Incorporating Adaptive Management and Translational Ecology into the North Dakota Total Maximum Daily Load Program

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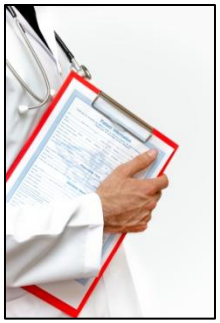
What is Translational Ecology?

- Translational medicine - “Bench to Bedside”
  - Defined as taking information gathered from biomedical research and having it applied in a timely and efficient manner to assist doctors in the prediction, prevention, diagnosis and treatment of their patients (Wehling, 2008 and Littman et al., 2007).
  - Basic medical findings and information were not leading to new drugs or treatments.



Translational Ecology

"*Ecology is well into its second century as an organized scientific discipline, rich with observations, experiments, and general understanding of how the natural world works. Today's environmental scientists have a powerful array of tools and techniques to measure and monitor the environment and to interpret vast and diverse data. Yet despite producing an enormous amount of new information, ecologists are often unable to convey knowledge effectively to the public and to policy-makers.*"

- Willliam H. Schlesinger president of the Cary Institute of Ecosystem Studies Millbrook, NY

Translational Ecology

- "Communication Gap" – ecologists are unable to translate knowledge to stakeholders to assist in successful action.
  - "Stakeholders believe science is disconnected from real-world concerns." – Mark Brunson and Scott Hoffman
- Clear understanding of environmental information will help the public and policy-makers understand the impacts and implications of their choices on the environment.

What do we need to do to make Translational Ecology effective?

- Interdisciplinary approach
  - Scientists, engineers, public health experts (biomedical researchers)
  - Public, resource managers, and policy-makers (doctors)
  - Ecosystem (patient)

What do we need to do to make Translational Ecology effective?

- **Effective Outreach Product** (ENVS 6900: Translational Ecology Syllabus)
  - What is the problem?
  - What is science doing to solve it?

- Understanding of the socio-ecological system and interaction.

- Effective communication with non-scientific audiences.
  - Stakeholder understanding of science.
  - Enhance public participation in scientific research.

What do we need to do to make Translational Ecology effective?

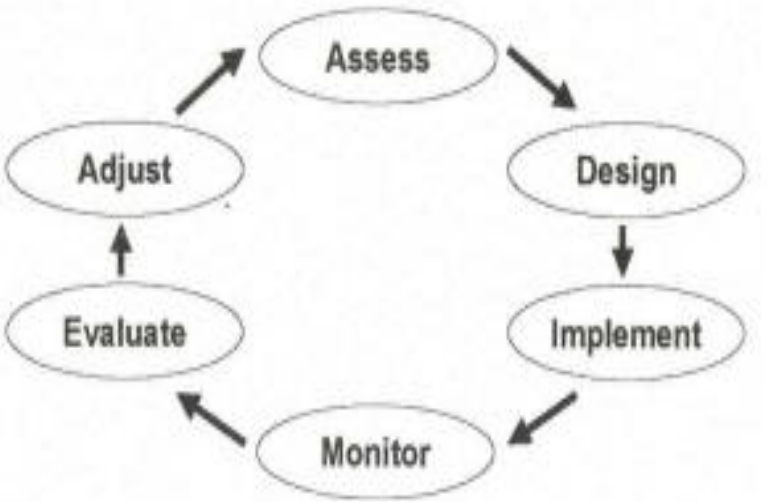
- Other groups to include: media (TV, newspaper, radio), city and state leaders.
  - These folks have “experience” communicating with the public and policy makers.
  - Also translational ecology could help them be better informed to convey accurate reports/information.

What is Adaptive Management?

- Defined as "learning while doing" despite uncertainty (Walters and Holling, 1990).
- Adaptive management comes in two forms:
  - **Active:** uses experimentation as a "learning process" to evaluate the best management action.
  - **Passive:** uses available information to choose the best management action but allows leeway for new information to alter future decisions (Walters and Holling, 1990).

Adaptive Management

- Six step process:
  - Assessment of problem
  - Design
  - Implementation
  - Monitoring
  - Evaluation
  - Adjustment



- Repeatable and do not need to follow any order (Freedman et al., 2004).

Adaptive Management

- Two Dominant Schools of Thought
  - Resilience – Experimentalist (Gunderson et al., 1995)
  - Decision – Theoretic (Possingham et al., 2001; Williams et al., 2007)

Resilience- Experimentalist School

- Hypothesis driven.
- Includes stakeholders in decision making.
- Develops a mutual understanding of the ecosystem, management and actions.

