Management of Lake Durowskie

WĄGROWIEC
wyzwala energię

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Education and Culture
Lifelong Learning Programme
ERASMUS

SIGILLVM ACADEMIÆ HOLSATORVM CHILONIENSIS PAX OPTIMA RERVM A.D. 1665

UAM

Outline

- Background
- Overview of current situation
- Management scenarios
- Evaluation of suggested measures
- Cost analysis
- Conclusion

Background

Aesthetics

Fishing

Eutrophication

Water sports

Swimming

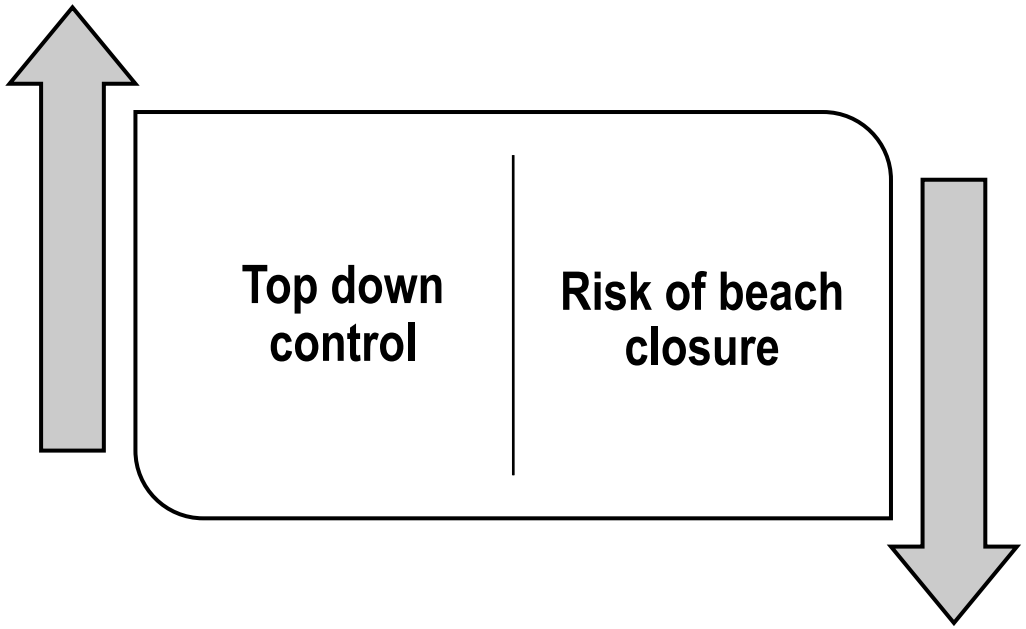
Background

Cyanobacteria bloom cause beach closure

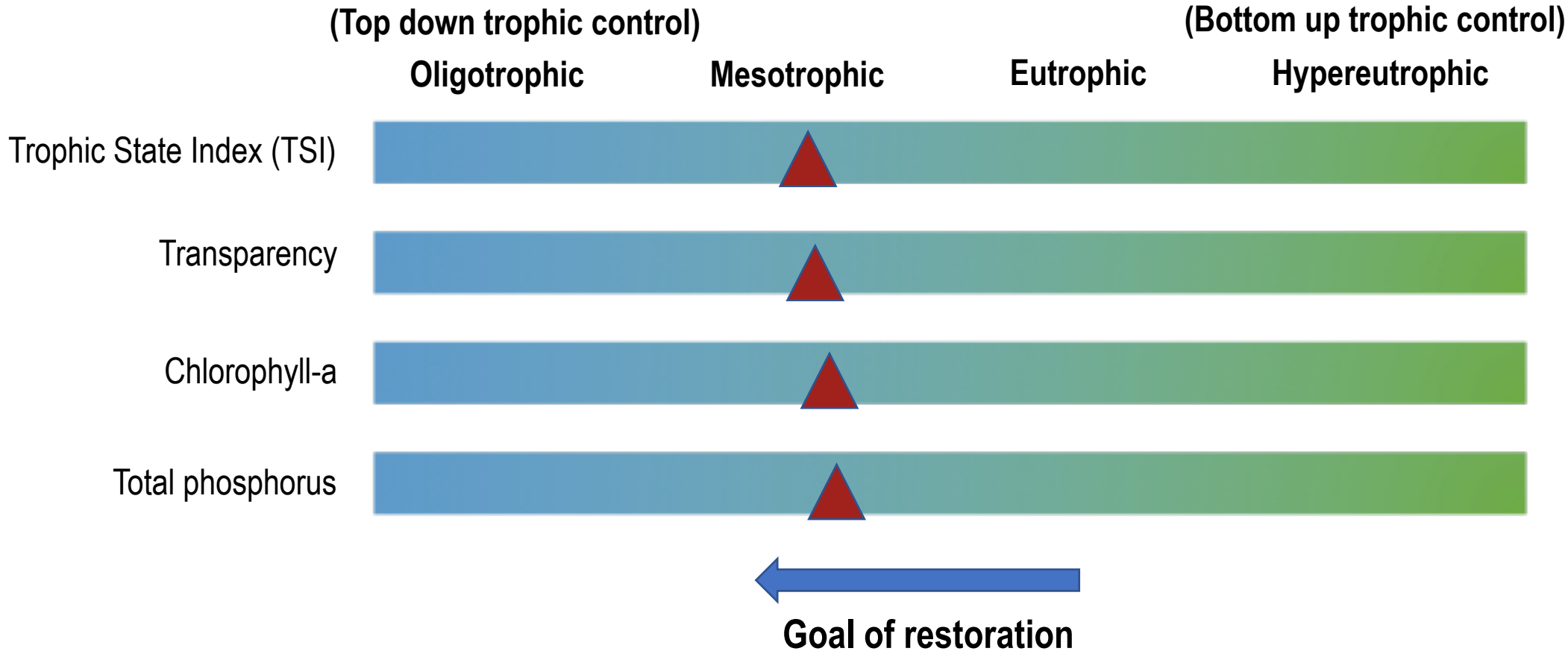
2009: Implementation of restoration measures

Monitoring

Suggest lake management measure



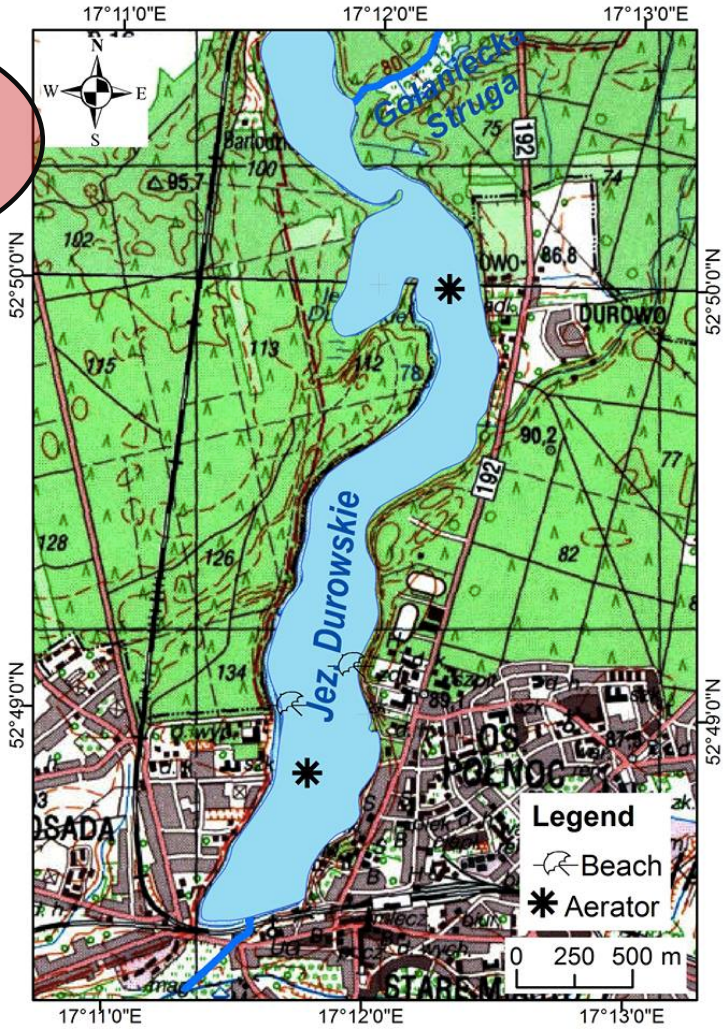
Current Situation



Management Response 2009

In-lake restoration measures

- **Wind aerators** to oxygenize hypolimnetic waters
- **Phosphorus immobilization** using iron treatment
- **Biomanipulation**: stocking lake with pike fingerlings

