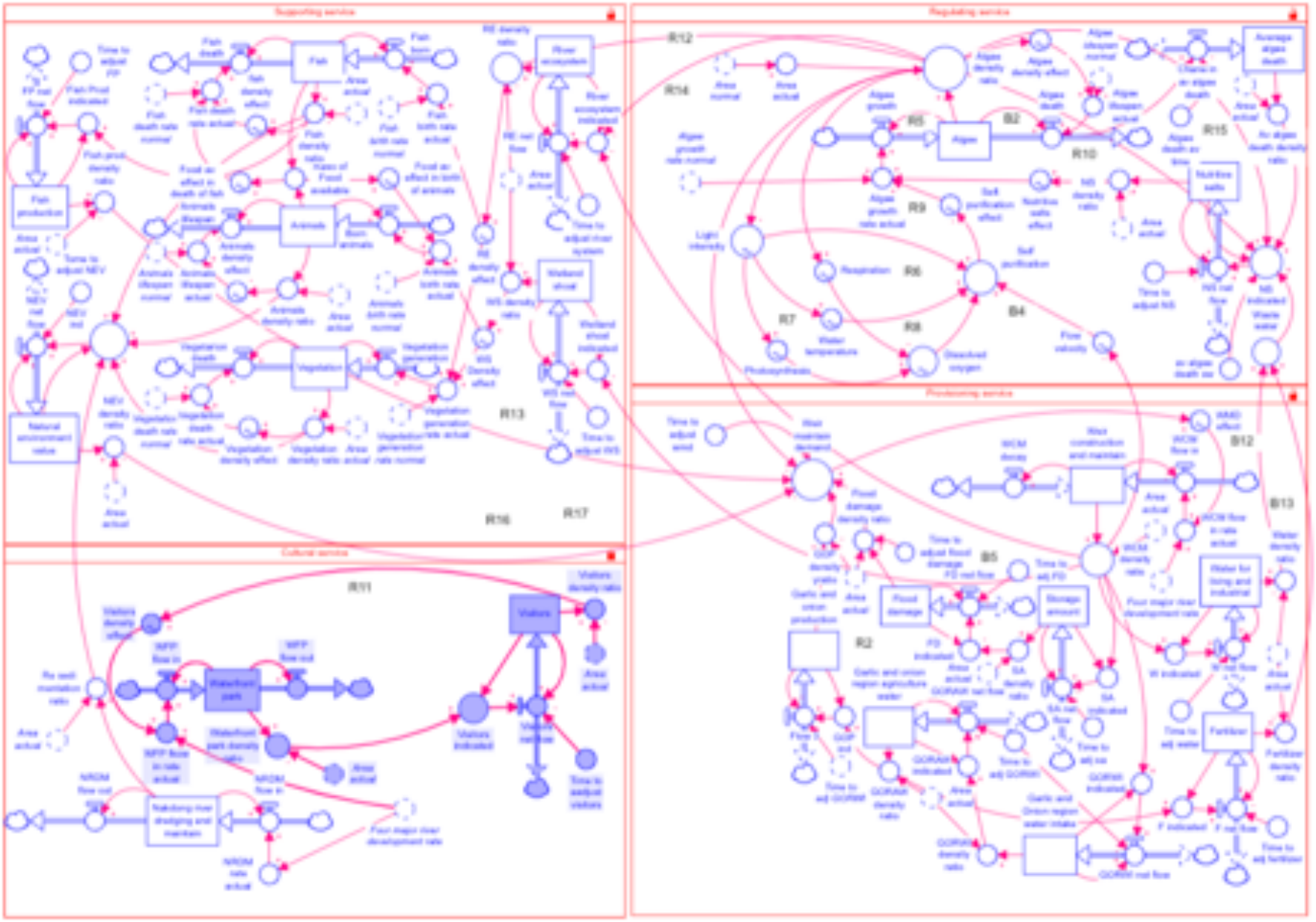
Population dynamics for animals in rivers predation-prey of animals & fish.