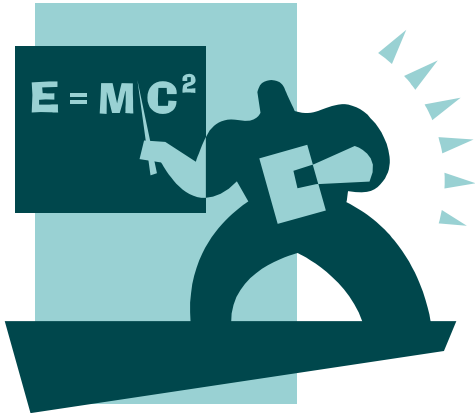
Resilience- Experimentalist School

- Gain knowledge through experimentation with management techniques on ecosystem resilience.

- **Complex ecological model**
  - Management of the ecosystem is through learning and understanding of ecosystem response to management actions.

Decision - Theoretic

- **Structured decision making theory**
  - Used in business and economics to make intricate decisions that involve risk.
- Communication with stakeholders focused on structured decision making.
  - Management problem
  - Objectives
  - Actions

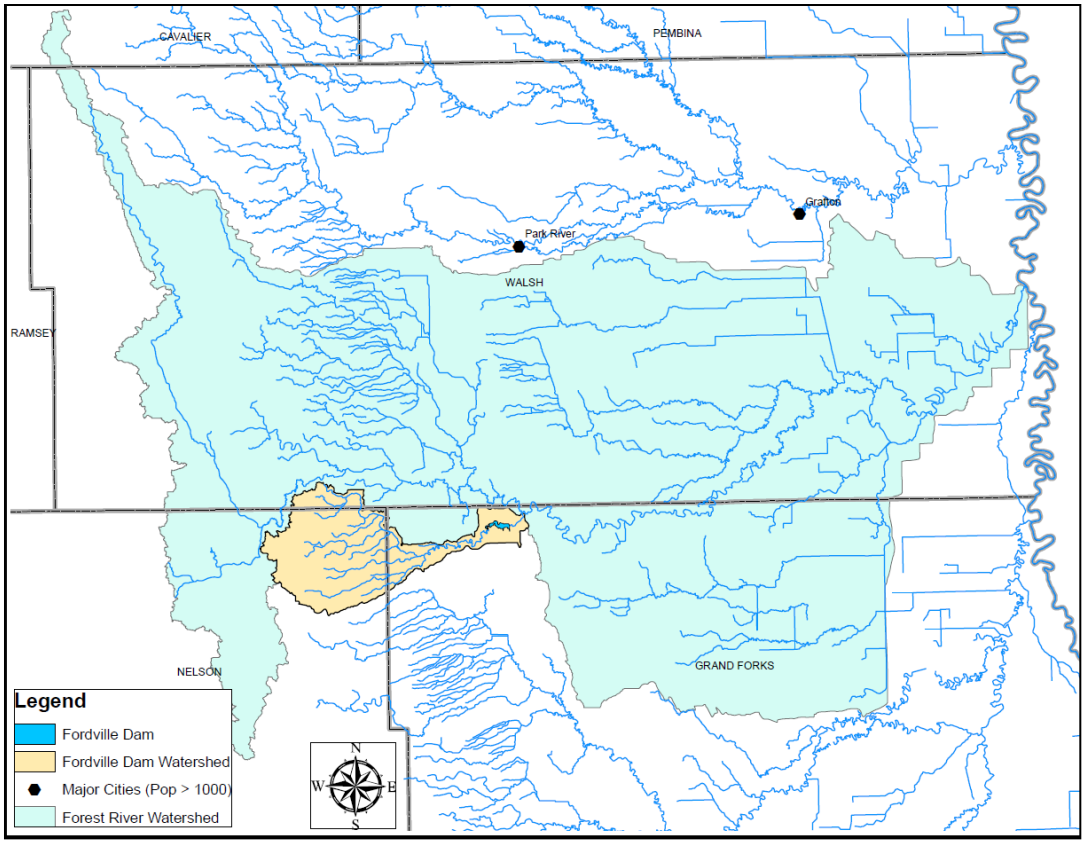


Decision - Theoretic

- No experimentation is needed.
- Prioritized set of objectives based on actions and tradeoffs of other management decisions.
- **Less complex ecological model**
  - Management of the problem with no regard to ecosystem response to those decisions.

