REGIME SHIFTS DATABASE

CASE STUDY TEMPLATE

Last updated: 14 October 2017

GREEN = Free text, paragraph style
BLUE = Free text, brief keywords or phrases
RED = Choose from predefined keyword options

BASIC INFORMATION (LEVEL 1)

1. Name of the case study
Short, succinct name for the case study (e.g. Lake Mendota)

2. Main Contributors
Names of those who primarily contributed to the text.

3. Other Contributors
Names of others who contributed to and reviewed the text.

4. Type of Regime Shift
What type of regime shifts is this case study an example of (eg eutrophication)? A case study may be an example of more than one type of regime shift.

5. Ecosystem type in which case study is located

- Marine & coastal
- Freshwater lakes & rivers
- Temperate & Boreal Forests
- Tropical Forests
- Moist savannas & woodlands
- Drylands & deserts (below ~500mm rainfall/year)
- Mediterranean shrub (Fynbos)
- Grasslands
- Tundra
- Rock & Ice
- Agro-ecosystems
- Planetary

6. **Land uses in the case study**

- Urban
- Small-scale subsistence crop cultivation
- Large-scale commercial crop cultivation
- Intensive livestock production (eg feedlots, dairies)
- Extensive livestock production (natural rangelands)
- Timber production
- Fisheries
- Mining
- Conservation
- Tourism

7. **Spatial scale of the case study**
   - Local/landscape (e.g. lake, catchment, community)
   - National (country)
   - Sub-continental (e.g. southern Africa, Amazon basin)
   - Global

8. Region/State
Region where the specific case study lies (e.g. Wisconsin, southern Africa)

9. Countries
Countries in which the specific example lies (e.g. USA, Sweden)

10. Continent or Ocean

Africa
Antarctica
Asia
Australia & New Zealand
Europe
North America
South America

Arctic Ocean
Atlantic Ocean
Indian Ocean
Pacific Ocean
Southern Ocean

11. Summary of the case study
Brief summary of the case study: the type of system (eg marine, savanna, urban) the alternate regimes, when the regime shift happened, key feedbacks maintaining each regime, key drivers that caused the regime shift to happen, main impacts on ecosystem services and human well-being, and management interventions. Note key features that make the regime shift in the particular case study different from the generic case of the regime shift.

12. References
Key references to get more information about the case study

13. Diagrams & Photos
Diagrams or photographs that illustrate the regime shift in the particular case study. Include a caption as well as the source. Only include photos or diagrams that can be freely distributed.

DETAILED DESCRIPTION (OPTIONAL) (LEVEL 2)

14. Introduction (max 200 words)
Brief introduction/background to the case study. Where is it located? How big is it (km^2)? What are the key features of the area? How connected or isolated is the system? When did the regime shift in the area take place?

15. Description of the alternate regimes (max 300 words)
A description of the 2 or more alternate regimes that have been observed in the case study, as well as the key features that characterize each regime. Include key references. Use the following structure:

Name for Regime 1

Para 1: Briefly describe what the regime looks like - what do you see in the field? (e.g., clear water, rooted plants on lake floor, limited agriculture in the catchment)

Name for Regime 2

Para 1: Briefly describe what the regime looks like - what do you see in the field? (e.g., turbid water, dense algal blooms, extensive agriculture in the catchment)

16. Drivers and causes of the regime shift (max 300 words per shift)
This section contains a description of the key drivers that caused the system to shift from Regime 1 to Regime 2. Include key references. We suggest the following structure:

Shift from Regime 1 to Regime 2

Para 1: Describe the main causes of the regime shift.

Para 2: Describe other important causes of the regime shift.

Where applicable, do the same for the shift from regime 2 to regime 1.

17. How the regime shift worked (max 400 words per shift)
This section describes in lay terms how the drivers and feedbacks interacted to cause the system to shift from Regime 1 to Regime 2. Include key references. We suggest the following structure for this section:

Shift from Regime 1 to Regime 2

Para 1: Describe how Regime 1 worked: under which conditions dis it occur, and what feedbacks maintained the regime?

Para 2: Describe how the key drivers caused the system to cross key thresholds and move into Regime 2.

Para 3: Describe how Regime 2 works, and the key feedbacks that maintain the regime and make it difficult to reverse.

Where applicable, do the same for the shift from regime 2 to regime 1.

18. Impacts on ecosystem services and human well-being (max 200 words per shift)
This section describes the impacts of the regime shift on ecosystems, ecosystem services (provisioning, regulating, cultural) and human well-being.

Shift from Regime 1 to Regime 2

Para 1: Which ecosystem services were lost and gained with this regime shift?

Para 2: What impacts did this have on human well-being? Who benefitted and lost?

Where applicable, do the same for the shift from regime 2 to regime 1.