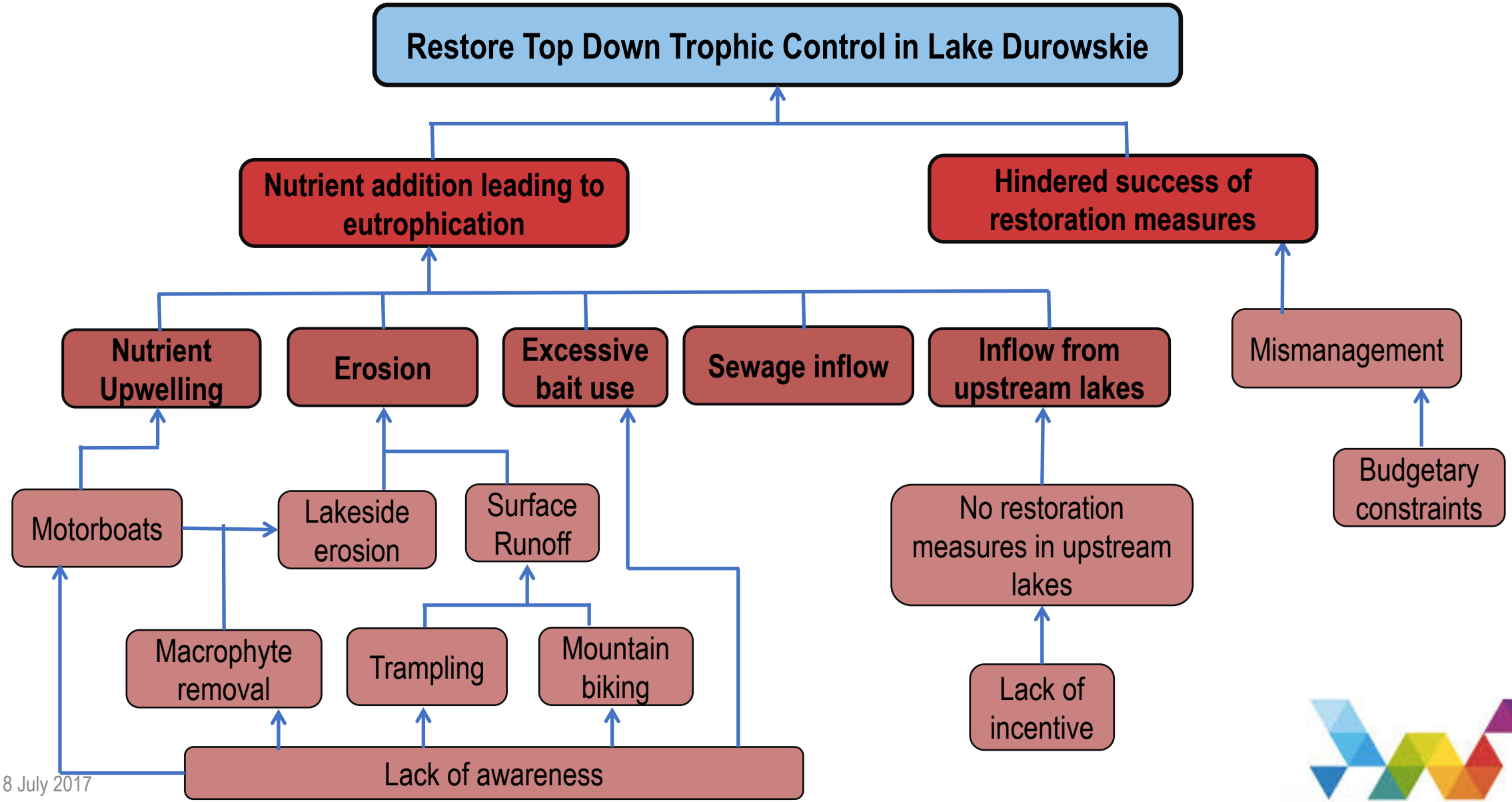


Management Response 2009

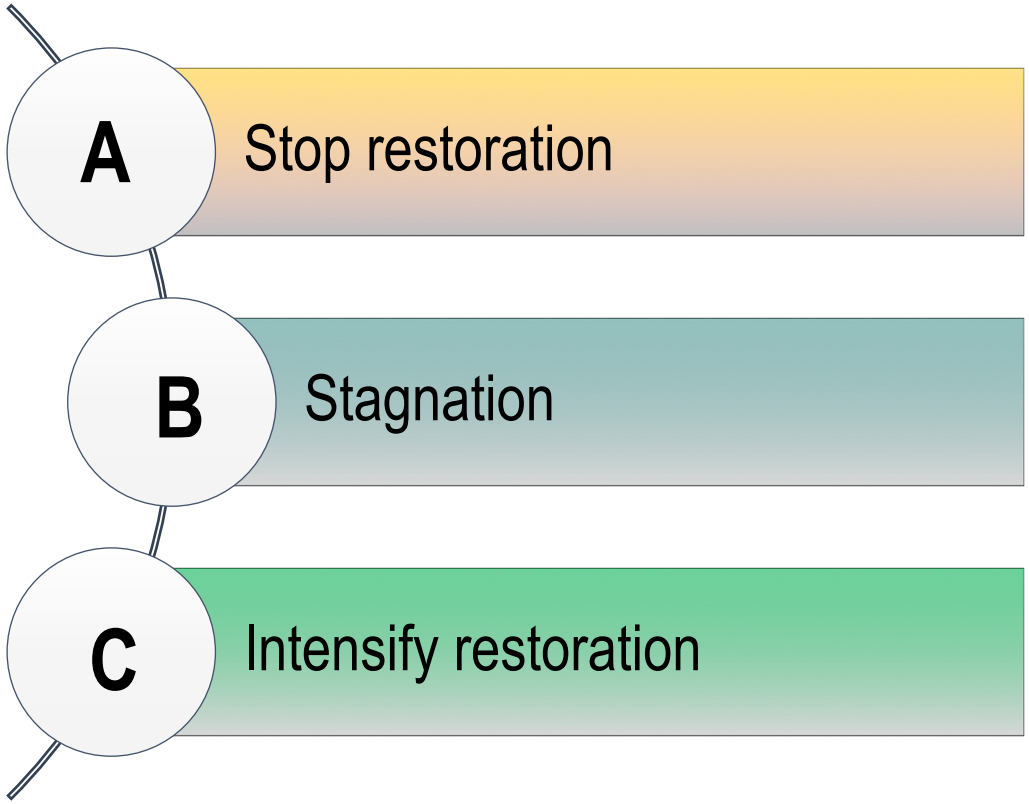
- **Wind aerators** to oxygenize hypolimnetic waters
- **Phosphorus immobilization** using iron treatment
- **Biomanipulation**: stocking lake with pike fingerlings

