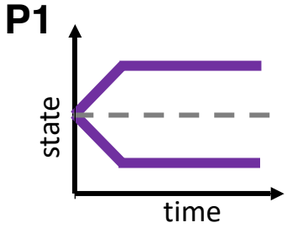
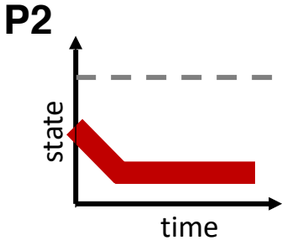
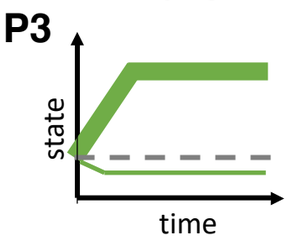
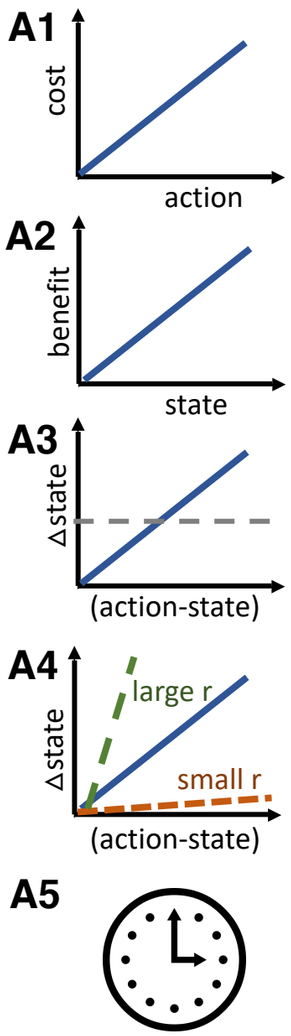
	Model predictions	Evidence in support of pattern	Value of MDP method
P1 	Bistability in ecosystem states (ecosystem services) can emerge without structural assumptions about non-monotonic cost structures and ecological dynamics (Fig 2)	Syndromes of production, or bistable patterns in adoption of agricultural practices, have been both empirically documented and theoretically described (Vandermeer et al., 2012)	The temporal mechanism for bistability leads to different suggested intervention strategies than mechanisms that require nonmonotonic assumptions about individual system dynamics
P2 	Decision making over short time horizons decreases investment in ecosystem service promoting activities (Fig 4) and removes bistability as decision horizons become infinitely short (Fig 3B)	U.S. corn farmers who rent land are less likely than landowners to implement grassed waterways, strip cropping, contour farming, and conservation tillage (Soule et al, 2000)	Decision horizons are less intuitive to explore in equilibrium models. Including these attributes of decision making important for understanding the impact of tenure systems.
P3 	Longer, more sustained incentive programs are more effective than short term policies at encouraging adoption of practices for which benefits accrue slowly (Fig 5)	***model prediction***	Tradeoffs between incentive duration and magnitude remain unresolved. MDPs allows us to explore these policy scenarios unlike equilibrium models.

Model assumptions, approximations, and rationale



A1: Larger actions are more costly. We approximate the relationship with a linear term (Eq 1): Actions accrue costs (i.e., investing time and area for cover cropping). This cost increases as actions increase.