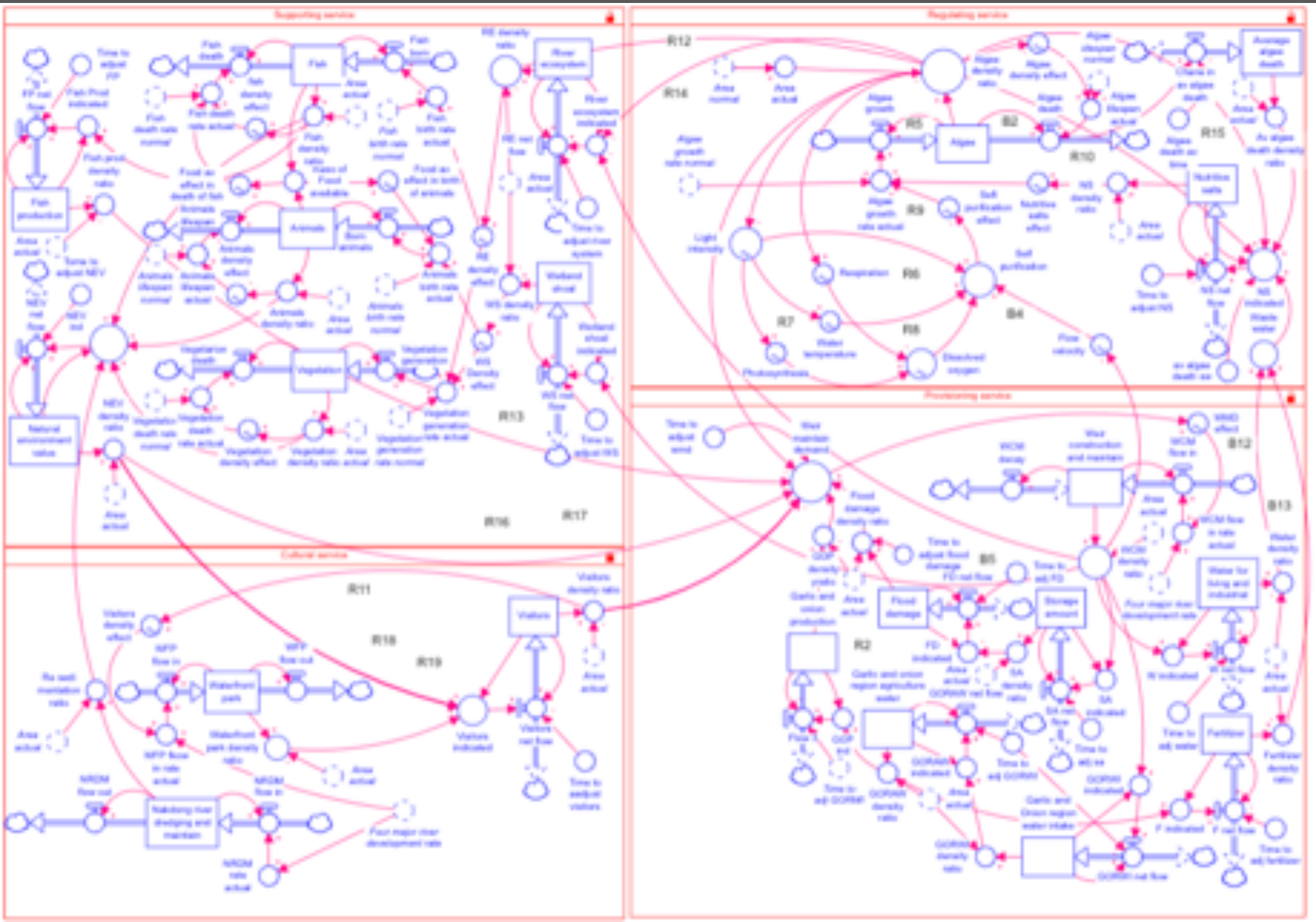
Feedback loop (R16, R17) for natural environment value