Delayed introduction of pike in 2017

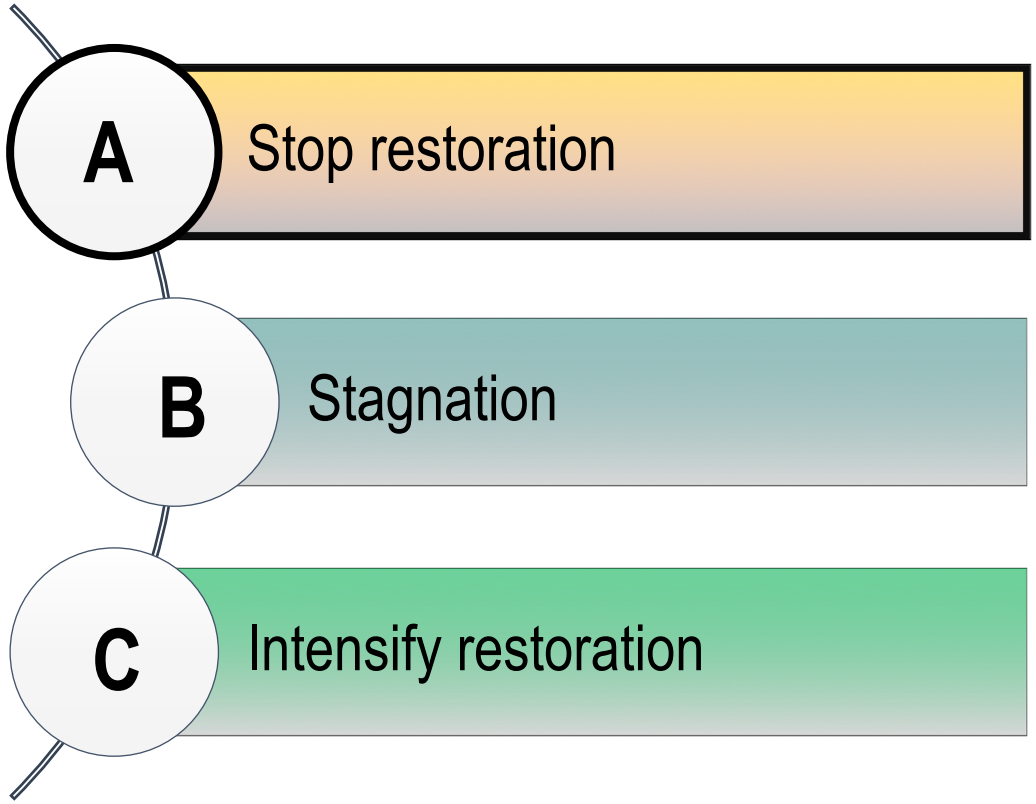
Conceptual Model



Management Scenarios

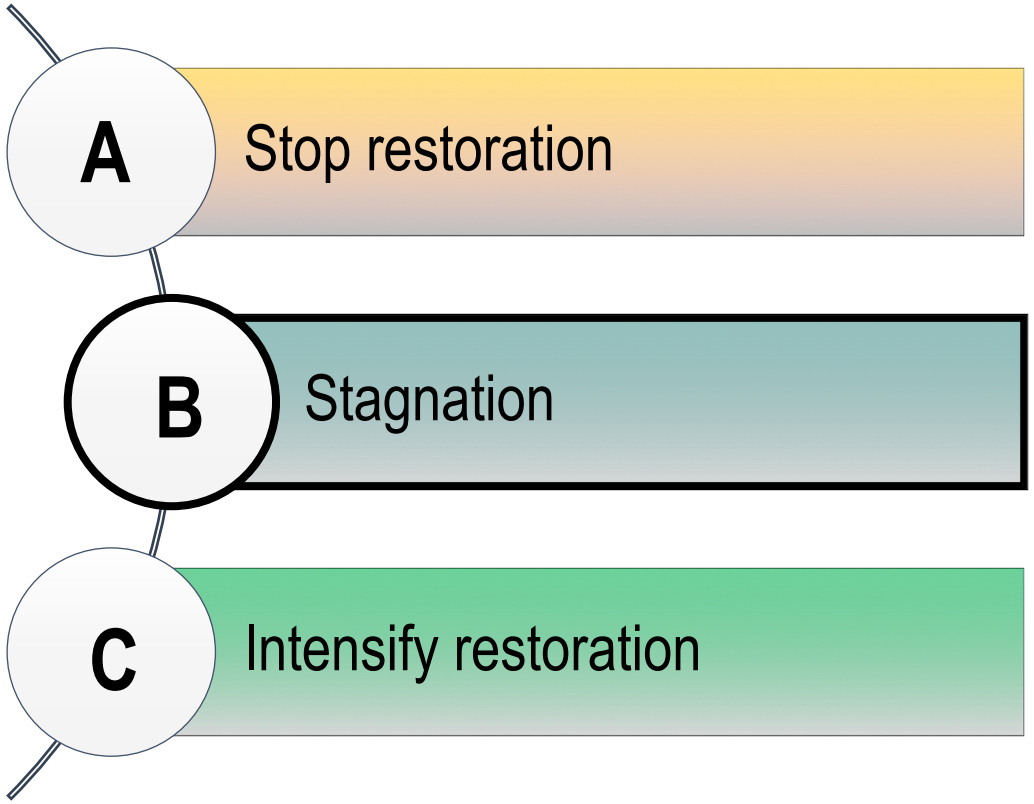


Management Scenarios



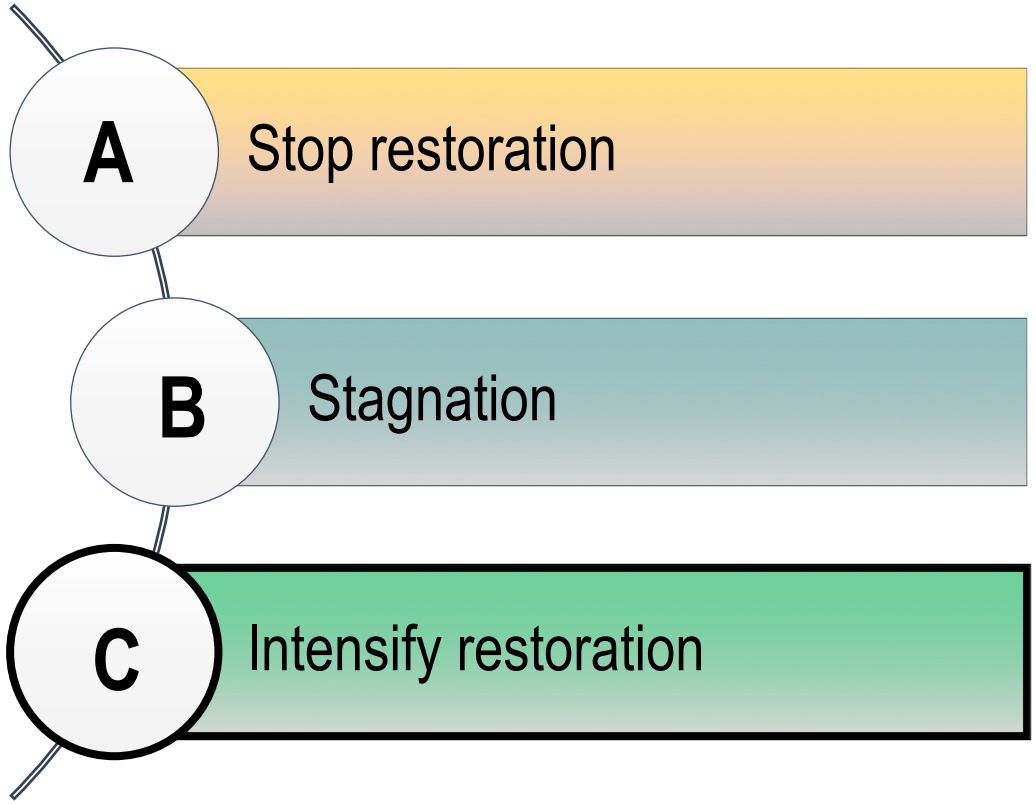
Strengths	Weaknesses
No immediate costs	Worsen lake health Will push back progress from previous restoration measures
Opportunities	**Threats**
Saved funds can be used for other development projects	Beach closure due to cyanoblooms Loss of tourism based revenue Reduced fishing catch

Management Scenarios



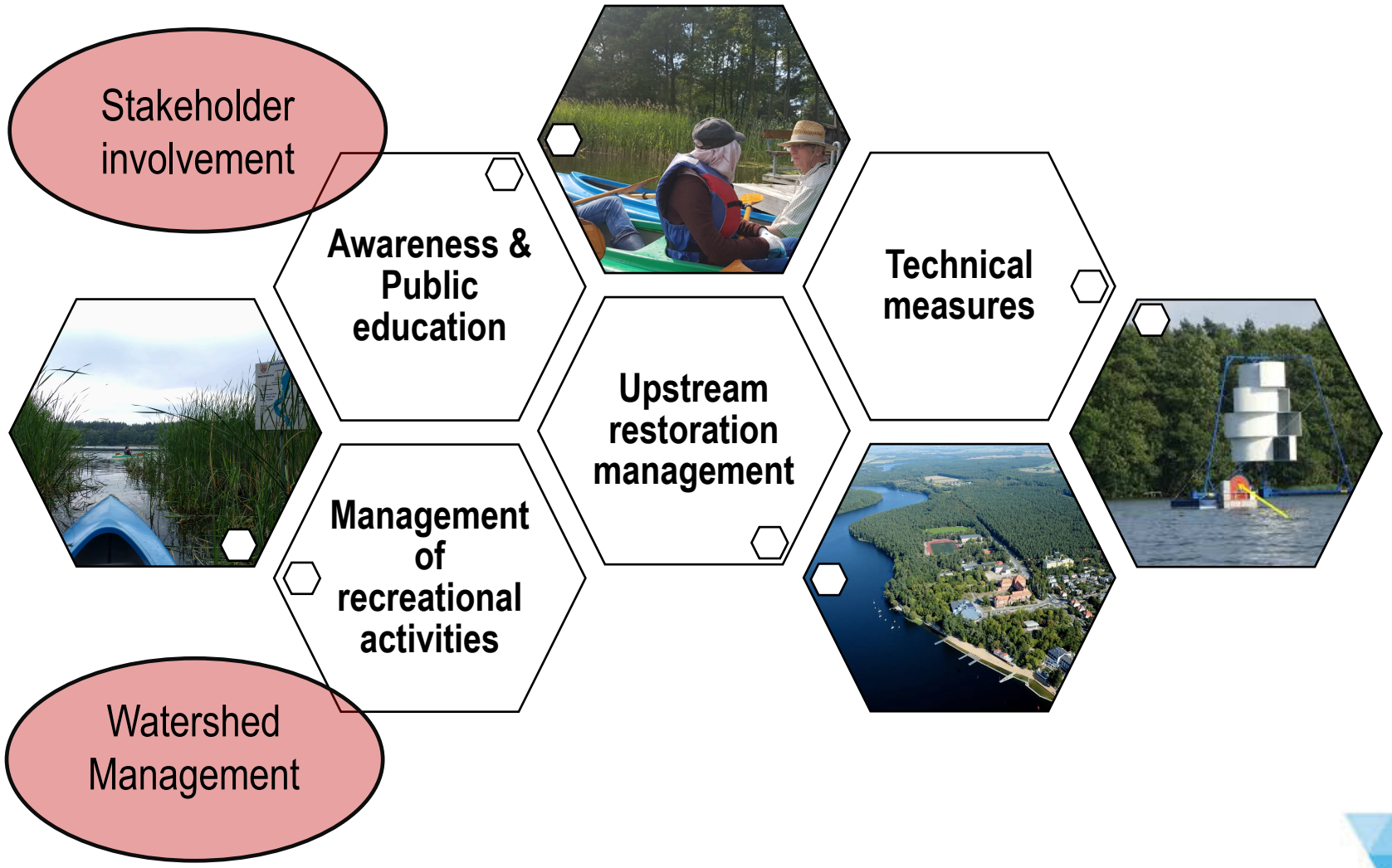
Strengths	Weaknesses
No additional investments required No need for new organizational systems Cyanoblooms have been prevented so far	Slow progress Continual long-term investment Doesn't address watershed management No community involvement
Opportunities	**Threats**
Can provide long-term data about effectiveness of current restoration measures	Risk of return of cyanoblooms due to any significant environmental change Dam on Lake Laskowieckie could destabilize the situation

