

11th World Conference on Ecological Restoration

Symposium on Shaping the Future of Landscape Restoration: Pathways to Integration

Landscape Restoration: Assessment, Goal Setting, Management, and Monitoring

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Assessment



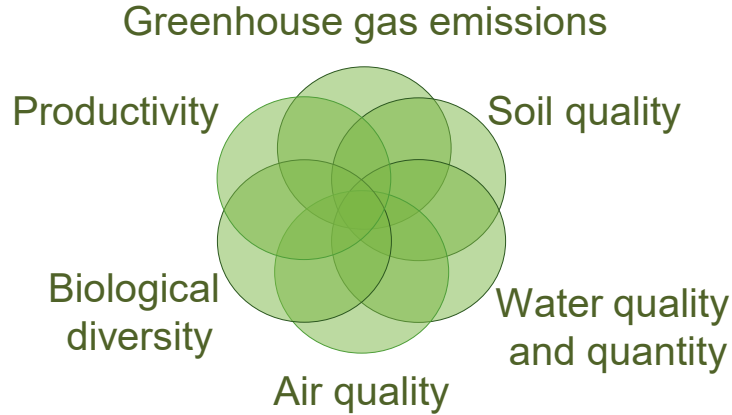
Restoration

Goal setting

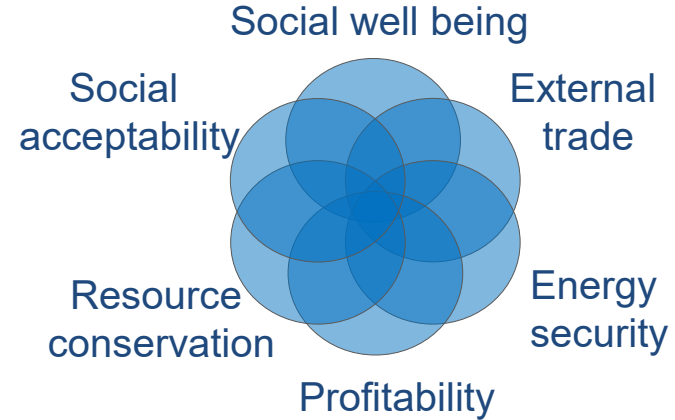
Management



Check list of categories of environmental conditions & socioeconomic conditions



McBride et al. (2011) *Ecological Indicators* 11:1277-1289



Dale et al. (2013) *Ecological Indicators* 26:87-102.

Measures & interpretations are context specific

Efroymson et al. (2013) *Environmental Management* 51:291-306.



Example check list of environmental indicators

Category	Indicator	Units
Soil quality	Total organic carbon (TOC)	Mg/ha
	Total nitrogen (N)	Mg/ha
	Extractable phosphorus (P)	Mg/ha
	Bulk density	g/cm ³
Water quality and quantity	Nitrate concentration in streams (and export)	concentration: mg/L; export: kg/ha/yr
	Total phosphorus (P) concentration in streams (and export)	concentration: mg/L; export: kg/ha/yr
	Suspended sediment concentration in streams (and export)	concentration: mg/L; export: kg/ha/yr
	Herbicide concentration in streams (and export)	concentration: mg/L; export: kg/ha/yr
	Storm flow	L/s
	Minimum base flow	L/s
	Consumptive water use (incorporates base flow)	feedstock production: m ³ /ha/day; biorefinery: m ³ /day

Category	Indicator	Units
Greenhouse gases	CO ₂ equivalent emissions (CO ₂ and N ₂ O)	kgC _{eq} /GJ
Biodiversity	Presence of taxa of special concern	Presence
	Habitat area of taxa of special concern	ha
Air quality	Tropospheric ozone	Ppb
	Carbon monoxide	Ppm
	Total particulate matter less than 2.5µm diameter (PM _{2.5})	µg/m ³
	Total particulate matter less than 10µm diameter (PM ₁₀)	µg/m ³
Productivity	Aboveground net primary productivity (ANPP) / Yield	gC/m ² /year



