BUILDING STATE AND TRANSITION MODELS

PURPOSE OF ACTIVITY

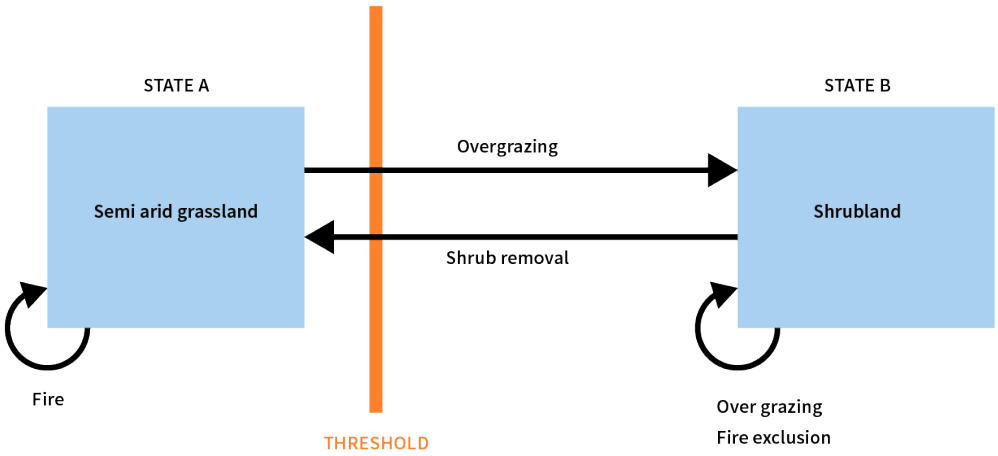
The purpose of this activity is to develop a simple model that illustrates possible changes in the state of your system in relation to thresholds or tipping points. These type of state-and-transition (S&T) models are used to focus in on the dynamics around key thresholds or tipping points in your system, the crossing of which leads to a more fundamental change in the structure and function of a system (sometimes also called a regime shift). Note, the terms threshold and tipping point are use interchangeably here. Threshold is typically used to describe biophysical changes, sudden shifts biological and ecological processes, whereas tipping points may either refer to system behavior at an aggregate level, as a cosequence of one or more thresholds being crossed, or it may refer to a social threshold, defined by perferences. Developing state and transition models is a powerful way to build a shared understanding between stakeholders about important system dynamics. It also helps you prepare for your strategies of change, by identifying potential leverage points in the system. An important indirect benefit is developing state and transition models builds system literacy and capacity to think about underlying system dynamics. See also linked disucssion guide.

RESOURCES NEEDED

Required skills: A general understanding of the concept of thresholds and state or regime shifts.
Time: 2-3 hours
Materials: Poster sheets, marker pens.
Useful links: http://regimeshifts.org/

HOW TO DO IT

Before building your own S&T model, familiarize yourself with the basic structure and format of such models by reviewing some examples.



STEP 1

Start by identifying the specific topic or issue that you are going to develop the model for. This is typically emerges from the more extensive social-ecological systems model developed in Phase 2 or earlier in Phase 3.

STEP 2

Depending on how well the system is known or has been previously studied, you may already be aware of the presence of a particular threshold or tipping points. If you do, start with that knowledge. Draw a line down the center of a large piece of paper. This line represents the threshold or tipping point, separating the different states your system or this aspect of the system could be in. Have a discussion about the threshold or tipping point, what is the nature of it? Have participants seen how the system can change quickly if the threshold is crossed?

If there are no obvious or known thresholds, start with your aspirations for this part of the system. Come up with short descriptive statements, such as good grass cover, productive farms, clean water etc. Then move to the undesirable side and repeat

the same process. Now, explore what the thresholds might be in between these? Is there a point at which the shift from one state to the other starts accelerating so that the system "slides" rapidly toward the other state. That suggests there is a change in the dynamics, such as a change in feedbacks, driving the system towards the new state. If you can, identify the specific change that is occurring.

STEP 3

Draw a box on each side of the center. You can label the box each side 'desirable' and 'undesirable' or 'health'/'unhealthy' or 'productive'/'unproductive', what ever best describes the different states for the stakeholders in the room. What are theconditions on each side?