Management Scenarios



Strengths	Weaknesses
Will speed restoration process Promotes cooperation between communities Involves community participation Addresses watershed management Reduces risk of destabilization due building of dam	Increased restoration costs in the short term New organizational systems required
Opportunities	**Threats**
Increased tourism due to improved condition of lake and from cross boundary economic activities New investments due to improved lake health Increased awareness could increase residents' sense of pride in the lake	Conflict of interest between stakeholders Breakdown of inter-organizational cooperation Dam on Lake Laskowieckie could destabilize the situation

Management strategies



Evaluation criteria

(E)ffectiveness

(L)ongevity

Ease of (I)mplementation

Potential (S)takeholder conflicts

Potential (N)egative impacts

(C)apital costs

Operating & (M)aintenance effort

Poor

Fair

Good

Excellent

Awareness & Public education

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

Teacher training program

E	I	L	N	S	C	O
4	3	-	4	4	4	-

E	I	L	N	S	C	O
4	3	-	4	4	4	-

Student field trips

Poor
Fair
Good
Excellent

Information signboards

E	I	L	N	S	C	O
2	4	4	4	4	4	4

Technical measures

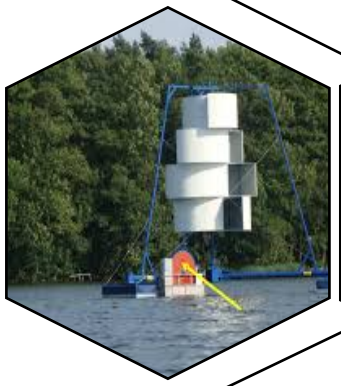
Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

Sediment traps

E	I	L	N	S	C	O
4	3	3	3	4	4	3

Bank stabilization

E	I	L	N	S	C	O
4	2	4	4	4	3	3



Increase efficiency of aerators

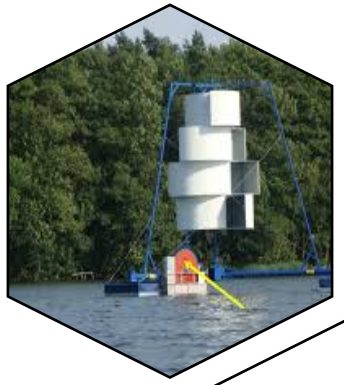
E	I	L	N	S	C	O
3	2	4	4	4	2	3

Harvest macrophytes

E	I	L	N	S	C	O
2	3	1	2	4	2	3

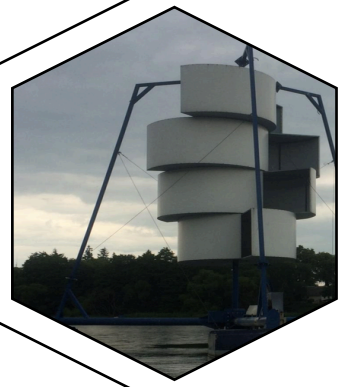
Poor
Fair
Good
Excellent

Upstream Management

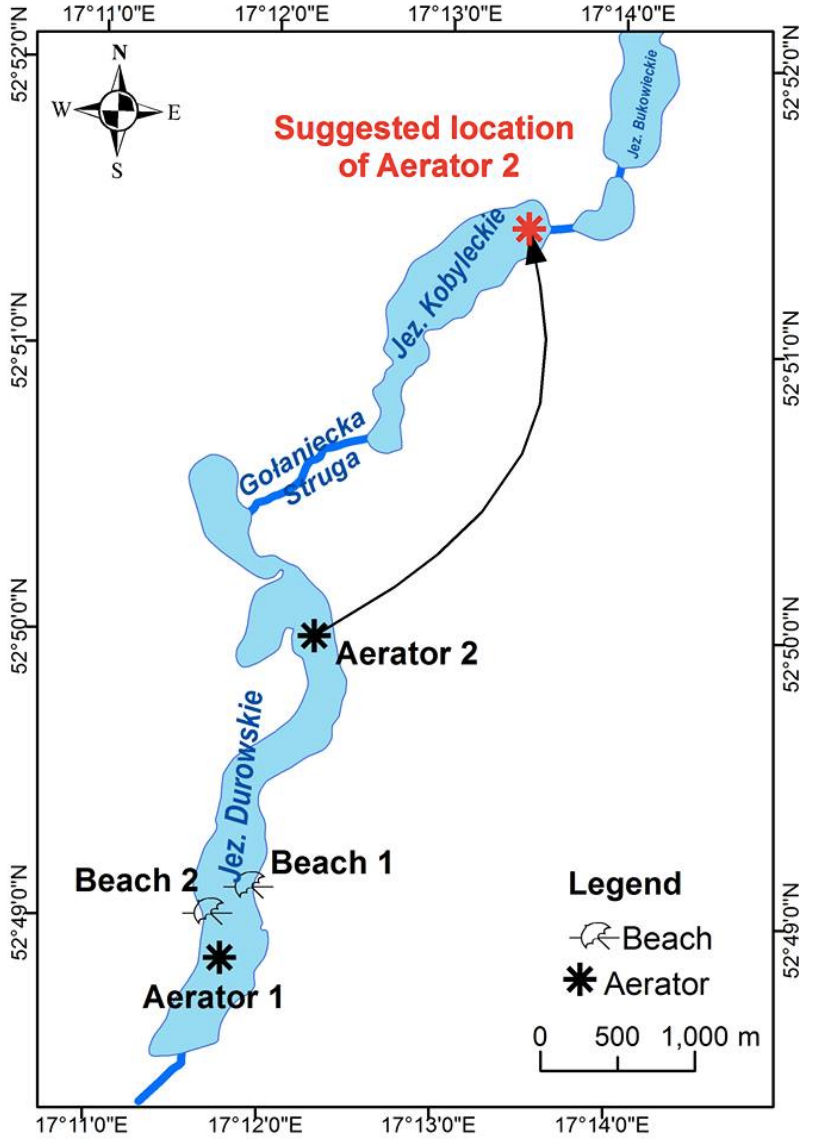


Shift Aerator

Install additional aerator

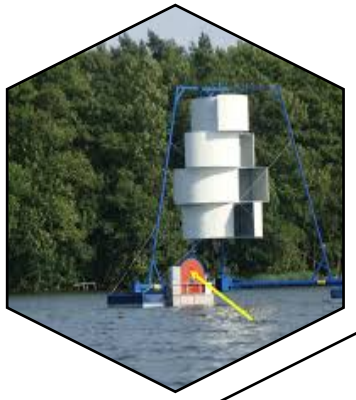


Joint Economic Activities



Upstream Management

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

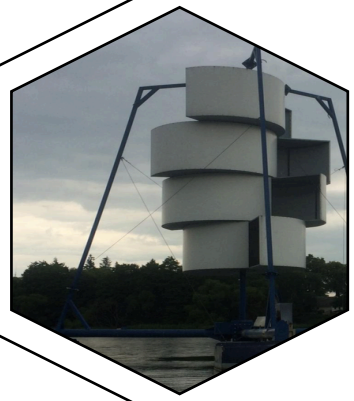


Shift Aerator

E	I	L	N	S	C	O
3	3	4	3	3	4	4

E	I	L	N	S	C	O
4	2	4	4	4	2	4

Install additional aerator



Joint Economic Activities

E	I	L	N	S	C	O
3	2	4	3	3	3	3

Poor
Fair
Good
Excellent

Management of recreational activities- motorboats

License management

E	I	L	N	S	C	O
2	4	4	4	2	4	4

Code of conduct

E	I	L	N	S	C	O
2	4	4	4	4	4	4

Price management

E	I	L	N	S	C	O
2	4	4	4	3	4	4

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

Poor
Fair
Good
Excellent

Management of recreational activities- fishing

License management

E	I	L	N	S	C	O
3	3	4	4	4	4	4

E	I	L	N	S	C	O
3	3	4	4	3	3	3

Access management

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

Poor
Fair
Good
Excellent

Management of recreational activities- mountain biking

Code of Conduct

E	I	L	N	S	C	O
2	4	4	4	4	4	4

Access management

E	I	L	N	S	C	O
3	2	2	3	3	3	3

Poor
Fair
Good
Excellent

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

Management of recreational activities- hiking

Access Management

E	I	L	N	S	C	O
3	3	3	3	4	3	4

Effectiveness
Ease of **I**mplementation
Longevity
Potential **N**egative impacts
Potential **S**takeholder conflicts
Capital costs
Operating & Maintenance

- Poor
- Fair
- Good
- Excellent

Cost analysis

Population: 25,000

Working population within city: ~25% => 6250

Income per person: ~50,000 PLN => Total income >300 million PLN

Contribution of income to taxes: ~10% => Total taxes >30 million PLN

Taxes going to city: ~10% => >3 million PLN

Employment in tourism and recreation: ~10% => Taxes to city from tourism >300,000 PLN