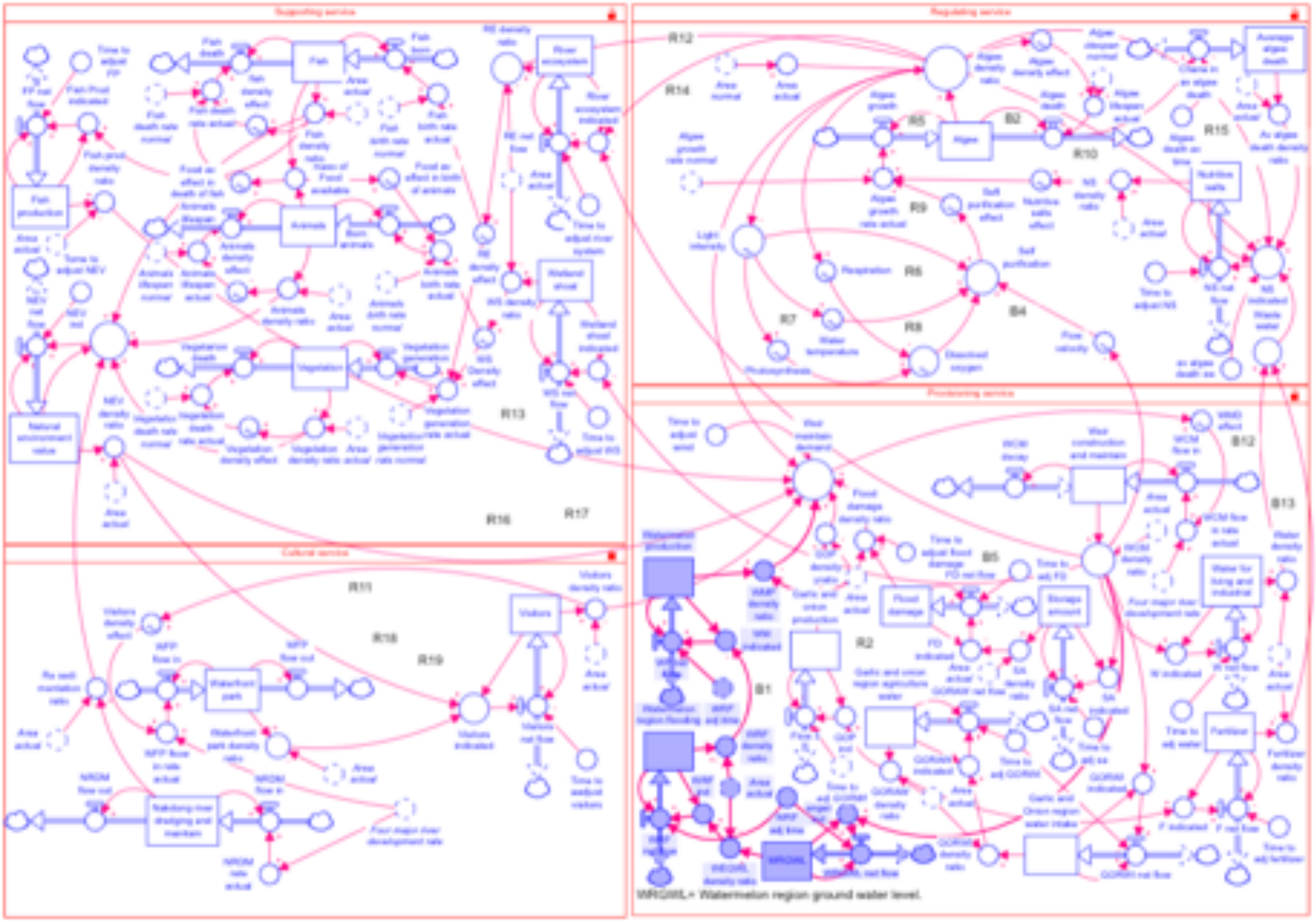
Feedback loop (R11) between waterfront park and visitors.