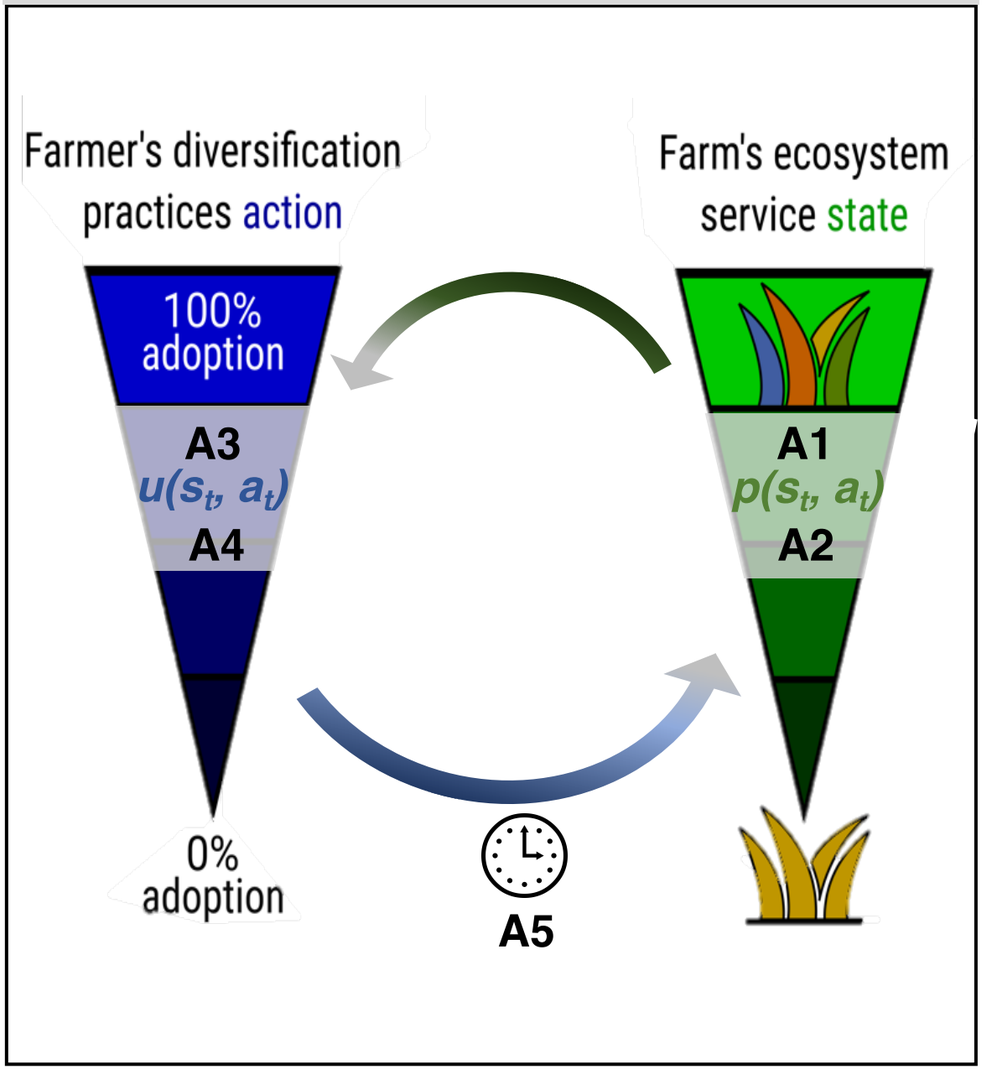
A2: Higher ecosystem service states provide more benefit to agents. We approximate with a linear term (Eq 2): High ecosystem service states (i.e., healthy soil) provide more benefits than low ecosystem service states (i.e., degraded soil).

A3: Actions change ecosystem states relative to the state (i.e., high ecosystem states require higher actions to increase). (Eq 3): Agents likely invest first in practices with largest ecosystem service impact per cost, leaving marginally more expensive practices

A4: Ecological processes respond over time relative to a given rate, r (Eq 3): Ecological systems do not respond instantaneously to management actions

A5: Agents make decisions to maximize discounted expected rewards over a decision horizon (Eq 4) Maximizing expected discounted rewards is a common assumption in economics

Conceptual diagram



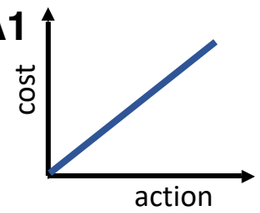
Farmer quotes on key socio-ecological system dynamics

“Cover crops cost money. And (there is resistance at our company because) some people don't believe they see the benefit right away. That's an internal discussion we try to have (at our company). I'm for the cover crop. It takes time. It takes time."	
“If you have a good source of compost and start incorporating those practices, I would hope that you would see something in five years. Not that there's anything magical about five years, but realizing that it's not going to happen necessarily in a year or two.”	
"I think a lot of those are Band-Aids for people that don't look more long-term and are not willing to put the investment into the ground, and so they look for Band-Aids”	

"I own the land. I want to make the soil as good or better when I give it to my son. Since I own it, I do care about it. But even if I leased, I believe that you should take care of the soil. But I know others that lease who do not do that. "	
“The biggest thing (that's a challenge for soil health) is the economic pressure. The pressure to make money off of a given piece of ground, which means using it too intensively, which is quite common around here.”	
“Sometimes the cost of doing things is a barrier"	

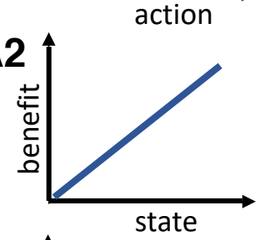
Model assumptions, approximations, and rationale

A1



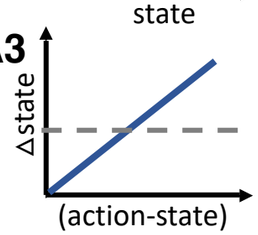
Larger actions are more costly. We approximate the relationship with a linear term (Eq 1): Actions accrue costs (i.e., investing time and area for cover cropping). This cost increases as actions increase.

A2



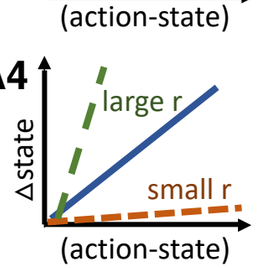
Higher ecosystem service states provide more benefit to agents. We approximate with a linear term (Eq 2): High ecosystem service states (i.e., healthy soil) provide more benefits than low ecosystem service states (i.e., degraded soil).