McBride et al. (2011) *Ecological Indicators* 11:1277-1289

Example check list of socioeconomic indicators

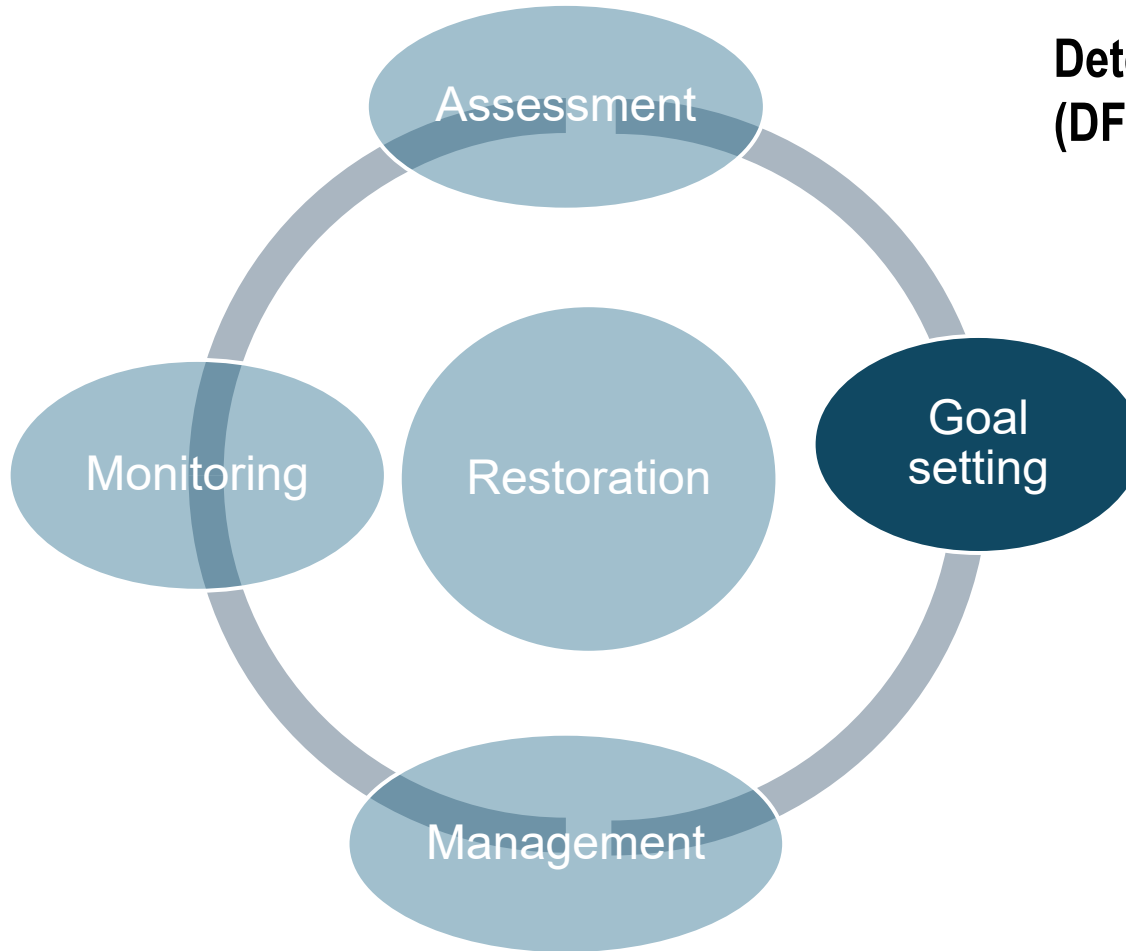
 Ten minimum practical measures

Category	Indicator	Units
Social well-being	Employment	Number of full time equivalent (FTE) jobs
	Household income	Dollars per day
	Workdays lost due to injury	Average number of workdays lost per worker per year
	Food security	Percent change in food price volatility
Energy security	Energy security premium	Dollars /gallon biofuel
	Fuel price volatility	Standard deviation of monthly percentage price changes over one year
External trade	Terms of trade	Ratio (price of exports/price of imports)
	Trade volume	Dollars (net exports or balance of payments)
Profitability	Return on investment (ROI)	Percent (net investment/ initial investment)
	Net present value (NPV) ²	Dollars (present value of benefits minus present value of costs)

Category	Indicator	Units
Resource conservation	Depletion of non-renewable energy resources	MT (amount of petroleum extracted per year)
	Fossil Energy Return on Investment (fossil EROI)	MJ (ratio of amount of fossil energy inputs to amount of useful energy output)
Social acceptability	Public opinion	Percent favorable opinion
	Transparency	Percent of indicators for which timely and relevant performance data are reported
	Effective stakeholder participation	Number of documented responses to stakeholder concerns and suggestions reported on an annual basis
	Risk of catastrophe	Annual probability of catastrophic event

Dale et al. (2013) *Ecological Indicators* 26:87-102.





