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Control measures of freshwater cyanobacterial blooms: a mini review

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Outline of this talk

1. Meaning of “control”
2. Closed-loop control system
3. Control elements
4. Issues
5. Ecosystem perspective
6. Integrative approach
7. Key points

What does “control” mean here?

Associated elements and attributes

Health
Environmental
Social
Economical

Cyanobacteria
(blue-green algae
or BGA)

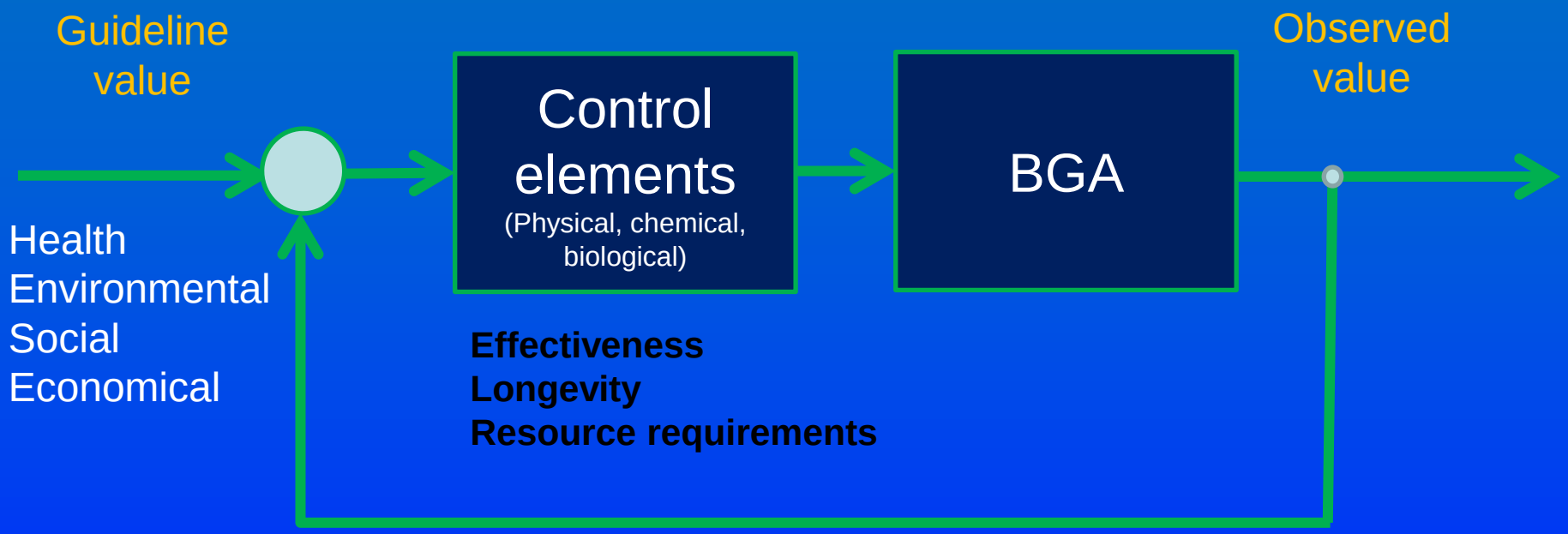
Physical
Chemical
Biological

Effectiveness
Longevity
Resource requirements

For most of us “control” may mean:

Realising a negative feedback system, using guideline values as a reference input and observed values as a controlled output in a modelled ecosystem

Feedback system



Guideline value < Observed value
(G – O < 0)

Control elements

Effectiveness
Longevity
Resource requirements

Physical: flushing, mixing, aeration, sonication, UV-ray, harvesting

Chemical: algaecides, chlorine, activated carbon, ozone, nutrients

Biological: virus, fungi, bacteria, zooplankton, fish, non-BGA (competition), macrophytes (regime shift)