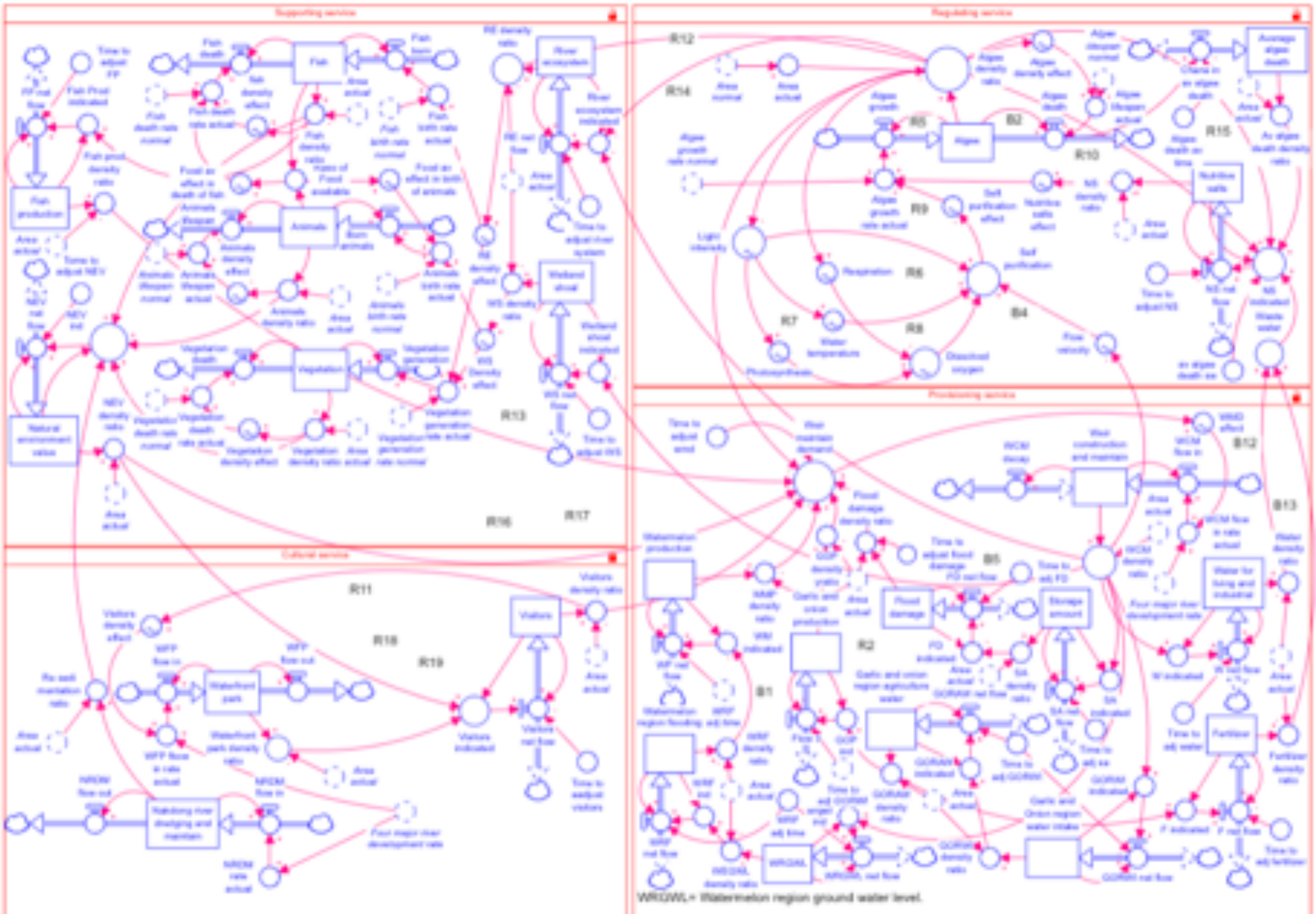
Feedback loop (R18, R19) for visitors.



