How the Resist-Accept-Direct (RAD) framework clarifies the challenge of modern natural resource management and supports strategic, forward-looking action

NC CASC webinar
8 July 2021

Gregor Schuurman, PhD
NPS Climate Change Response Program
Natural resource focus, but broad relevance
This is a heavy topic

THAT'S A BUMMER,

MAN.
An evolution of NPS climate change adaptation tools and approaches
An evolution of NPS climate change adaptation tools and approaches

2013
An evolution of NPS climate change adaptation tools and approaches
An evolution of NPS climate change adaptation tools and approaches

An evolution of NPS climate change adaptation tools and approaches

“Manage for change, not just persistence”

“Reconsider goals and actions”
An evolution of NPS climate change adaptation tools and approaches

“Manage for change, not just persistence”
An evolution of NPS climate change adaptation tools and approaches

But how?

(details TBD)
An evolution of NPS climate change adaptation tools and approaches

“Manage for change, not just persistence”

“Reconsider goals and actions”
An evolution of NPS climate change adaptation tools and approaches

2013

Using Scenarios to Explore Climate Change: A Handbook for Practitioners

“Manage for change, not just persistence”

“Reconsider goals and actions”

2014

Climate-Smart Conservation

Putting Adaptation Principles into Practice

2020

Resist-Accept-Direct (RAD)—A Framework for the 21st-century Natural Resource Manager

“Develop forward-looking goals that consider climate change”

“Consider more than one scenario of the future”

2021

Planning for a Changing Climate

Climate-Smart Planning and Management in the National Park Service
What is the RAD framework?

Resist
Work to maintain or restore ecosystem processes, function, structure, or composition based upon historical or acceptable current conditions

Accept
To allow ecosystem processes, function, structure, or composition to change, without intervening to alter their trajectory

Direct
Actively shape ecosystem processes, function, structure, or composition towards preferred new conditions

Definitions from Schuurman et al. (in press); design adapted from Thompson et al. 2020
What is the RAD framework?

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Direct
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Accept
To allow ecosystem processes, function, structure, or composition to change, without intervening to alter their trajectory
How does the RAD framework support natural resource management decision making?

- Focuses on manager intent
- Identifies manager actions
- Encompasses all possible options
- Simple
- Neutral (toolkit)
- Works across time and space
- Complements other approaches
Where does the RAD framework come from?
“Manage for change, not just persistence”
“Reconsider goals and actions”
NC CASC-funded project to advance adaptation in the northern Great Plains (2015-2019)
“Manage for change, not just persistence”

“Reconsider goals and actions”

NC CASC-funded project to advance adaptation in the northern Great Plains (2015-2019)
Is ‘Resilience’ Maladaptive? Towards an Accurate Lexicon for Climate Change Adaptation

Nicholas A. Fisichelli¹ · Gregor W. Schuurman¹ · Cat Hawkins Hoffman¹
“In short, it is increasingly clear that naturalness is no longer the umbrella under which all protected area values comfortably sit.

D. Cole, et. al. 2008

“…new concepts are needed to guide management... concepts that account for human impacts, global change, and evolving public

G. Aplet, D. Cole, 2010

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Resource Management and Operations in Central North Dakota
Climate Change Scenario Planning Workshop Summary
November 12-13, 2015, Bismarck, ND
Natural Resource Report NPS/NESS/NRR—2016/1202

Resist Change  Accommodate Change  Direct Change

Climate Change Adaptation Strategies
Federal Navigating Ecological Transformation (FedNET) working group (2017-present)
“existing agency guidance does not anticipate rapid, directional, transformative ecological changes that are currently underway.”

“develop a shared science-based framework from which land management entities may derive guidance for managing changing conditions, including wide-ranging changes that may result in ecological transformation of ecosystems - while considering how each entity’s parcels fit into the overall system.”
Federal Navigating Ecological Transformation (FedNET) working group (2017-present)

WHEN RESISTANCE IS FUTILE: ADAPTATION IN THE FACE OF SYSTEM TRANSFORMATION (Meeting Room 5)

Symposium Organizer: Bruce Stein, National Wildlife Federation

Accelerating climate change is already beginning to transform the structure, composition and function of ecosystems, with attendant consequences for the services and benefits these systems provide to people. Unfortunately, much of the climate adaptation currently underway still focuses on efforts to resist change as a means of retaining the persistence of current conditions. Natural resource managers increasingly will be confronted by situations where such persistence-oriented approaches are untenable: in other words, when resistance is futile. This symposium will focus on adaptation in the context of change management, and specifically the challenges of preparing for and adapting to system realignments and transformations. The session will address the conceptual basis for transformation-oriented adaptation, including the challenges of identifying ecological thresholds and tipping points, and the cyclical nature of managing for persistence and change. Symposia talks will also review the historical context for ecosystem transformation, drawing lessons from the paleo record and major ecological transitions in the past. Finally, the symposium will focus on a system undergoing major ecological transformations, and explore various management options for responding to, or even facilitating, such transitions, along with policy issues that may constrain or promote such change-oriented responses.
Federal Navigating Ecological Transformation (FedNET) working group (2017-present)