19. Options for managing the regime shift (max 300 words)
Describe what actions were taken to prevent a shift to an undesirable regime or restore/ encourage a shift to a desirable regime. Use the following structure to write this section:

Para 1: Actions taken to prevent the regime shift (ie, to enhance resilience). What management actions or interventions were taken to maintain desirable regimes and avoid undesirable regime shifts?

Para 2: Actions for restoration of desirable regimes (ie, reducing resilience to encourage restoration or transformation). What management actions or interventions were taken to transform to or restore desirable regimes?

The following fields serve as summaries of the details captured in 3-5, their main purpose being to enable searching and organization of the database.

20. **Key direct drivers of the RS**
    - 20.1. Vegetation conversion and habitat fragmentation
    - 20.2. Harvest and resource consumption
    - 20.3. External inputs (eg fertilizers, pest control, irrigation)
    - 20.4. Adoption of new technology (eg new fishing nets)
    - 20.5. Infrastructure development (eg roads, pipelines)
    - 20.6. Species introduction or removal
    - 20.7. Disease
    - 20.8. Soil erosion & land degradation
    - 20.9. Environmental shocks (eg fire, floods, droughts)
    - 20.10. Global climate change

21. **Impacts on Key Ecosystem Processes**
    - 21.1. Soil formation
    - 21.2. Primary production
    - 21.3. Nutrient cycling
    - 21.4. Water cycling

22. **Impacts on Biodiversity**
    - 22.1. Biodiversity

23. **Impacts on ecosystem services**
    - 23.1. Provisioning services
        - Freshwater
        - Food Crops
        - Livestock
        - Fisheries
        - Wild animal and plant products

Timber
Woodfuel
Feed, fuel and fiber crops
Hydropower

23.2. Regulating services
Air quality regulation
Climate regulation
Water purification
Water regulation
Regulation of soil erosion
Pest & disease regulation
Pollination
Natural hazard regulation

23.3. Cultural services
Recreation
Aesthetic values
Knowledge and educational values
Spiritual and religious

24. **Impacts on Human Well-being**
- 24.1. Food and nutrition
- 24.2. Health (eg toxins, disease)
- 24.3. Livelihoods and economic activity
- 24.4. Security of housing & infrastructure
- 24.5. Aesthetic and recreational values
- 24.6. Cultural identity
- 24.7. Social conflict
- 24.8. No direct impact

25. **Impacts on the Sustainable Development Goals (SDGs)**
- 25.1. No poverty
- 25.2. Zero hunger
- 25.3. Good health and well-being
- 25.4. Quality education
- 25.5. Gender equality
- 25.6. Clean water and sanitation
- 25.7. Affordable and clean energy
- 25.8. Decent work and economic growth
- 25.9. Industry, innovation & infrastructure
- 25.10. Reduced inequalities
- 25.11. Sustainable cities and communities
- 25.12. Responsible consumption and production
- 25.13. Climate action
- 25.14. Life below water
- 25.15. Life on land
- 25.16. Peace, justice and strong institutions
- 25.17. Partnerships for the goals

26. **Time scale over which RS occurred**
- 26.1. Weeks
- 26.2. Months
- 26.3. Years
- 26.4. Decades
- 26.5. Centuries

26.6. Unknown

27. **Reversibility of RS**
    27.1. Irreversible (on 100 year time scale)
    27.2. Hysteretic (difficult to reverse)
    27.3. Readily reversible
    27.4. Unknown

28. Sources of Evidence
    28.1. Models
    28.2. Paleo-observation
    28.3. Contemporary observations
    28.4. Experiments
    28.5. Other

29. Confidence: Existence of RS
    29.1. Speculative – Regime shift has been proposed, but little evidence as yet
    29.2. Contested – Reasonable evidence both for and against the existence of RS
    29.3. Well established – Wide agreement in the literature that the RS exists

30. Confidence: Mechanism underlying RS
    30.1. Speculative – Mechanism has been proposed, but little evidence as yet
    30.2. Contested – Multiple proposed mechanisms, reasonable evidence both for and against different mechanisms
    30.3. Well established – Wide agreement on the underlying mechanism

REGIME SHIFT ANALYSIS (OPTIONAL) (LEVEL 3)

30. Causal loop diagram illustrating the regime shift

The figure should illustrate the dynamics of the integrated SES, not only the ecological system. You will usually develop the CLD iteratively as you work through the template.