Cost analysis

Population: 25,000

Working population within city: ~25% => 6250

Income per person: ~50,000 PLN => Total income >300 million PLN

Contribution of income to taxes: ~10% => Total taxes >30 million PLN

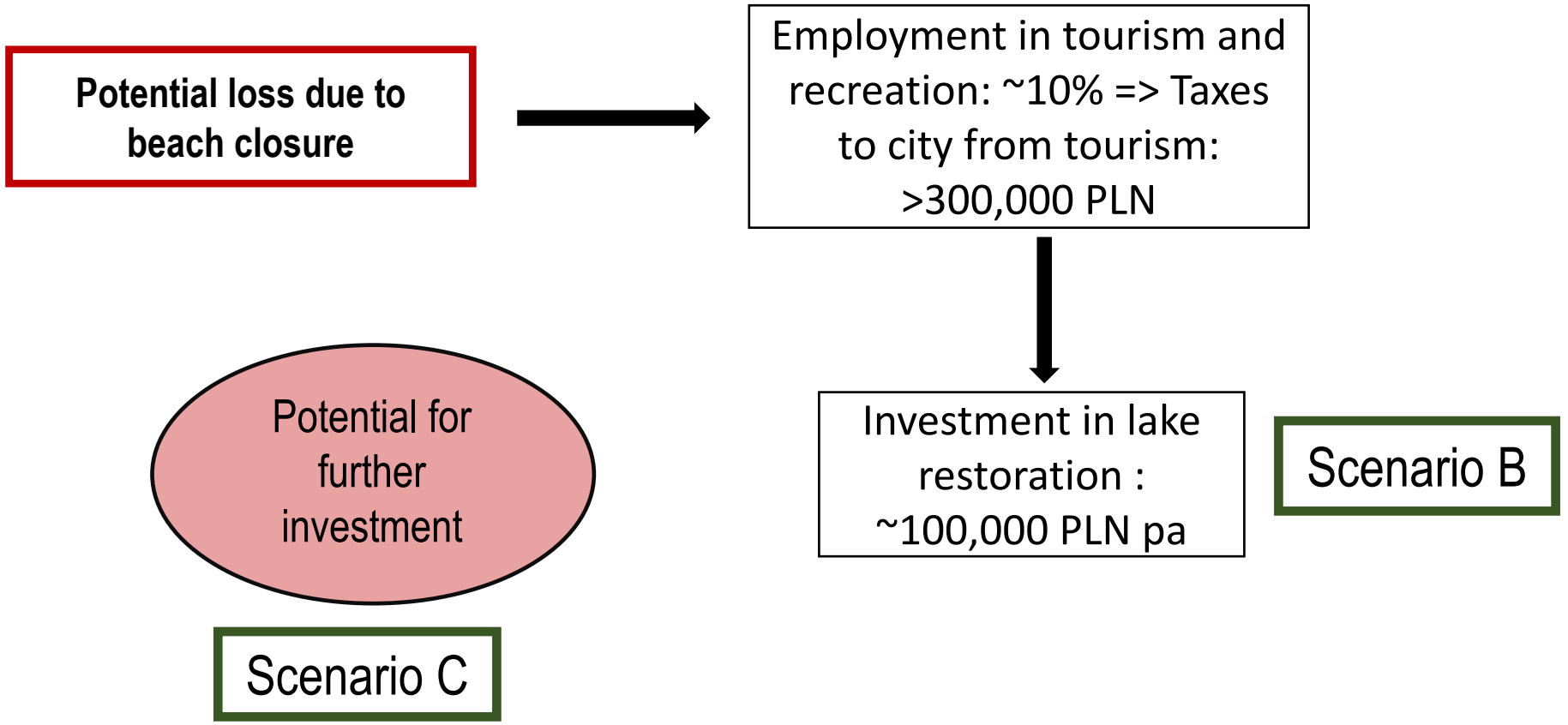
Taxes going to city: ~10% => >3 million PLN

Potential loss due to beach closure

→

Employment in tourism and recreation: ~10% => Taxes to city from tourism >300,000 PLN

