

Coordinating ecological restoration options and risk assessment to improve environmental outcomes

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Three Observations

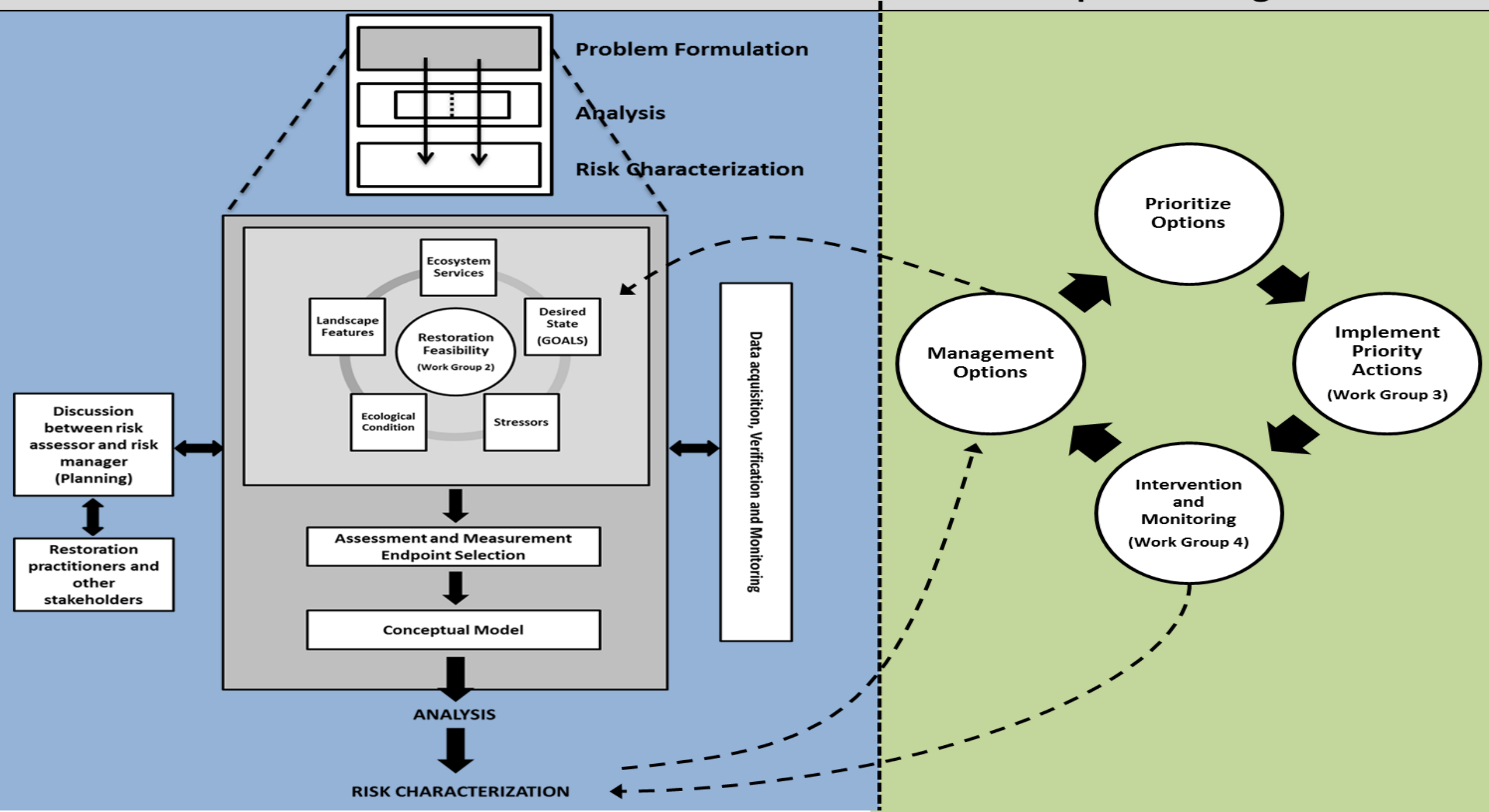
- Currently practices in dealing with contaminated sites often pre-empt restoration options.
 - The driver is risk reduction and not restoration
- Nothing precludes bringing restoration options to the front of the problem formulation phase of risk framework.
 - Under the risk paradigm, one could think of this as “future land use”
- A regional/landscape/seascape focus should be considered in developing stakeholder-driven desired outcomes.
 - This input is important for addressing community concerns / acceptance
 - It can also help reduce transaction costs when remedy and restoration are combined