31. Feedback mechanisms

This section contains a description of the known or proposed feedback mechanisms that maintain each regime. Note that the same mechanism can act to maintain both regimes (eg albedo can both maintain ice and open water) – in this case describe how the feedback works to maintain each regime. Include key references. Use the following structure to write this section:

Name of Regime 1

- *Name of feedback mechanism 1 (scale, uncertainty)*: Describe how the feedback works to maintain the regime. Note the scale at which the feedback operates (local, regional or global), and whether it is well-established, contested or speculative.
- *Name of feedback mechanism 2 (scale, uncertainty)*: Describe how the feedback works to maintain the regime. Note the scale at which the feedback operates (local, regional or global), and whether it is well-established, contested or speculative.
- *Etc.*

Name of Regime 2

- *Name of feedback mechanism 1 (scale, uncertainty)*: Describe how the feedback works to maintain the regime. Note the scale at which the feedback operates (local, regional or global), and whether it is well-established, contested or speculative.
- *Name of feedback mechanism 2 (scale, uncertainty)*: Describe how the feedback works to maintain the regime. Note the scale at which the feedback operates (local, regional or global), and whether it is well-established, contested or speculative.
- *Etc.*

32. Drivers of the regime shift

This section contains a description of the key drivers that cause the system to shift from Regime 1 to Regime 2 and vice versa. Explicitly describe how the drivers affect the system state or the feedback mechanisms identified above in order to cause the shift. The description should not focus purely on the ecological dynamics, but include anthropogenic links and drivers – i.e. describe the regime shift from an SES perspective. Include key references. Use the following structure to write this section (if there are no factors in a particular category, then simply delete that category):

Shift from Regime 1 to Regime 2

Important shocks (eg droughts, floods) that contribute to the regime shift include:

- *Shock 1 (scale, uncertainty):* Describe how the shock affects the system state and/or feedbacks to cause the shift. Where possible note the scale at which the shock operates (local, regional or global), and whether its effect is well-established, contested or speculative.

- Etc.

The main **external <u>direct</u> drivers** that contribute to the shift include:

- *External direct driver 1 (scale, uncertainty)*: Describe how the driver affects the system state and/or feedbacks to cause the shift. Where possible note the scale at which the driver operates (local, regional or global), and whether its effect is well-established, contested or speculative.
- Etc.

The main **external <u>indirect</u> drivers** that contribute to the shift include:

- *External in direct driver 1 (scale, uncertainty)*: Describe how the driver affects the system state and/or feedbacks to cause the shift. Where possible note the scale at which the driver operates (local, regional or global), and whether its effect is well-established, contested or speculative.
- Etc.

Slow internal system changes that contribute to the regime shift include:

- *Slow variable 1 (scale, uncertainty)*: Describe how the slow variable affects the system state and/or feedbacks to cause the shift. Where possible note the scale at which the internal system change operates (local, regional or global), and whether its effect is well-established, contested or speculative.
- Etc.

	Driver (Name)	**Type** (Direct, Indirect, Internal, Shock)	**Scale** (local, regional, global)	**Uncertainty** (speculative, proposed, well-established
1				
Etc				

Where applicable, do the same for the shift from regime 2 to regime 1.

33. <u>Key Thresholds</u>

Describe the key thresholds that “tip” the system from one regime to another.

Shift from Regime 1 to Regime 2

- Threshold 1 – briefly describe
- Threshold 2 – briefly describe
- Etc

Shift from Regime 2 to Regime 1

- Threshold 1 – briefly describe
- Threshold 2 – briefly describe
- Etc

34. <u>Leverage Points</u>

Describe the key places to intervene in the system – ie key variables and drivers that can be manipulated to enhance resilience of desirable regimes or encourage restoration or transformation. Point out if the leverage points are differ for different actors.

- *Leverage point 1 (scale, uncertainty):* Describe how the leverage point affects the system state and/or feedbacks to effect change in the system. Where possible note the scale and level of certainty about the leverage point.

- Etc.

35. Ecosystem Service & Human Wellbeing Impacts

Detailed, systematic description of ecosystem service impacts. List by the following categories and identify how the changes affect different user groups in different ways. Complete the following table:

	Direction of change*	References (if available)	Agribusiness*	Subsistence Farmers*	Urban dwellers*	Tourists*	Other group*
Provisioning Services							
Freshwater							
Crops							
Livestock							
Fisheries							
Wild Food &							
Timber & Woodfuel							
Hydropower							
Regulating Services							
Air Quality							
Climate Regulation							
Water Purification							
Soil Erosion Regulation							
Pest & Disease Regulation							
Pollination							
Protection against Natural Hazards							
Cultural Services							
Recreation							

Aesthetic Value							
Cognitive & Educational							
Spiritual & Inspirational							

*Use one of the following 5 options for direction of change:

i. Increase = +
ii. Decrease = -
iii. Context-dependent (sometimes increases, sometimes decreases) = +/-
iv. No change = 0
v. Uncertain/unknown = ?

36. Uncertainties and unresolved issues

Note any uncertainties or unresolved issues regarding the regime shift.