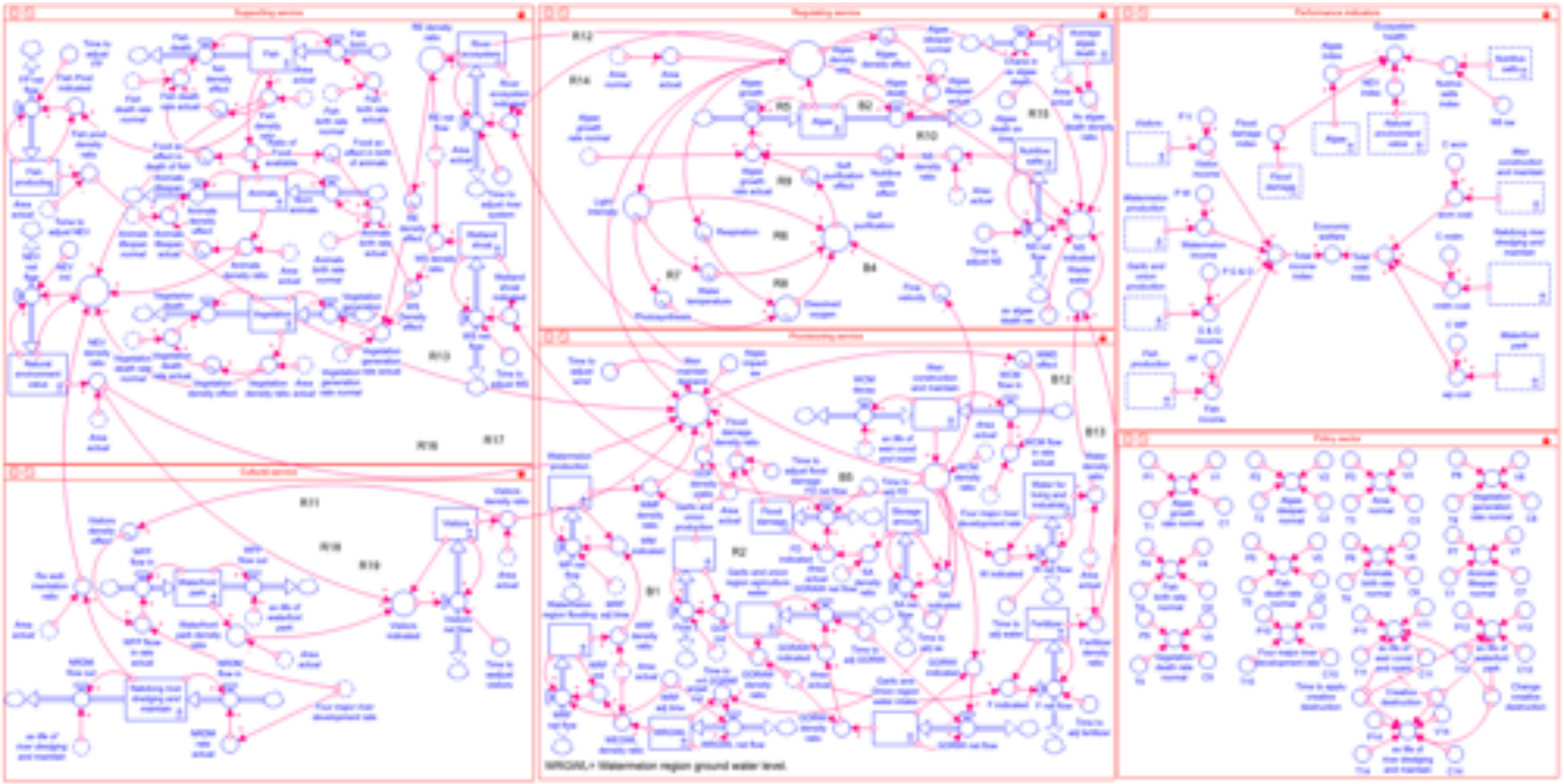
Feedback loop (B1)
to harvest watermelon.