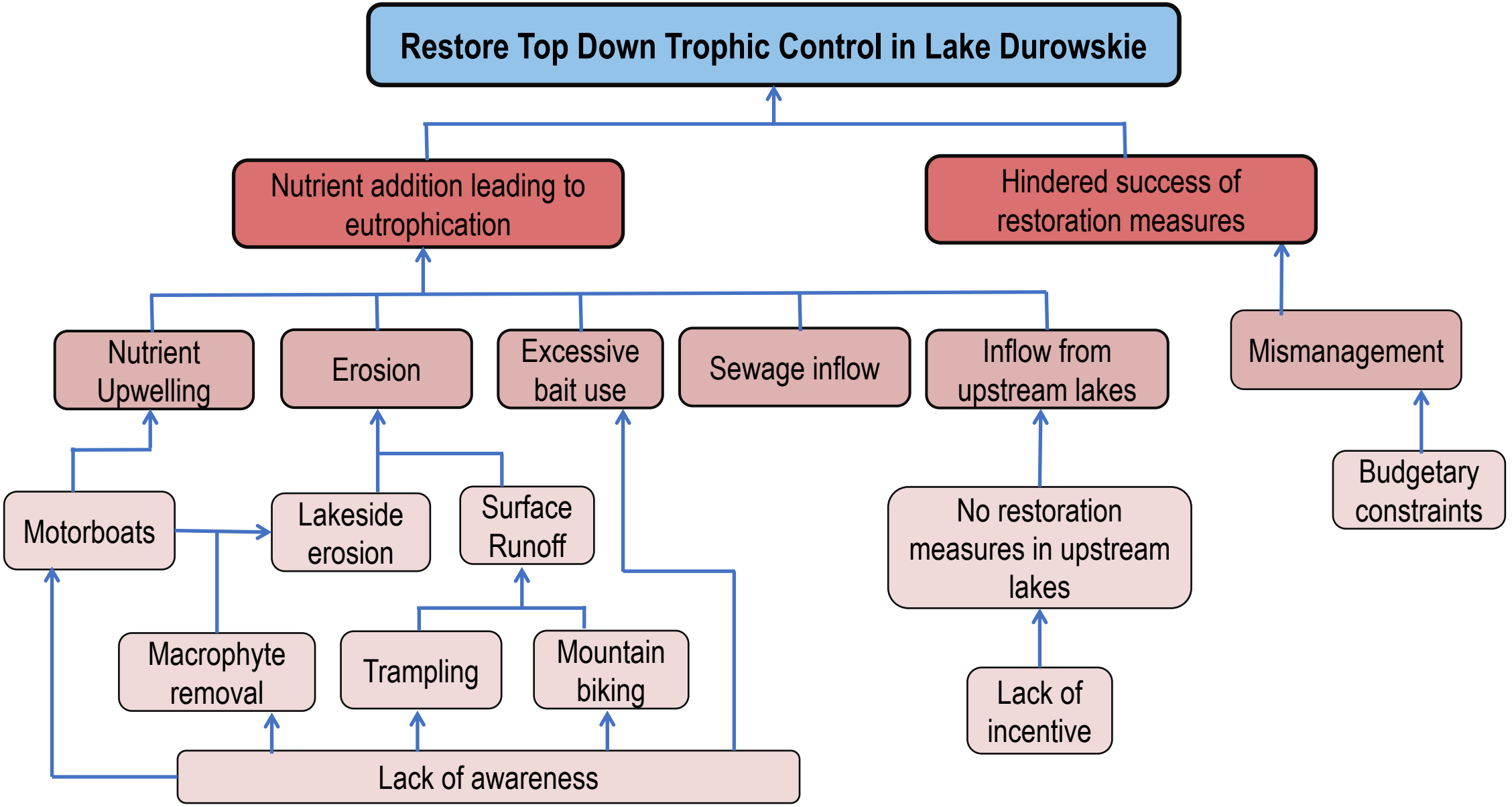
Cost analysis

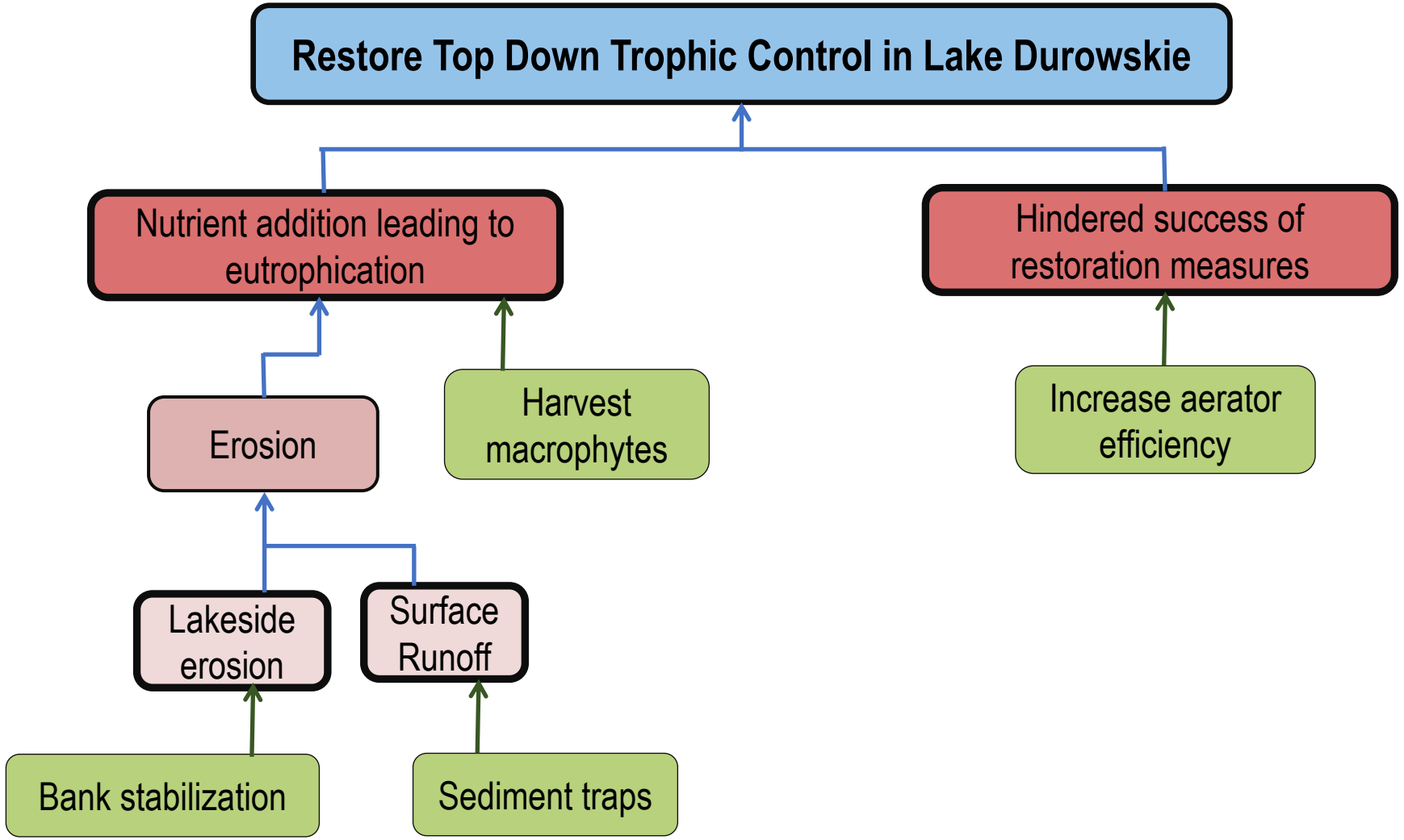


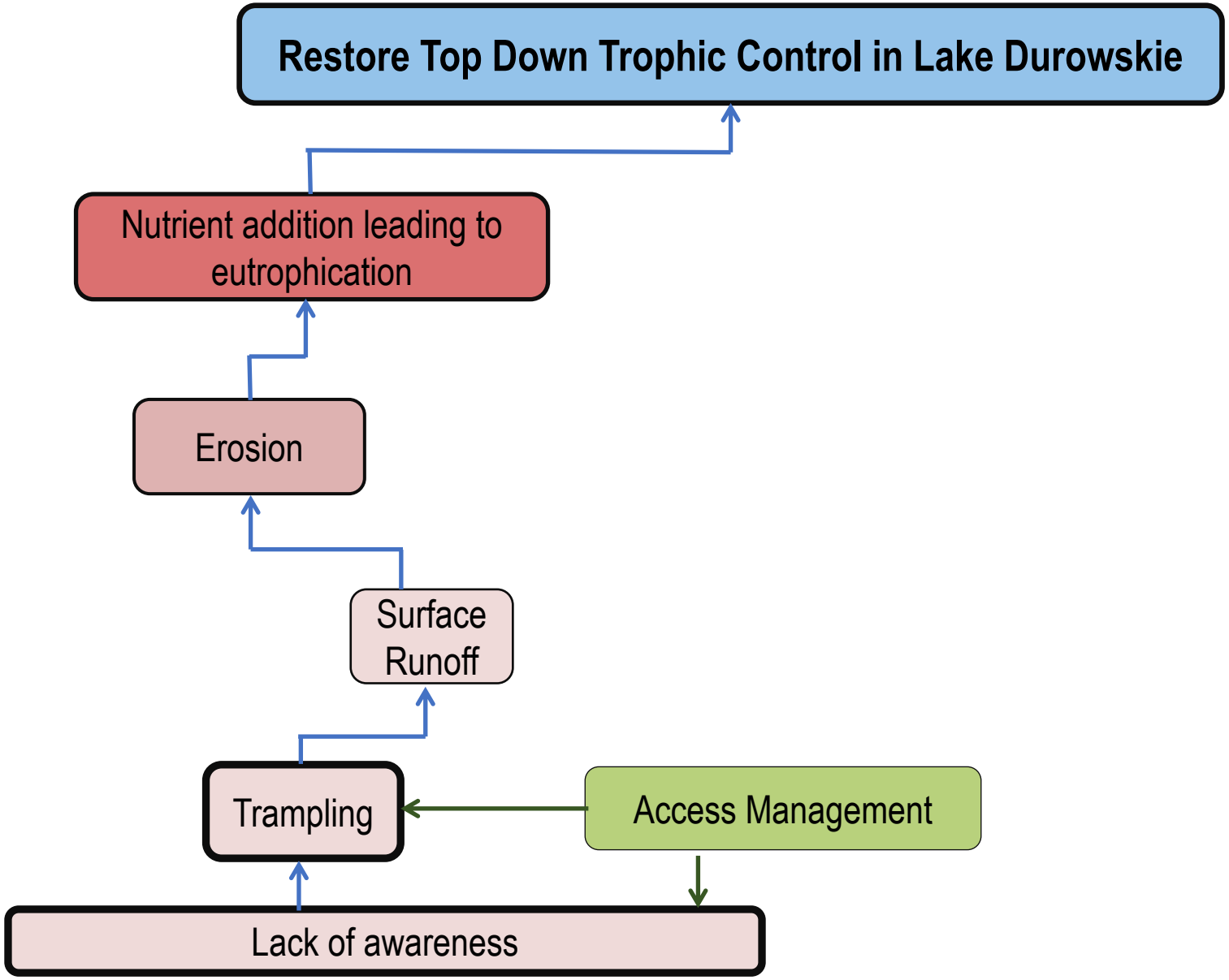
Conclusion

- Restoration measures successful so far in preventing cyanoblooms
- However, lake still in unstable state
- Additional measures possible with minimal cost and effort
- The best outcomes for restoration will result from a multi-faceted approach
- Inspiring a sense of ownership and educating people about good practices is important for long term lake health
- Nutrient inflow from upstream must be addressed for long term stability


Dziękuję


Restore Top Down Trophic Control in Lake Durowskie
Nutrient addition leading to eutrophication
Hindered success of restoration measures
Nutrient Upwelling
Erosion
Excessive bait use
Sewage inflow
Inflow from upstream lakes
Mismanagement
Budgetary constraints
Motorboats
Lakeside erosion
Surface Runoff
No restoration measures in upstream lakes
Macrophyte removal
Trampling
Mountain biking
Lack of incentive
Lack of awareness