As the participants to describe the different states, what does a desirable state look like? How does it function? Repeat the question for the other state on the other side of the threshold. You should record 4-6 characteristic dot points in each box that describing the state. For example, if the threshold relates to the dynamics of *community* participation in a land management practices, you would record in the box describing the 'Desired state;

Desired state

- Majority of farmers use the practice
- Sharing of knowledge and information between farmers
- New farmers quickly learn the practice from others
- Learning is coordinated by local government officials

Undesired state

- Few farmers use the practice
- Knowledge is fragmented and not shared between farmers
- Difficult for new farmers to learn
- Limited coordination by local government officials

You should now have 2 boxes, one either side of the threshold or tipping point line, each boxes labeled and containing 4-6 dot points describing those different states. This provides the basic structure for the model.

STEP 4

Now you should reflect on whether there are other possible states the system could be in. You may be able to identify another clear state the system could be in, which may be equally as desirable or undesirable as the ones already identified. Check that they are actually different to the states before continuing. If they are, draw in the new state box below the existing state on the appropriate side of the page (i.e. would

this third alternative be desirable or undesirable?). Repeat this step for other recognizable state, there are usually no more than 2-3 other possible states.

Sometimes there are no other clearly recognizable states, but participants can identify 'transition' states, these are states the system may move through on the way to another desired or undesired state, but the system does not get 'stuck', in other words it will transition through to another more stable state over time, either desired or undesired.
If you can identify transition states, draw them in with dashed lines to signify that they are transitional, placing them somewhere in between the desired and undesired states.

STEP 5

Once you have the basic structure of the S&T model, you can then ask what maintains the system in the various states? What are the reinforcing processes that keep the system in that desired state? These can be identified as a feedbacks. These might include for example regular burning that keeps pasture open and grassy, annual cultivation that prevents regeneration of over story trees, strong governance processes that maintain local resource use within certain limits etc. Try to identify the main one or two processes that are required to keep the system in this state. Use a circular arrow in one corner of the box and record the process that maintains the system in that state.

STEP 6

Now that the basic structure of the model has been established, you can 'analyse' changes between states. Begin by asking 'what cause the system to move from one state to another?' There will be two types of 'forces' acting on the system, drivers and shocks. Drivers are slow 'pushing' forces that build up and may act on a system over long periods, whereas shocks are short duration, extreme events with a fundamental impact on a system. Shocks include issues such as natural disasters and extreme weather events, disease and new pests, conflict, price shocks, policy and governance failures.

In identifying drivers and shocks, start looking at a one directional shift between the states (ie from desired to undesired state). Drivers and shocks typically act on the feedbacks (the curly arrows), weakening the reinforcing nature of the feedback, allowing the system to leave that state and shift towards another state. If the driver or shock is strong enough, it will overcome the feedback mechanism and drive the system towards a new state where different feedbacks will establish and maintain the system in that new state. Keep in mind that while there are typically lots of drivers acting on a system, and different kinds of shocks occurring, you are looking

to identify the main drivers and shocks that are forcing the change in states by acting on feedbacks. Repeat the process for the other states and directions the system could move in. List the drivers and shocks and sort them into those that can be influenced from within the system and those that cannot be. Reflect on how drivers and shocks influence each other?

(STEP 7)

While the focus of this Wayfinder phase is to understand system dynamics, people developing the S&T model should by be able to recognize places where interventions are required to move the system towards desired states or maintain the system in a desired state and prevent it from slipping towards undesired states. If you want to, you can start exploring interventions already here, in preparation for Phase 4. Start by asking what needs to be done to prevent the system from moving towards an undesired states. These are 'preventative' interventions that maintain the system in the desired state so it continues to deliver the desired benefits to people. The interventions should be linked to the drivers and shocks, acting directly on them to reduce their impact some way or building the capacity of the system to withstand those drivers and shocks. Now look at the undesired state, what interventions are required to restore the system to a more desired state? These 'restorative' actions must target and overcome any feedbacks that are maintaining the system in an undesired state.

TIPS

Most people are unfamiliar with S&T models so there can be some confusion in the early stages about what the process is trying to achieve. Once you have the basic structure in place, the process flows well, so be sure to provide guidance in the initial stages, even drawing an example model for others to follow along before strting on your own.

There is a risk that too many general comments and points are documented on the model. Try to be as detailed as possible around thresholds, feedbacks, drivers, shocks and interventions.