Full model



Complete model



1. Political design sector
2. Performance indicators sector.

Social-Ecological System of the Nakdong River, South Korea

Dashboard

Home | Run | Storytelling | Restore all device | Restore all inputs | Time to apply policy

Dashboard | Regulating service | Cultural service | Provisioning service | Supporting service | Performance indicators

Policy design

1 - Equilibrium (Restore all devices)

2 - Four mayor river development rate

3 - Global Creative destruction

3.1- Av. life of weir const & maintain

3.2- Average life of waterfront park

3.3- Av. life of river dredging & maint

4 - Vegetation generation

5 - Vegetation death

6 - Animals birth

7- Animals lifespan

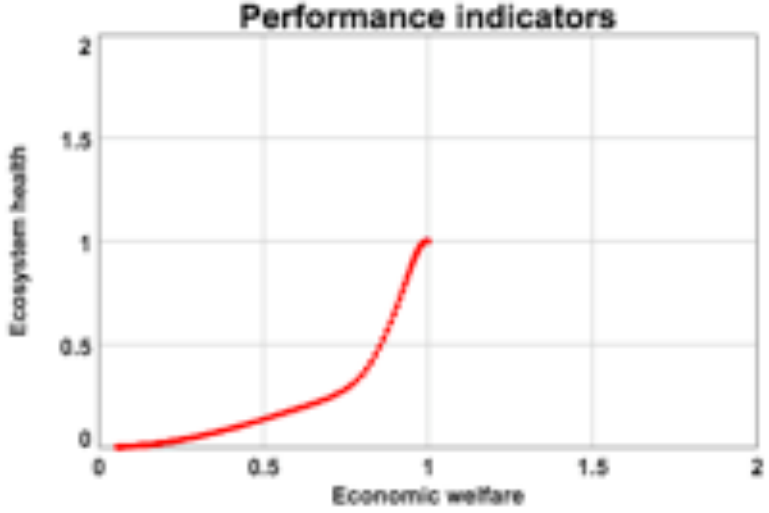
8- Fish birth

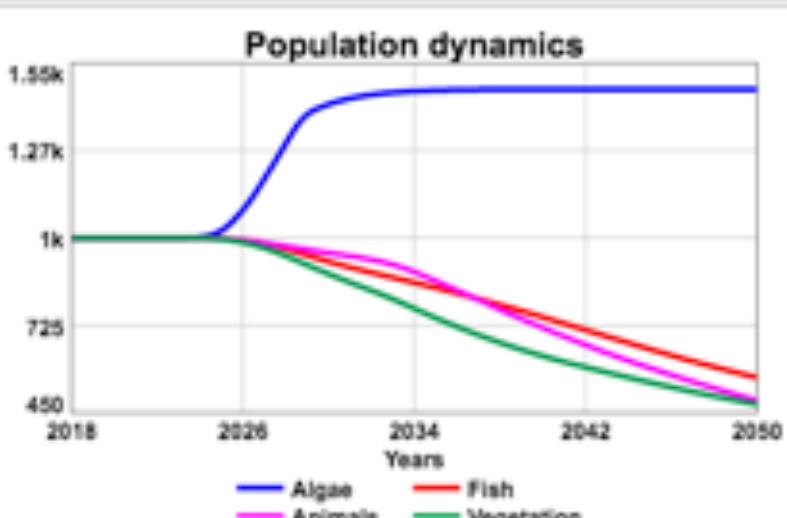
9 - Fish death

10 - Algae growth

11 - Algae death

12 - Territorial reservation





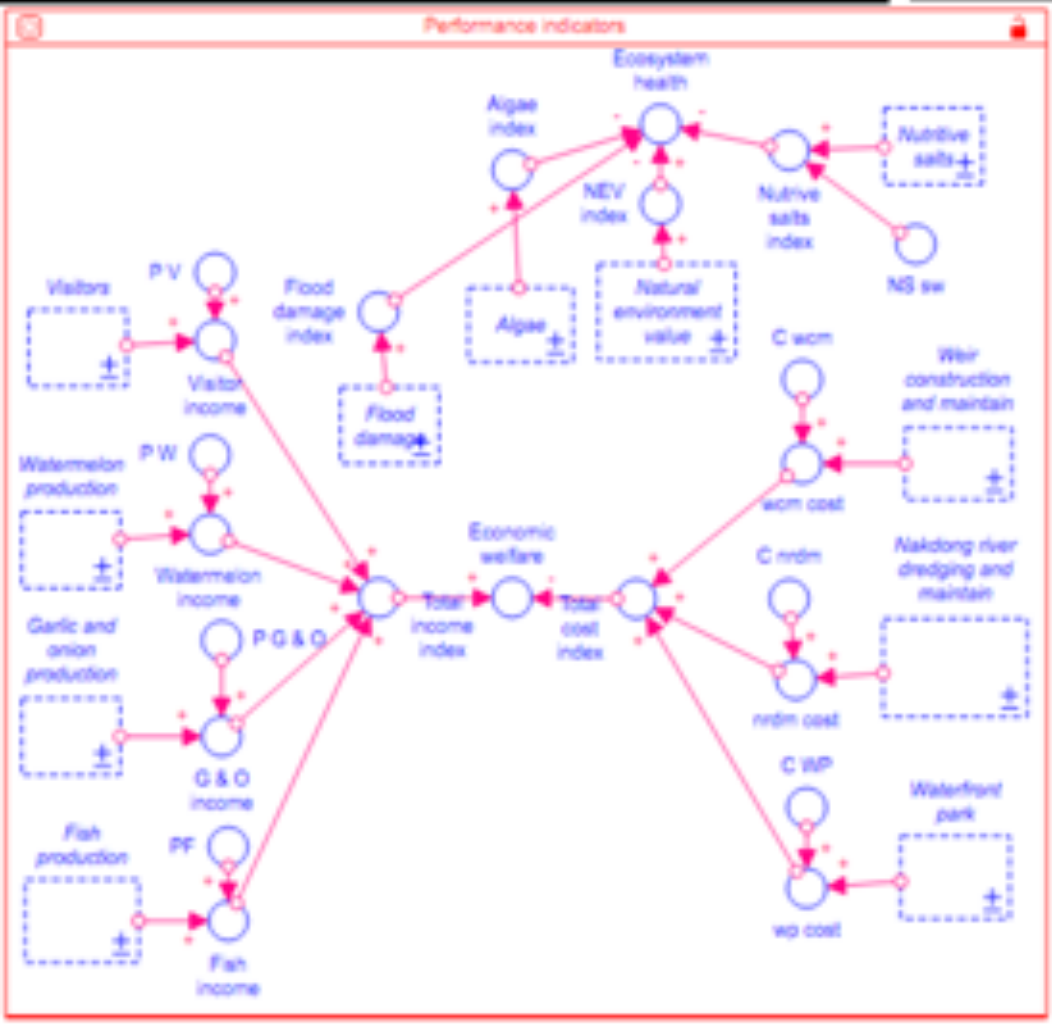
Social-Ecological System of the Nakdong River, South Korea