Increasingly difficult and perhaps sometimes futile

When Resistance is Futile: Adaptation in the Face of System Transformation

(Meeting Room 5)

Symposium Organizer: Bruce Stein, National Wildlife Federation

Accelerating climate change is already beginning to transform the structure, composition and function of ecosystems, with attendant consequences for the services and benefits these systems provide to people. Unfortunately, much of the climate adaptation currently underway still focuses on efforts to resist change as a means of retaining the persistence of current conditions. Natural resource managers increasingly will be confronted by situations where such persistence-oriented approaches are untenable: in other words, when resistance is futile. This symposium will focus on adaptation in the context of change management, and specifically the challenges of preparing for and adapting to system realignments and transformations. The session will address the conceptual basis for transformation-oriented adaptation, including the challenges of identifying ecological thresholds and tipping points, and the cyclical nature of managing for persistence and change. Symposia talks will also review the historical context for ecosystem transformation, drawing lessons from the paleo record and major ecological transitions in the past. Finally, the symposium will focus on a system undergoing major ecological transformations, and explore various management options for responding to, or even facilitating, such transitions, along with policy issues that may constrain or promote such change-oriented responses.
### Federal Navigating Ecological Transformation (FedNET) working group (2017-present)

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FedNET

Federal Navigating Ecological Transformation (FedNET) working group (2017-present)

Resist-Accept-Direct (RAD)
A Framework for the 21st-century Natural Resource Manager

Cole et al. (2011) foresee the future elimination of Joshua tree throughout most of the southern portions of its current range, thus invalidating a past premise of stability of the Joshua tree as a climax species.

NPS / Emily Hossel

News Release Date: January 19, 2021

Contact: Jeff Olson

The National Park Service and several federal land management agency partners recently published a report titled Resist-Accept-Direct (RAD)—A Decision Framework for the 21st-century Natural Resource Manager. The report presents and explores a simple set of distinct management options that decision makers can consider when responding to ecosystems facing the potential for rapid, irreversible ecological change. In so doing, the report provides a framework that encourages natural resource managers to consider strategic, forward-looking actions, rather than structure management goals based on past conditions.

https://irma.nps.gov/DataStore/DownloadFile/654543
TWS-AFS Ecosystem Transformation working group (2018 onward)
FedNET-TWS/AFS collaboration

Federal Navigating Ecological Transformation Working Group

TWS-AFS Ecosystem Transformation Working Group
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Rapidly expanding body of RAD literature...

Thompson et al. 2020

Schuurman et al. 2020

Lynch et al. 2021

Published online today
Rapidly expanding body of **RAD** literature...

[Image: USGS Climate Adaptation Science Centers]

usgs.gov/casc/rad
Why is the RAD framework needed?
Why is the RAD framework needed?

Answer: to help managers make unavoidable choices strategically.
Modern human-driven ecological trajectories bring new choices and questions
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

*“the idea that natural systems fluctuate within an unchanging envelope of variability” (Milly et al. 2008. Stationarity is dead: Whither water management? Science 319: 573–574)
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

- Trend departs historical range of variability
- "Climate departure" (min conditions > historical max)

"Non-stationarity"

Stationarity
- historical range of variability
- climate envelope
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

Drought is here to stay in the Western U.S. How will states adapt?

Drought "is not a temporary condition we can expect to go away, but rather something we have to deal with," one expert said.

Megadrought in western U.S. pushing Lake Mead to first-time water shortage

JUNE 10, 2021 / 01:11
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

Rocky Mountain forests burning more now than any time in the past 2,000 years

June 14, 2021 3:05pm EDT

Colorado’s East Troublesome Fire jumped the Continental Divide on Oct. 22, 2020, and eventually became Colorado’s second-largest fire on record. Source: Go_NOAA/NASA Earth Observatory
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

Rocky Mountain subalpine forests now burning more than any time in recent millennia

Philip E. Higuera\textsuperscript{a,1}, Bryan N. Shuman\textsuperscript{b,2}, and Kyra D. Wolf\textsuperscript{a}

\textsuperscript{a}Department of Ecosystem and Conservation Sciences, University of Montana, Missoula, MT 59812; and \textsuperscript{b}Department of Geology and Geophysics, University of Wyoming, Laramie, WY 82071
Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