Issues

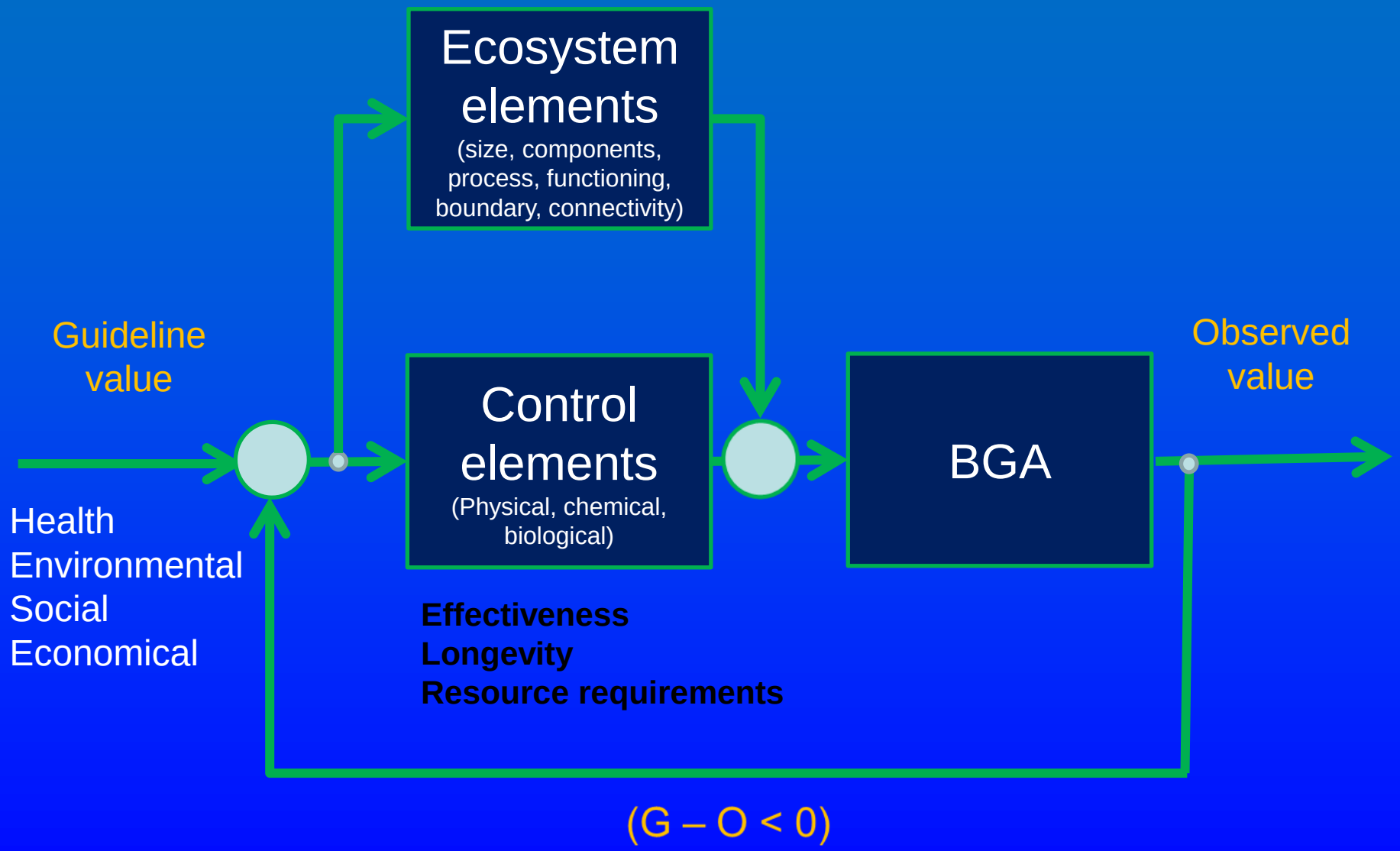
- A growing sophistication in studying the small and an increasing irrationality in handling the whole (Puccia and Levins, 1985): forgetting something that should not be forgotten

- Inevitable un-modelled dynamics that produce substantial uncertainly (Doyle et al., 1992): something else goes wrong

Ecosystem perspective

- Ecosystem size and components (species-area relationship: more species in larger ecosystems)
- Ecosystem process and functioning (species interaction through predation and competition; transformation and transfer of energy and matter by species)
- Ecosystem boundary and connectivity (tangible and intangible; things are connected)

Integrative approach



Key points

- Articulation of a system
  - Corollary: Importance of modelling (conceptual, qualitative, quantitative; simple, complex)
- Effective negative feedback system, weighted by an ecosystem perspective
  - Corollary: Need for diverse research, monitoring and reporting

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