Performance indicators 3

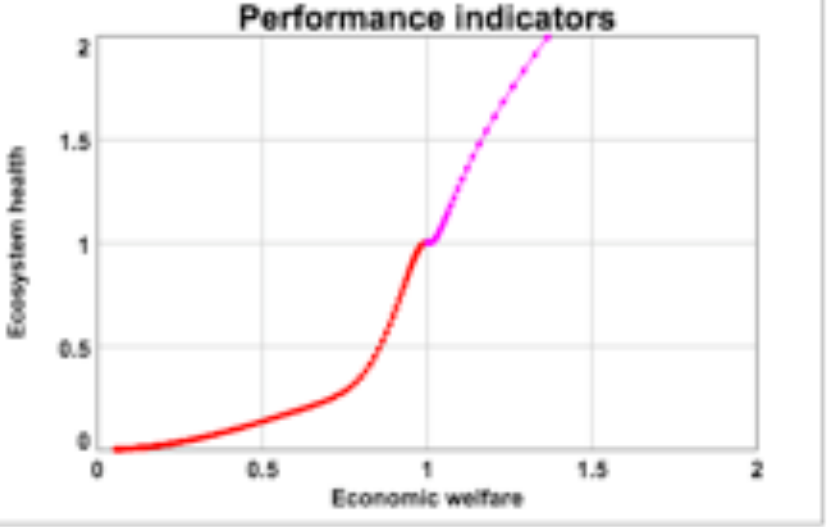
Home | Run | Storytelling | Restore all device | Restore all inputs | Time to apply policy

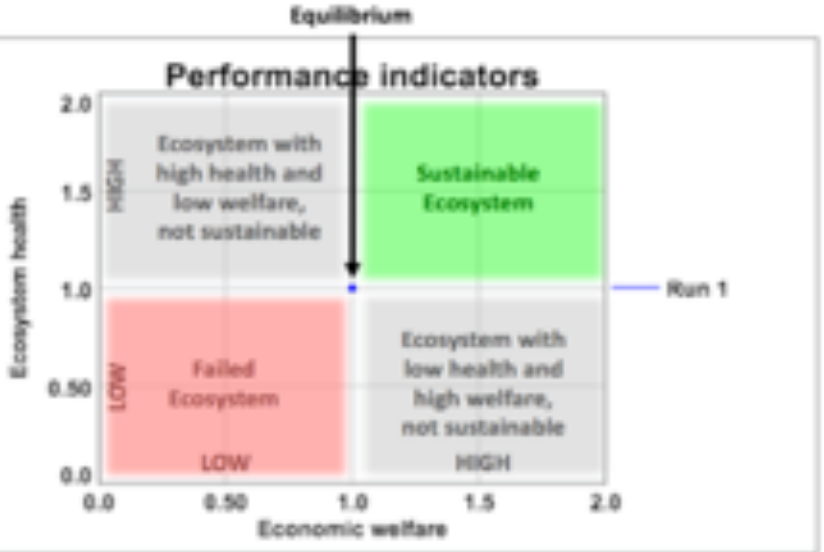
Dashboard | Regulating service | Cultural service | Provisioning service | Supporting service | Performance indicators

Policy design



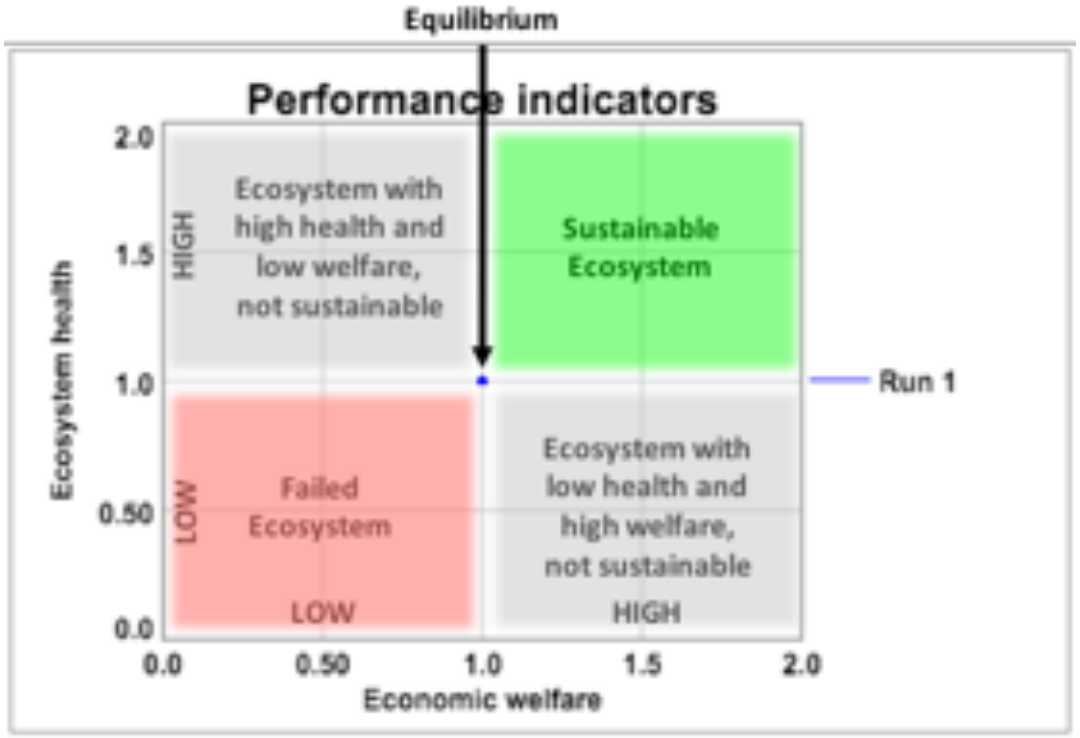
Performance indicators | Performance description | Performance Stock & flow