Historically, fires burned in the subalpine central Rockies every 230 years, on average. That has increased significantly in the 21st century, Philip Higuera

Modern human-driven ecological trajectories bring new choices and questions

How climate change drives ecological change and transformations

* Ecological transformation: “the dramatic and effectively irreversible shift in multiple ecological characteristics of an ecosystem, the basis of which is a high degree of turnover in ecological communities” (Schuurman et al. in press)
Modern human-driven ecological trajectories bring new choices and questions
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Modern human-driven ecological trajectories bring new choices and questions

1900 - 68 cm, 2.3°C
1980 - 73 cm, 3.3°C
2090 - 84 cm, 6.8°C

Modern human-driven ecological trajectories bring new choices and questions
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge
Q: Can the change be reversed or resisted?
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: Can the change be reversed or resisted?
A: Think about scale, directional climate change, and ecological uncertainty.
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: Can the change be reversed or resisted?
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Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: Can the change be reversed or resisted?
A: Think about scale, directional climate change, and ecological uncertainty.
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: What happens if we accept the trajectory? Where is it going?
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: What happens if we accept the trajectory? Where is it going?
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: What happens if we accept the trajectory? Where is it going?
A: We don’t really know (this is a novel circumstance).
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: Can we try to direct this ecological trajectory?
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge
Q: Can we try to direct this ecological trajectory?

DECREASING UNCERTAINTY BUT REDUCED OPPORTUNITY TO STEWARD THE OUTCOME

BIODIVERSITY

CURRENT TRAJECTORY (ACCEPT)

TIME
Potential responses to ecological transformation on the Kenai National Wildlife Refuge

Q: Can we try to direct this ecological trajectory?
A: Yes, in fact, neighbors are already doing some of this.
Modern human-driven ecological trajectories bring new choices and questions

Potential responses to ecological transformation on the Kenai National Wildlife Refuge

What’s a manager to do?

Bluejoint grassland

Lutz Spruce forest

DECREASING UNCERTAINTY BUT REDUCED OPPORTUNITY TO STEWARD THE OUTCOME

CURRENT TRAJECTORY (ACCEPT)

BIODIVERSITY

TIME

GRASS

PRESERVED FIRE

BLACK-TAILED DEER

INTRODUCED GRAZERS

LODGEPOLE PINE

FOREST

PRESCRIBED FIRE

GRASS

INTRODUCED GRAZERS

Black-tailed deer

Lodgepole pine

Bluejoint grassland
What does RAD framework application look like?
RAD natural resource management in action

Thinking About Adaptation: Exploring the Resist-Accept-Direct Framework

Date
June 22, 2021 2:00-3:30 PM EST

Who Should Attend
The course is highly recommended to managers, biologists, other natural resource professionals who are interested in responding to climate change.

Tuition
There is no cost to attend.

To Join
https://livestream.com/nctc

Contact
Danielle Bruce,
danielle_bruce@fws.gov

https://fws.rev.vbrick.com/#/videos/3d468dcb-47bf-4f43-8cc8-efeceoda832a
RAD natural resource management in action

Marsh Management

The overarching purpose of marsh management is to develop and promote strategies for tidal marsh adaptation to sea level rise. Blackwater NWR is a Refuge at risk. Since the 1930s, over 8,000 acres of marsh have been lost at Blackwater. That's a rate of 150 acres lost per year. Causes of marsh loss include sea level rise, erosion, subsidence, salt water intrusion and invasive species. The marsh's natural ability to build elevation cannot keep up with sea level rise.

Ongoing efforts to save the marsh include:
- Reducing the population of resident Canada geese, which devour newly-planted crops and marsh plants
- Restoration and protection of brackish marsh habitat
- Blackwater River thin layer spraying project
- Shoreline stabilization and marsh enhancement
- Use of co-sited material for marsh restoration
- Acquisition/protective of priority marsh areas and adjacent upland buffers
- Nutria Eradication Program
- Phragmites control
- Facilitate migration of marsh habitats
- Reducing saltwater intrusion

Building up a portion of marsh at Blackwater National Wildlife Refuge with sediment from the Blackwater River. (Photo: Middleton Evans)

RAD natural resource management in action

Marsh Management

The overarching purpose of marsh management is to develop and promote strategies for tidal marsh adaptation to sea level rise. Blackwater NWR is a Refuge at risk. Since the 1930s, over 8,000 acres of marsh have been lost at Blackwater. That’s a rate of 150 acres lost per year. Causes of marsh loss include sea level rise, erosion, subsidence, saltwater intrusion and invasive species. The marsh’s natural ability to build elevation cannot keep up with sea level rise.

