REGIME SHIFTS DATABASE

REGIME SHIFTS TEMPLATE

Last updated: 14 October 2017

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

1. Regime shift name
Short, succinct name for the type of regime shift. Try to include a brief reference to both regimes (e.g. clear to turbid water). The regime shift types should be generalized descriptions of the dynamics of a particular kind of RS as observed over multiple case studies, rather than a description of the dynamics that occurred in a particular case (e.g. Lake Eutrophication in Lake Mendota). However, for large-scale regional or global RS the case may be unique (e.g. collapse of the thermohaline circulation) and can then be described in unique terms.

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. Summary/Abstract of regime shift (max 150 words)
Brief, clear, easy-to-understand summary of the regime shift: the alternate regimes, the key drivers (social and ecological), and key impacts. This section is intended to be understandable by lay persons and the general public. Limit the summary to 1 paragraph and do not include references. This section should be written last, once you have finalized all the other sections.

5. Alternate regimes (max 300 words)
This section describes the different regimes that may exist in the system. Use the following structure to write this section:

Para 1: Brief introduction and background to the topic/system. Clearly define the system and its boundaries (eg, lake and its watershed, including the people living in the landscape). Where does the system (eg coral reefs) occur?

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)

6. Drivers and causes of the regime shift (max 300 words per shift)

This section contains a description of the key drivers that cause 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.

7. How the regime shift works (max 400 words per shift)

This section describes in lay terms how the drivers and feedbacks interact to cause the system to shift from Regime 1 to Regime 2 and vice versa. Include key references. We suggest the following structure for this section:

Shift from Regime 1 to Regime 2

Para 1: Describe how Regime 1 works: under which conditions does it occur, and what feedbacks maintain the regime?

Para 2: Describe how the key drivers cause 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.

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

8. 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 are lost and gained with this regime shift?

Para 2: What impacts does this have on human well-being? Who benefits and loses?

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

9. Options for managing the regime shift (max 300 words)

Describe the options for preventing undesirable regime shifts or restoring/encouraging desirable regime shifts. Use the following structure to write this section:

Para 1: Options for preventing regime shift (ie, enhancing resilience). What management actions or interventions can be taken to maintain desirable regimes and avoid undesirable regime shifts?

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

10. Key References

References cited in the paragraph descriptions and other key references

The following fields serve as a summary of the details above, and their main purpose is to enable database searches. Highlight the options that apply:

11. **Key direct drivers of the RS**
    - 11.1. Vegetation conversion and habitat fragmentation
    - 11.2. Harvest and resource consumption
    - 11.3. External inputs (eg fertilizers, pest control, irrigation)
    - 11.4. Adoption of new technology (eg new fishing nets)
    - 11.5. Infrastructure development (eg roads, pipelines)
    - 11.6. Species introduction or removal
    - 11.7. Disease
    - 11.8. Soil erosion & land degradation
    - 11.9. Environmental shocks (eg fire, floods, droughts)
    - 11.10. Global climate change

12. **Land use under which the RS occurs**
    - 12.1. Urban
    - 12.2. Small-scale subsistence crop cultivation
    - 12.3. Large-scale commercial crop cultivation
    - 12.4. Intensive livestock production (eg feedlots, dairies)
    - 12.5. Extensive livestock production (natural rangelands)
    - 12.6. Timber production
    - 12.7. Fisheries
    - 12.8. Mining
    - 12.9. Conservation
    - 12.10. Tourism
    - 12.11. Land use impacts are primarily off-site (e.g. dead zones in the ocean caused by fertilizer use in the interior; also indicate the relevant land uses above)

13. **Ecosystem type in which the RS occurs**
    - 13.1. Marine & coastal
    - 13.2. Freshwater lakes & rivers
    - 13.3. Temperate & Boreal Forests
    - 13.4. Tropical Forests
    - 13.5. Moist savannas & woodlands
    - 13.6. Drylands & deserts (below ~500mm rainfall/year)
    - 13.7. Mediterranean shrub (e.g. fynbos)
    - 13.8. Grasslands
    - 13.9. Tundra
    - 13.10. Rock & Ice
    - 13.11. Agro-ecosystems
    - 13.12. Planetary

14. **Impacts on Key Ecosystem Processes**
    - 14.1. Soil formation
    - 14.2. Primary production
    - 14.3. Nutrient cycling
    - 14.4. Water cycling