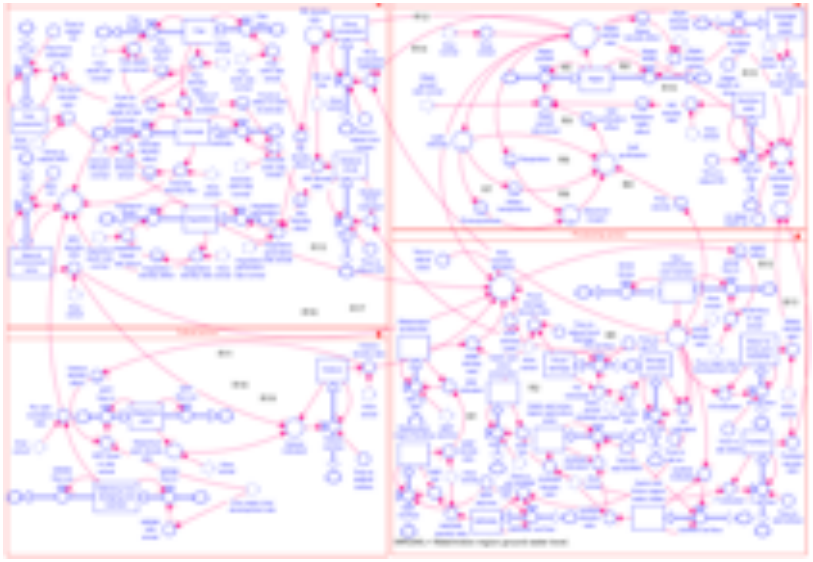


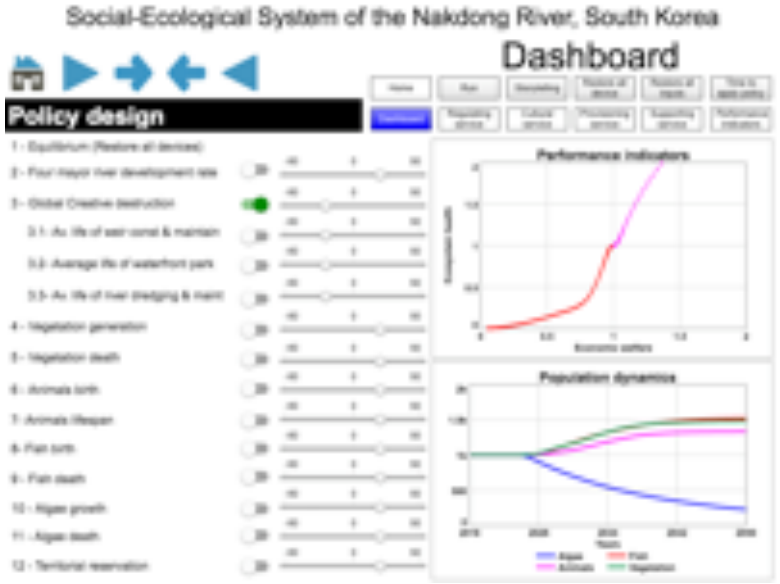
Conclusion 1

To facilitate the interpretation of results, we had to add a new sector to calculate two performance indicators, one focused on measuring economic welfare and one more for the global ecosystem health, by taking their results to a Scatter-type graph, we detected four possible areas shown below. (In this way, you can review the impact of an intervention in a simple way.)



Conclusion 2





Fantastic:

- Original Hypothesis
- Full model
- Learning lab

Video https://youtu.be/VDZuQ9mq7c8

References

Model developed from the hypothesis published in the article:

Analysis of the Social-Ecological System of the Four Major Rivers Project and Resilience Improvement Plan with a Focus on the Ecosystem Services of the Nakdong River.

The name of its authors
Kihwan Song,
Jinhyung Chon,
Nam Hee Choi