Restore Top Down Trophic Control in Lake Durowskie
Nutrient addition leading to eutrophication
Hindered success of restoration measures
Erosion
Harvest macrophytes
Increase aerator efficiency
Lakeside erosion
Surface Runoff
Bank stabilization
Sediment traps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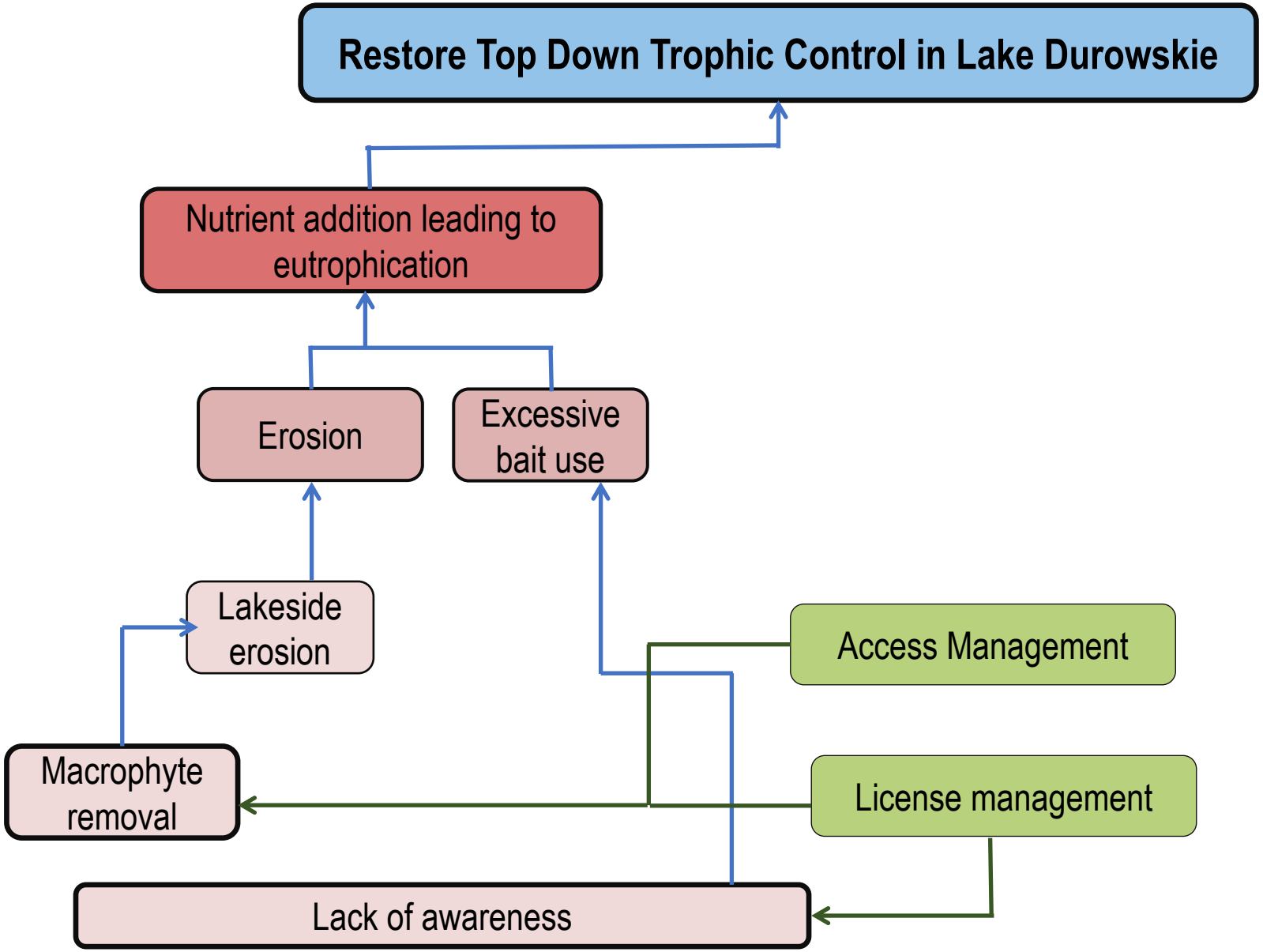
Nutrient addition leading to eutrophication
Erosion
Surface Runoff
Trampling
Access Management
Lack of awareness