15. **Impacts on Biodiversity**
    - 15.1. Biodiversity

16. **Impacts on ecosystem services**
    - 16.1. Provisioning services
        - Freshwater
        - Food Crops
        - Livestock
        - Fisheries
        - Wild animal and plant products
        - Timber
        - Woodfuel
        - Feed, fuel and fiber crops
        - Hydropower
    - 16.2. Regulating services
        - Air quality regulation
        - Climate regulation
        - Water purification
        - Water regulation
        - Regulation of soil erosion
        - Pest & disease regulation
        - Pollination
        - Natural hazard regulation
    - 16.3. Cultural services
        - Recreation
        - Aesthetic values
        - Knowledge and educational values
        - Spiritual and religious

17. **Impacts on Human Well-being**
    - 17.1. Food and nutrition
    - 17.2. Health (eg toxins, disease)
    - 17.3. Livelihoods and economic activity
    - 17.4. Security of housing & infrastructure
    - 17.5. Aesthetic and recreational values
    - 17.6. Cultural identity
    - 17.7. Social conflict
    - 17.8. No direct impact

18. **Impacts on the Sustainable Development Goals (SDGs)**
    - 18.1. No poverty
    - 18.2. Zero hunger
    - 18.3. Good health and well-being
    - 18.4. Quality education
    - 18.5. Gender equality
    - 18.6. Clean water and sanitation
    - 18.7. Affordable and clean energy
    - 18.8. Decent work and economic growth
    - 18.9. Industry, innovation & infrastructure
    - 18.10. Reduced inequalities
    - 18.11. Sustainable cities and communities
    - 18.12. Responsible consumption and production
    - 18.13. Climate action
    - 18.14. Life below water
    - 18.15. Life on land
    - 18.16. Peace, justice and strong institutions

18.17. Partnerships for the goals

19. **Typical spatial scale at which RS occurs**
    19.1. Local/landscape (e.g. lake, catchment, community)
    19.2. National (country)
    19.3. Sub-continental (e.g. southern Africa, Amazon basin)
        (actual RS mechanism occurs at the regional scale OR cumulative impact/extent of local-scale RS is regional in scale)
    19.4. Global

20. **Typical time scale over which RS occurs**
    20.1. Weeks
    20.2. Months
    20.3. Years
    20.4. Decades
    20.5. Centuries
    20.6. Unknown

21. **Reversibility of RS**
    21.1. Irreversible (on 100 year time scale)
    21.2. Hysteretic (difficult to reverse)
    21.3. Readily reversible
    21.4. Unknown

22. **Evidence**
    22.1. Models
    22.2. Paleo-observation
    22.3. Contemporary observations
    22.4. Experiments
    22.5. Other

23. **Confidence: Existence of RS**
    23.1. Speculative – Regime shift has been proposed, but little evidence as yet
    23.2. Contested – Reasonable evidence both for and against the existence of RS
    23.3. Well established – Wide agreement in the literature that the RS exists

24. **Confidence: Mechanism underlying RS**
    24.1. Speculative – Mechanism has been proposed, but little evidence as yet
    24.2. Contested – Multiple proposed mechanisms, reasonable evidence both for and against different mechanisms
    24.3. Well established – Wide agreement on the underlying mechanism

25. Links to other regime shifts

List other regime shifts that may be triggered by or that may trigger the current regime shift (eg lake eutrophication is often linked to hypoxia and fisheries collapse).

26. Diagrams/Photos illustrating the regime shift

Diagrams or photographs that illustrate the regime shift or concisely summarize the key drivers and dynamics of the regime shift. Each figure should be accompanied by a caption and information about the source (credit or html link). Only use open-source material.

REGIME SHIFT ANALYSIS (OPTIONAL)

27. 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.

28. 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.*

29. 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.

30. <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

31. <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.

32. 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 **	**Large-scale commercial resource user***	**Small-scale or subsistence resource user***	**Urban dwellers***	**Tourists outside city***	**Other group***	**References (if available)**
Provisioning Services							
Freshwater							
Food Crops							
Feed, Fuel and Fibre 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 Values							
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 = ?

33. Uncertainties and unresolved issues

Note any uncertainties or unresolved issues regarding the regime shift.