A3



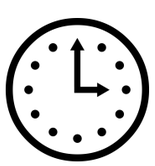
Actions change ecosystem states relative to the state (i.e., high ecosystem states require higher actions to increase). (Eq 3): Agents likely invest first in practices with largest ecosystem service impact per cost, leaving marginally more expensive practices

A4



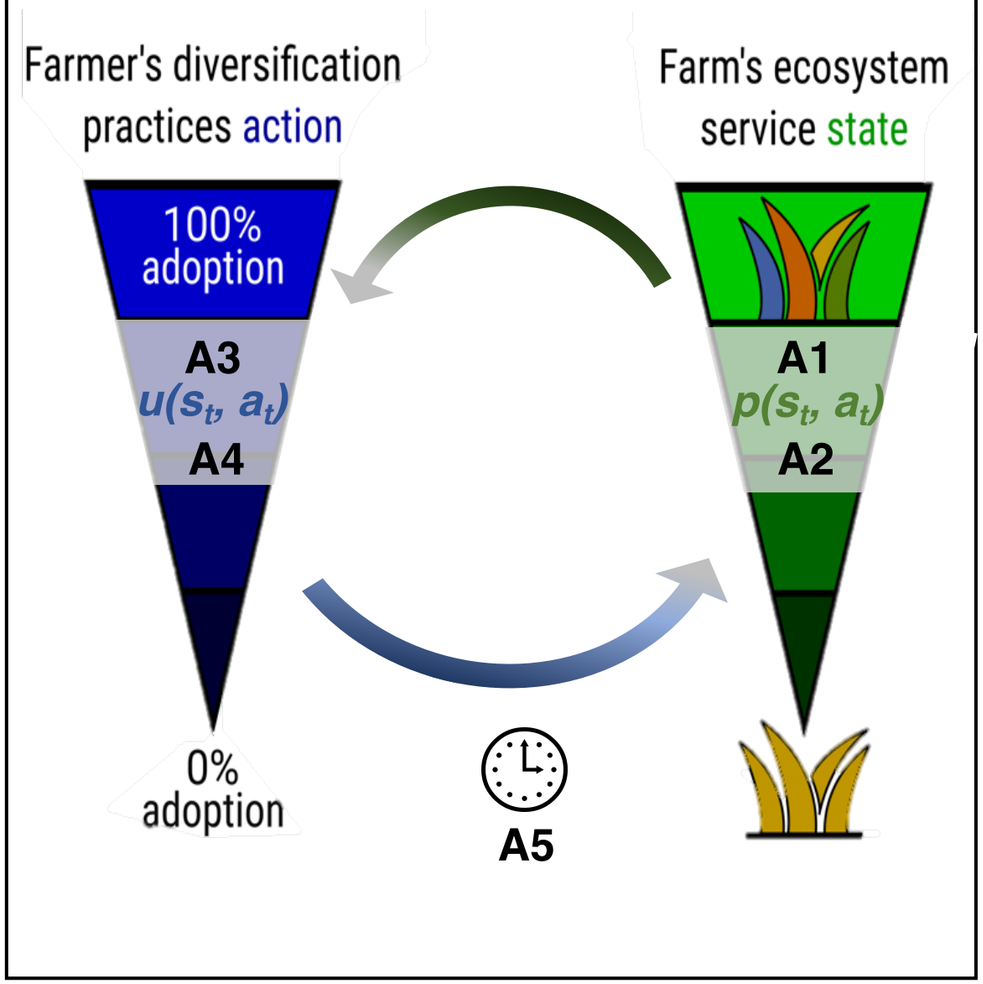
Ecological processes respond over time relative to a given rate, r (Eq 3): Ecological systems do not respond instantaneously to management actions

A5



Agents make decisions to maximize discounted expected rewards over a decision horizon (Eq 4) Maximizing expected discounted rewards is a common assumption in economics

Conceptual diagram

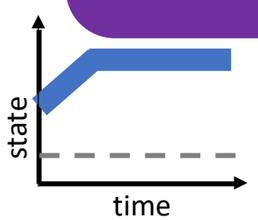


Q1: *"Cover crops cost money. And (there is resistance at our company because) some people don't believe they see the benefit right away. That's an internal discussion we try to have (at our company). I'm for the cover crop. It takes time. It takes time."*

Q2: *"I own the land. I want to make the soil as good or better when I give it to my son. Since I own it, I do care about it. But even if I leased, I believe that you should take care of the soil. But I know others that lease who do not do that. "*

Q3: *"If you have a good source of compost and start incorporating those practices, I would hope that you would see something in five years. Not that there's anything magical about five years, but realizing that it's not going to happen necessarily in a year or two."*

Q1: *“We do have hedge rows on several of the ranches, more where we have long-term leases.”*



Q3: “"Sometimes the cost of doing things is a barrier. Sometimes getting out of your box of thinking is a barrier to doing things. I mean, you're used to doing something a certain way, and to change it very dramatically…how much effort does it take to do that as opposed to what you know kind of works now?"

Q2*: "I think a lot of those are Band-Aids for people that don't look more long-term and are not willing to put the investment into the ground, and so they look for Band-Aids”*

Q4*: “The biggest thing (that's a challenge for soil health) is the economic pressure. The pressure to make money off of a given piece of ground, which means using it too intensively, which is quite common around here.”*