Restore Top Down Trophic Control in Lake Durowskie
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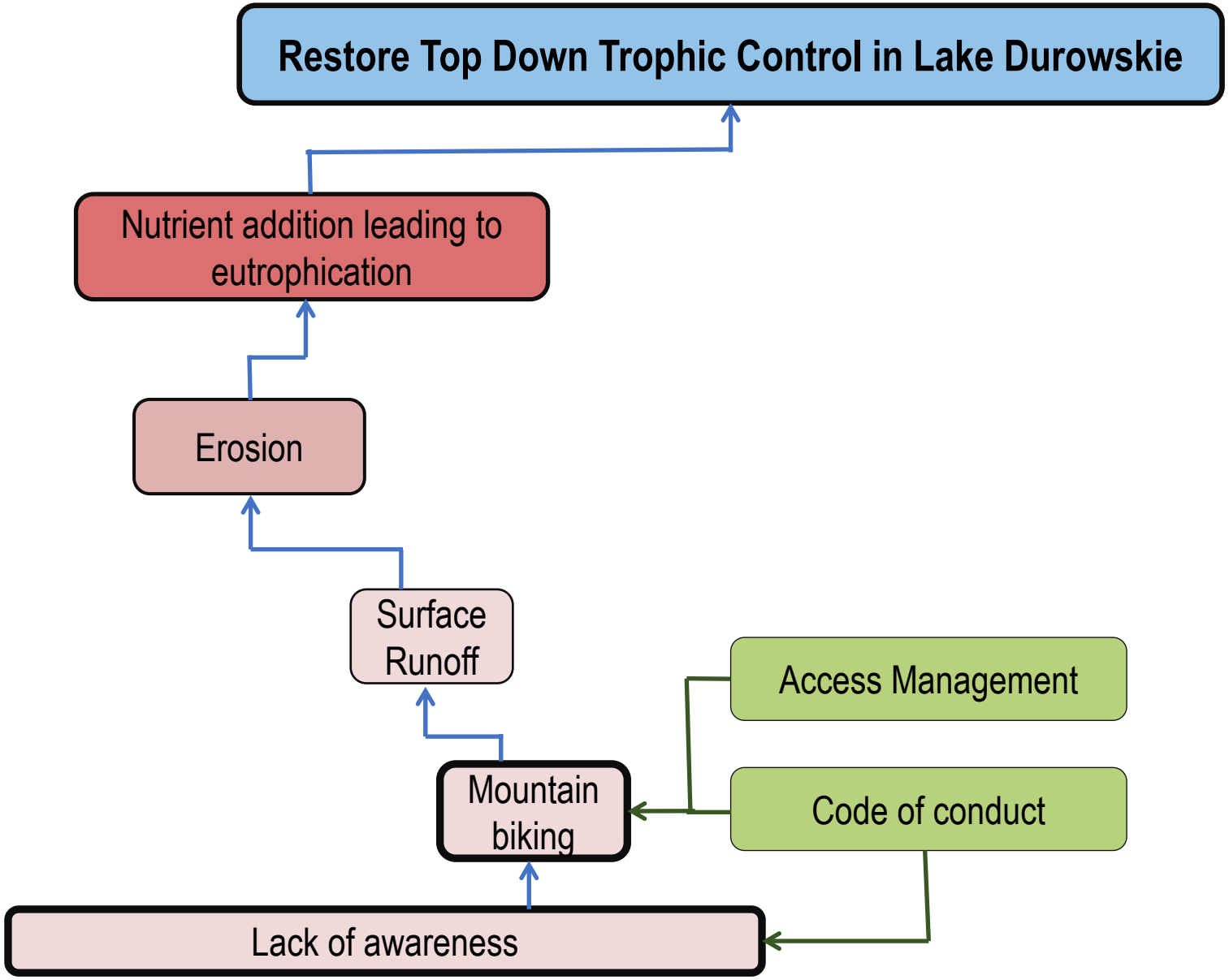
Erosion
Excessive bait use
Lakeside erosion
Access Management
Macrophyte removal
License management
Lack of awareness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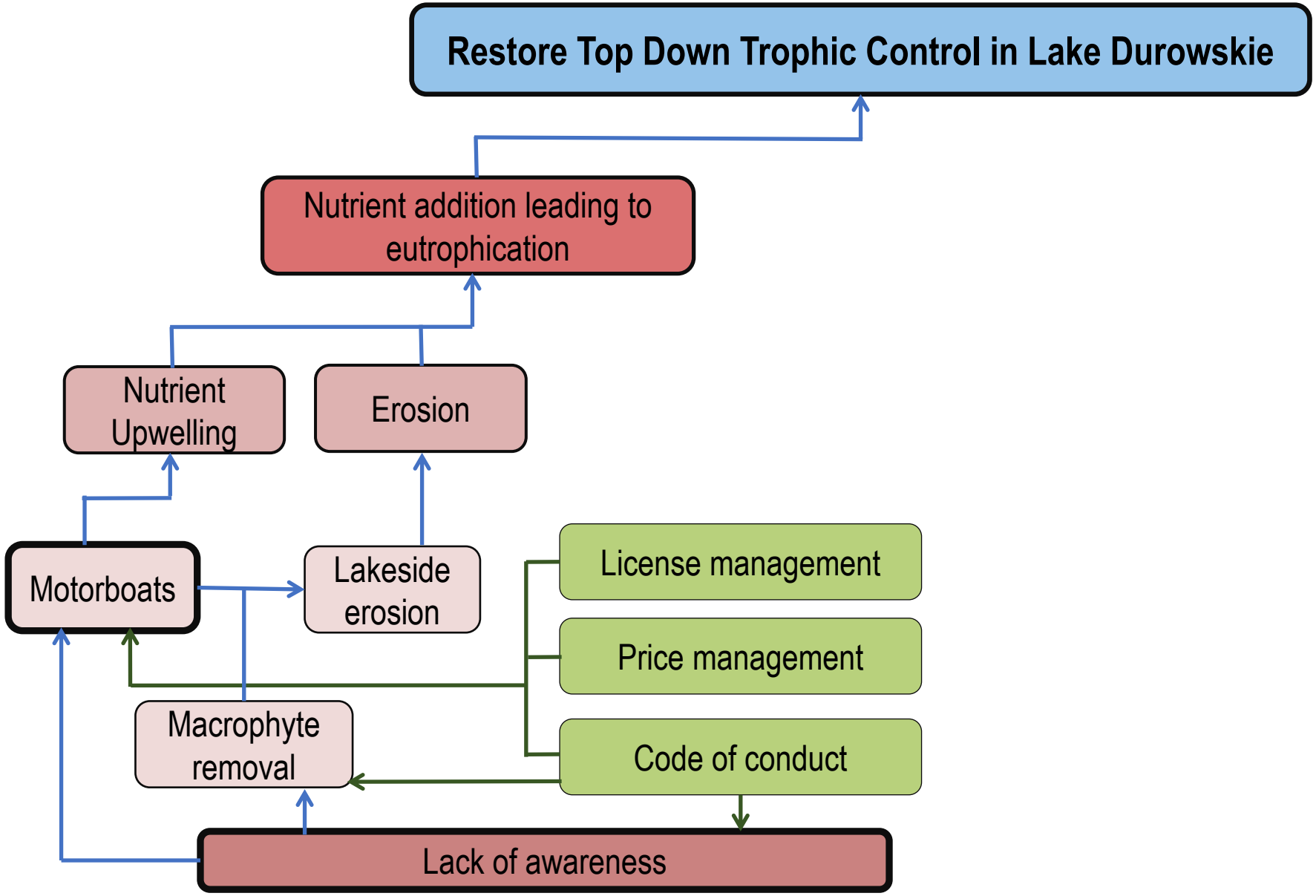
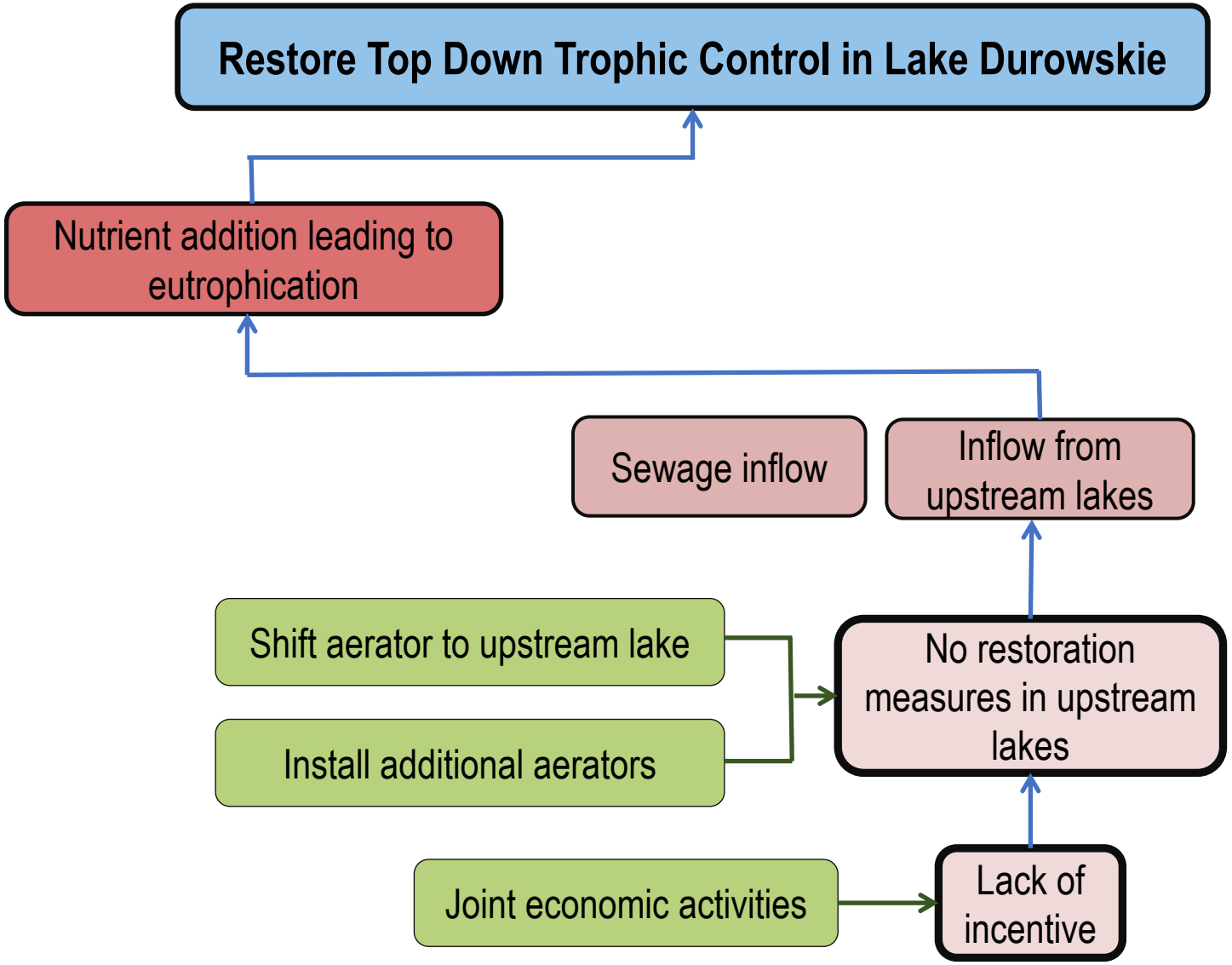
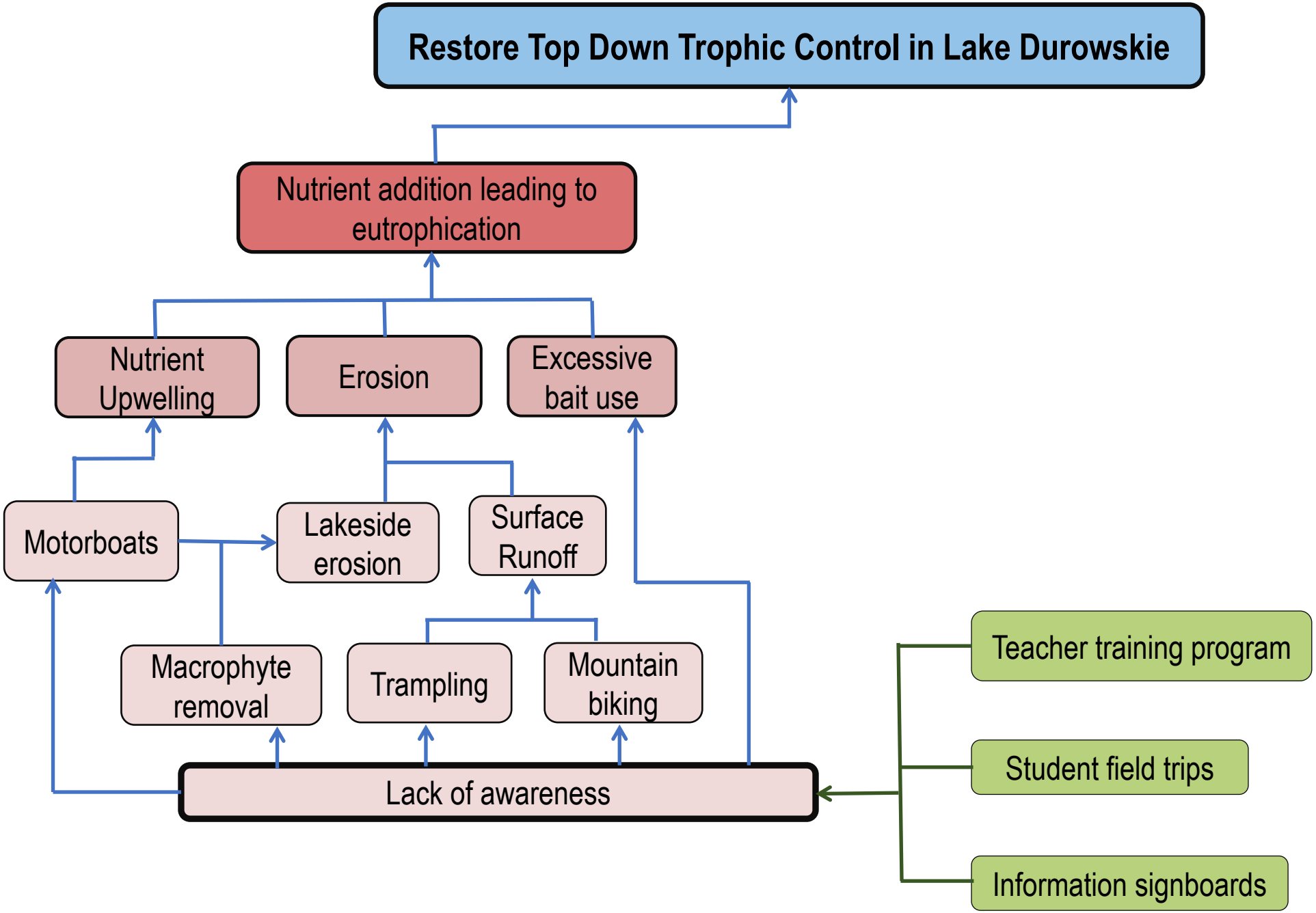
Erosion
Surface Runoff
Mountain biking
Access Management
Code of conduct
Lack of awareness


Restore Top Down Trophic Control in Lake Durowskie
Nutrient addition leading to eutrophication
Nutrient Upwelling
Erosion
Motorboats
Lakeside erosion
License management
Price management
Code of conduct
Macrophyte removal
Lack of awareness


Restore Top Down Trophic Control in Lake Durowskie
Nutrient addition leading to eutrophication
Sewage inflow
Inflow from upstream lakes
Shift aerator to upstream lake
Install additional aerators
No restoration measures in upstream lakes
Joint economic activities
Lack of incentive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