We Advocate

- that project managers and other stakeholders use an ecological planning framework with restoration options included up front in the risk assessment
- exploring opportunities to incorporate ecosystem services as potential assessment endpoints in the problem formulation stages of a risk assessment process
- using measurement endpoints to characterize the existing ecological conditions for selected ecosystem services that can also be used to evaluate restoration success

Risk Assessment

Adaptive Management

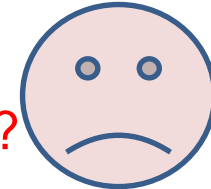


Potential End-states of Ecological Restoration

- Development
 - Residential
 - Commercial/Industrial
 - Infrastructure
- Reclamation
 - Erosion Control
 - Agriculture/Aquaculture
 - Active recreation
 - Open space
- Rehabilitation
 - One or more ecosystem services
 - Single species or habitat type
 - Passive (succession)
- Restoration
 - Historic fidelity
 - Hybrid state that accommodates/anticipates changes in regional and global environmental factors
 - Novel state

Three Key Findings

- Limitations of ERA as currently practiced have hindered consideration of ecosystem services endpoints and restoration goals in the environmental management process.
 - True or False ?
- Ecological restoration options should be brought to the front of the problem formulation phase of the risk framework; and
 - Does this mean we have to work with the clean up people???????
- A regional/landscape/seascape focus is needed throughout the risk assessment process so that restoration efforts play a more prominent role in enhancing ecosystem services, especially provision of selected habitat and its potential end state.



Business Case

Corporations, academic institutions, and governments taking proactive measures to protect and enhance ecological resources and the flow of ecological goods and services



Five Case Studies

- LaFarge Company
- Newmont Mining Company
- Biosphere Reserve of Los Tuxtlas, Veracruz, Mexico
- Kakadu National Park, Northern Australia
- Ecosystem Services and the Gulf of Mexico Oil Spill

Case Studies

Industry Led [Biodiversity]

LaFarge -- guidance designed to maintain biodiversity while extracting resources safely and in a manner that is appropriate under regulatory programs; upfront funding to implement guidance

NEWMONT – partnered with other companies and the BLM (Maggie Creek Watershed Restoration Project)

- to restore and enhance 132 km of stream, 8 km² of riparian habitat, and 162 km² of upland habitat in the watershed
- reversed population trend for Lahonton cutthroat trout and other wildlife



BEFORE (1980)



AFTER (2011)

Industry Led [Cultural Services]

ENERGY RESOURCES AUSTRALIA – worked with stakeholders to establish consensus restoration goals

- Risk assessment within a landscape framework characterized risks throughout the operational, decommissioning, stabilization, and long-term restoration phases
- Closure (planned for 2026) criteria designed to ensure appropriate ecosystem restoration, including cultural and social requirements of the Traditional Owners

Case Studies

Academic

[Provisioning Services]

State University of Morelos (UAEM), the National University of Mexico (UNAM), and the University of Illinois at Chicago (UIC)

- Evaluated cattle exclusion and planting compositions in select areas to improve ecosystem services (e.g., primary production, soil retention, and provision of habitat for plants and animals)
- **Recommend plantings of a few wind-dispersed, high production trees to accelerate litter formation and a higher proportion animal-dispersed trees that favor higher recruitment and attraction of frugivorous animals**



BEFORE



AFTER

Government Led

[Feasibility]

US congress (2011) funded the National Research Council (NRC) to examine the use of ecosystem services in assessing the harm from the Deep Water Horizon eruption

NRC (2013) – Developed case studies of wetlands, fisheries, marine mammals, and deep ocean and noted that ecosystem services inclusion could expand the range of restoration actions that typically are not considered

- Data to develop ecosystem production functions are lacking
- Models needed to understand the linkages among the various ecosystem production functions and ecosystem services are scant

Supplemental Slides

Case Studies

The LaFarge Company



- Operates quarries and other resource extraction sites worldwide
- Collaborate with the world wildlife fund to develop guidance directed at improving biodiversity or avoiding, adversely impacting biodiversity at its facilities
- The guidance is designed to balance the need to maintain biodiversity with the need for resource extraction while ensuring the work is done safely and in a manner that is appropriate under regulatory programs
- Funds needed for undertaking biodiversity improvements and habitat conservation are identified in advance so that the appropriate work can be done in a financially prudent manner.