Fordville Dam Case Study

- 185 acre multipurpose reservoir
- Flood Protection and Wildlife Habitat
- Located on the South Branch Forest River
- Recreational activities include fishing, boating, hiking, and swimming



Fordville Dam Case Study

- 303(d) TMDL Listing
  - Recreational use is impaired
  - Nutrient/eutrophication
  - 1992-1993: hypereutrophic 0.33 mg/L TP
  - 2009-2010: hypereutrophic 0.35 mg/L TP
  - Nutrient TMDL approved in 2011

Translational Ecology Strategy Plan

- Watershed Council
  - Resource managers/voting members: Soil Conservation Districts and Water Resource Boards, landowners, residents, other local government officials
  - Technical support members: NDDoH, NDG&F, ND Parks and Recreation, NRCS, USGS, USFWS, ND Extension Service, and universities

Translational Ecology Strategy Plan

- **Scientific Knowledge Session**
  - Build a knowledge foundation
  - Two-way Learning: Scientist-Stakeholders
- **Water Quality Results Session**
  - Clear up misunderstanding and miscommunication
  - Express questions, opinions, or comments
  - Form partnerships and team building
- **Implementation Planning Session**
  - Stakeholders are involved in the decision making process

Scientific Knowledge Session

- Watershed council has a variety of members in the social-ecological system.
  - Knowledge will vary concerning ecosystem function and response, conservation, and water quality.
- Translational ecology issues:
  - Scientific concepts and terminology
  - Modeling
  - Ecology
  - Conservation
  - Water Quality
- *Social-ecological implications of decision-making*

Scientific Knowledge Session

- Information and knowledge would be translated through various activities.
  - **Hands on activities** (ex) water quality sampling).
    - Group discussion focused on outlining the importance of gathering baseline data.
  - **Classroom data analysis**
    - Group discussion focused data analysis and methods.
    - Feedback from the council members would be utilized to identify information gaps and opportunities for further learning.
    - **Two way communication:** scientists teaching stakeholders but also stakeholders teaching scientists

Water Quality and Watershed Assessment Results Session

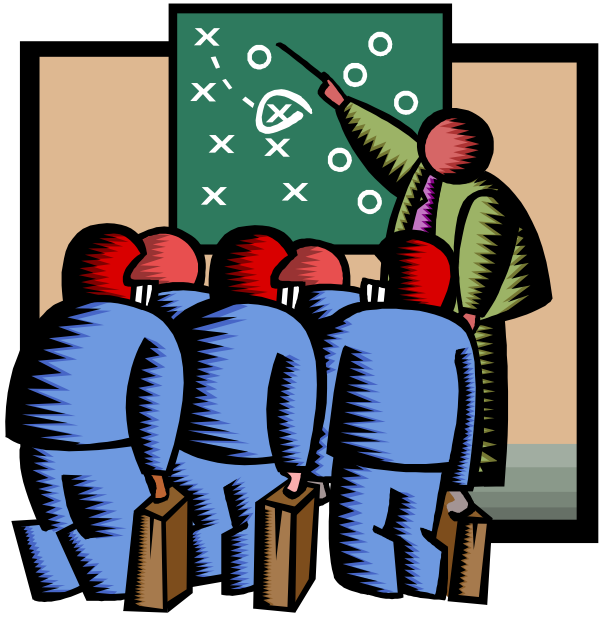
- Water quality assessment and TMDL report would be discussed.
  - Small group "breakout sessions" will be held to discuss.
    - Miscommunication or misunderstanding of the data.
    - Barriers to learning.
    - Each group will have a member of the technical support group as moderator.
  - Large group discussion will focus on questions, opinions, or topics that arose during the "breakout sessions".
  - Data gaps will be identified and prioritized.
  - Teaching and learning techniques would also be fine tuned to be more effective.

Implementation Strategy Plan

- Planning Session focused on BMP implementation.
  - Local, state, and/or national projects used as examples to identify a management plan.
- **"Building Resilience"** into the system.
  - Alternative management techniques will be analyzed to account for future uncertainty (Polasky et al., 2011).
    - Various models could be utilized to assess future watershed change scenarios.
    - Accounting for disturbances or stressors.
- Basic implementation guide map.
  - Allow future watershed council members to reference as they make management decisions.

Adaptive Management Strategy Plan

- Series of management actions to attain the TMDL target.
- Periodic review of the implementation plan to incorporate new information or water quality controls.
- Completion dates to promote progress.



Adaptive Management Strategy Plan

Three different alternatives:

1) Information/Education/ Technical Assistance
2) Voluntary Cost Share Assistance
3) Watershed/Water Quality Improvement Special Assessment