Going efforts to save the marsh include:

- Reducing the population of resident Canada geese, which devour newly-planted crops and marsh plants
- Restoration and protection of brackish marsh habitat
- Blackwater River thin layer spraying project
- Shoreline stabilization and marsh enhancement
- Use of co-site material for marsh restoration
- Acquisition/protection of priority marsh areas and adjacent upland buffers
- Nutria Eradication Program
- Phragmites control

1. Facilitate migration of marsh habitats
2. Reducing saltwater intrusion

Removing trees to promote marsh growth, Blackwater National Wildlife Refuge. (Photo: Erik J. Meyers/The Conservation Fund)

RAD natural resource management in action

Firefighter Luis Magane stands guard at General Grant tree at Grant Grove in Kings Canyon National Park, California. Photograph: Gary Kazanjian/AP
RAD natural resource management in action

A Perfect Storm
Severe drought X
Dead/drown beetle killed trees X
High winds X
Poor humidity recovery overnight

"unprecedented, wind, fire behavior with rapid (IncWeb East Troublesome)

Fern Lake Trail, Rocky Mountain NP, 24 May 2023
RAD natural resource management in action

A Perfect Storm
Severe drought X
Dead/down beetle killed trees X
High winds X
Poor humidity recovery overnight

Limber pine recovery

Resist
RAD natural resource management in action
RAD natural resource management in action

Fisheries biologist Jon McCubbin releases the first juvenile bull trout from 2014 into Logging Creek upstream of Grace Lake — the new bull trout Shangri-La.

Source: Chris Cooney/National Park Service
RAD natural resource management in action
RAD natural resource management in action

Climate Change Adaptation & Mitigation Plan

 Fisheries: 
 To adapt to climate change, the tribe has shifted management of a 61-acre inland lake from a cold water (brook trout) fishery to a cool water fishery (yellow perch and walleye) through fish propagation and stocking. This occurred because warming temperatures in the lake reached critical lethal levels for brook trout causing complete collapse of the population. The Grand Portage Natural Resources Department adapted to the fishery collapse by choosing to develop a cool water fishery using yellow perch and walleye.

https://www7.nau.edu/itep/main/tcc/Tribes/gl_gpchippewa
What next?
What next?

Scaling up
A Response Framework

The Resist-Accept-Direct framework allows managers to choose from three management responses:

- **Resist** the direction of change, by working to maintain or restore function, structure or composition, based on historical or acceptable current conditions. To resist means to return a system to its historical condition.

- **Accept** the direction of change, by allowing the change to occur without intervening. To accept is to allow nature to change conditions without any management response.

- **Direct** the change, by actively shaping managing processes, function, structure or composition toward a new desired condition. To direct is to take management actions to forcefully move a system toward some condition that humans find desirable.

Landscapes in Flux  |  Managing for Change  |  A Response Framework  |  Case Study: Blackwater National Wildlife Refuge  |  Resist-Accept-Direct Resources  |  Other Agencies Addressing Climate Change

The body of RAD literature is rapidly expanding.

Thompson et al. 2020

Schuurman et al. 2020

Lynch et al. 2021

Coming 6 July 2021

Special issue

In review
Special issue, in review


The body of RAD literature is rapidly expanding
Paper 1: RAD for navigating ecological transformation
The body of RAD literature is rapidly expanding

Special issue, in review


Paper 2: Applying the RAD framework

Four Foundations *that enable a transition to future-oriented management*

- identify plausible social-ecological trajectories
- apply upstream and deliberative engagement and decision-making with stakeholders
- formulate management pathways to desired futures
- consider a portfolio approach across space and time

Magness et al. *in review.* Preliminary Information-Subject to Revision. Not for Citation or Distribution.
The body of RAD literature is rapidly expanding

Special issue, in review


• **When the system state is stable:**
  - Traditional **adaptive management** double loop.

• **When the system state is changing:**
  - **RAD** decisions come into play.

Lynch et al. *in review*. Preliminary Information-Subject to Revision. Not for Citation or Distribution.
The body of RAD literature is rapidly expanding

Special issue, in review


Manager make different RAD decisions even when presented with the same information in the same place (Clifford et al. 2020, *Environ. Management*).

RAD decisions result from intersection of:
- Internal factors i.e., managers’ mental models
- External factors i.e., understanding of the science, institutional context, and social feasibility
Special issue, in review


Paper 5: Ecological transformation science agenda

Crausbay et al. in review. Preliminary Information-Subject to Revision.
Paper 5: Ecological transformation science agenda

Crausbay et al. in review. Preliminary Information-Subject to Revision.
Paper 5: Ecological transformation science agenda

Crausbay et al. in review. Preliminary Information-Subject to Revision.
What next?

Scaling up

• Compiling/sharing case studies
• Social dimensions
• Science needs
• Sustaining federal collaboration
Thank you!

For more:
usgs.gov/casc/rad