Newmont Mining Company

Maggie Creek (Tributary to the Humboldt River)

- Previous a haven for Lahonton cutthroat trout
- Land use severely reduced LCT habitat and populations
- Maggie Creek Watershed Restoration Project (Newmont, Elko Land & Livestock Company, US Bureau of Land Management, And Maggie Creek Ranch) formed in 1993 developed plan to restore and enhance 132 km of stream, 8 km² of riparian habitat, and 162 km² of upland habitat in the watershed
- After 20 yrs:
 - Now one of the largest strongholds for LCT.
 - Habitat for populations of other species, including mule deer, beaver, waterfowl, neotropical birds, and insects have also benefited

BEFORE (1980)



AFTER (2011)



Images Courtesy Bureau of Land Management

Later partners (Trout Unlimited, the US Fish and Wildlife Service, Barrick Goldstrike Mines, the 26 Ranch, and Nevada Department of Wildlife)

Biosphere Reserve of Los Tuxtlas, Veracruz, Mexico

- Highly fragmented tropical rainforest by cattle ranching
- Aim is to improve ecosystem services (e.g., primary production, soil retention, and provision of habitat for plants and animals)
- Plantings of early and late-successional trees to attract widely foraging fruit-eating bats, birds, and terrestrial mammals from forests into the agricultural landscape,
- Cattle excluded from areas where animal-dispersed and wind-dispersed tree species were planted
- Findings:
 - seedling mortality reduced by planting large seedlings and a mix of pioneer and late-successional species (soil depth was a key criterion for survival of the smallest seedlings)
 - recommend plantings of few wind-dispersed, high production trees to accelerate litter formation and a higher proportion animal-dispersed trees that favor higher recruitment and attraction of frugivorous animals

BEFORE



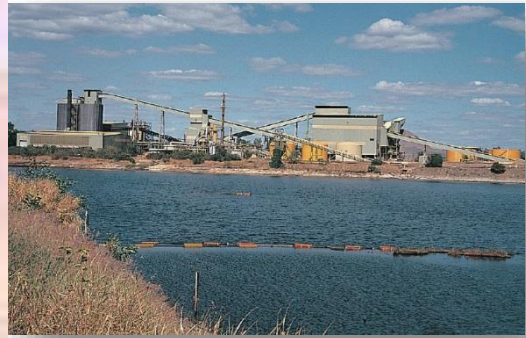
(Photos courtesy of Cristina Martínez-Garza)

AFTER



Researchers with the State University of Morelos (UAEM), the National University of Mexico (UNAM), and the University of Illinois at Chicago (UIC) undertook a restoration project

Kakadu National Park, Northern Australia



Setting

- Aboriginal peoples ≥ 40 K yrs.
- Uranium mine and mill in the region
- Subject to seasonal extremes in rainfall typical of monsoonal climates in which ephemeral streams dominate
- Need for a long-term action plan that spans mine operations, rehabilitation, and restoration efforts were appropriate to the world heritage-listed area

Actions

- Energy Resources Australia worked with stakeholders to establish consensus restoration goals
- Risk assessment within a landscape framework characterized risks throughout the operational, decommissioning, stabilization, and long-term restoration phases
- Monitoring (30+ yrs.) To track changes in water and air quality using biological, chemical, physical, and radiological techniques
- Closure (planned for 2026) criteria designed to ensure appropriate ecosystem restoration, including cultural and social requirements of the traditional owners
- Long-term restoration is targeted for 7 generations (300 years), with tailings containment for 10,000 years

Ecosystem Services and the Gulf of Mexico Oil Spill



Context

- US congress (2011) funded the National Research Council (NRC) to examine the use of ecosystem services in assessing the harm from the spill
- NRC (2013) it noted that ecosystem services could expand the spectrum of restoration actions that might not be considered under existing state and federal assessment procedures
- Case studies of wetlands, fisheries, marine mammals, and deep ocean were developed and used to illustrate the methods to assess impacts to ecosystem services

Challenges

- Data to develop ecosystem production functions are lacking
- Models needed to understand the linkages among the various ecosystem production functions and ecosystem services are scant