Information/Education/Technical Assistance

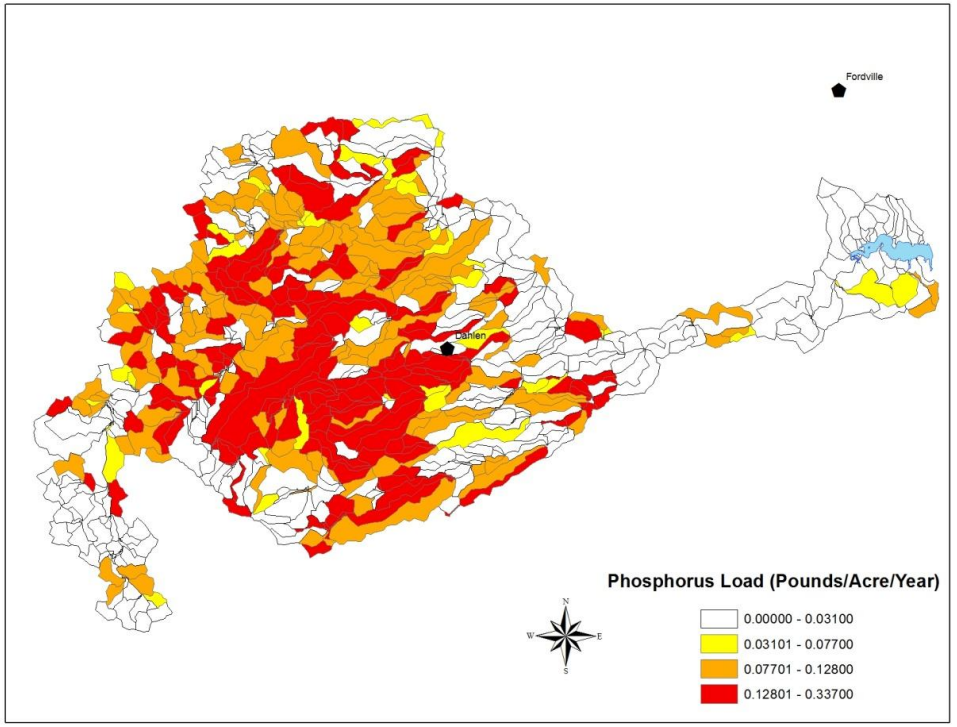
- Stimulates communication between resource managers, stakeholders, and scientists on water quality results, impacts, and BMP's.
- Stakeholders will have a better idea as to how their actions are impacting the watershed (i.e. policies, decisions, management techniques etc.)
- Stakeholders would have personalized resource management plans addressing their specific resource concerns.
- As new information became available outreach would continue to provide the latest tools and techniques to address future resource concerns.

Information/Education/Technical Assistance

- Goal: Stakeholders will have the tools, techniques, and environmental knowledge to make management decisions/understand the impacts, address their resource concerns, improve their operation, and be conservation minded.

Voluntary Cost Share Assistance

- Cost share assistance would be pro-rated based on critical areas identified in a watershed model and attainment of TMDL target.
- Cost Share Rates
  - 100% high critical areas
  - 50% medium critical are
  - 25% anywhere in the watershed



Voluntary Cost Share Assistance

- Resource managers would work closely with each landowner to design and implement site specific BMP's and address resource concerns.
- Monitoring would be used to evaluate effectiveness of the BMP's installed.
- If results are less than ideal alternative BMP's will be researched and implemented until the desired feedback is achieved.

Water Quality/Watershed Special Assessment

- Remove enough phosphorus to improve the water quality and beneficia
- Cost
  - Amount
  - Removal Technique
    - Low Cost Input Example
      - Low level drawdown
    - High Cost Input Example
      - Dredging
  - Time

Water Quality/Watershed Special Assessment

- Payment Plan
  - Landowners and residents
  - Recreationists
  - Alternative Funds
- Monitoring would be used to gauge the social-ecological response of the system (ex. ecosystem response, recreation activity, public satisfaction).
- Future management decisions would be based on data and adjustments made until desired results are met.



Summary

- Translational Ecology can be used for all areas of ecology.
- Translational ecology is vital in the success of adaptive management because it returns information back into the system.
- Adaptive management has been used to manage wildlife/wildlife habitat but not water quality or TMDLs.

Summary

- Adaptive management probes or experiments will not be "fail safe" but "**safe to fail**".
  - "Safe to fail" (Snowden and Boone, 2007)
    - Small adaptive management probes or experiments should be implemented that allow the ecosystem to recover quickly.
  - Failure is seen as a learning process and the information accrued is used to develop a better understanding of the consequences of decisions.
  - As stakeholder confidence grows large adaptive management probes or experiments would be implemented.

Conclusions

- Incorporating learning through translational ecology process will make adaptive management more complete.

- Learning is not structurally incorporated into adaptive management and lack of structured learning is a reason for adaptive management failing (Ruhl and Fischman, 2010).

Conclusions

- Translational ecology allows information to be transferred more efficiently and effectively to stakeholders, lawmakers, and resource managers.
  - Making adaptive management more effective across multiple ecosystems.

Suggested Reading

"Don't be such a scientist: Talking substance in an age of style."

By Randy Olson

Youtube Video

http://youtu.be/XjaTDA-9_sk