Determine desired future conditions (DFCs) & incentives for achieving them:

- Define DFCs with stakeholders using
 - Multi-stakeholder partnerships
 - Collaborative processes
- Address key issues
 - Pertinent to the scale & extent of project
 - Within constraints of system
- Determine incentives & disincentives for achieving DFCs

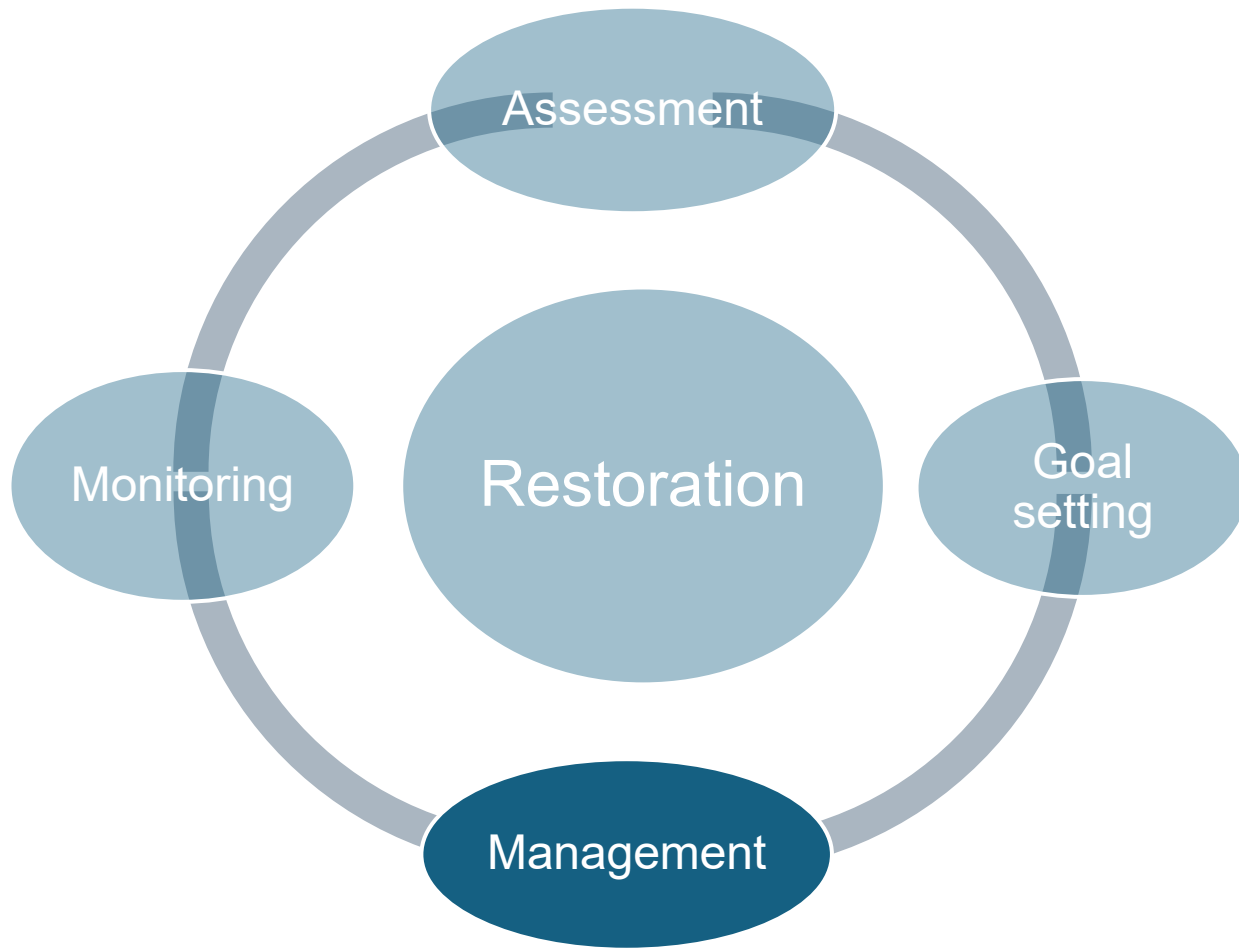


Solicit input from diverse stakeholders on incentives & DFCs using interactive posters or other means



- Dale & Kline (2017) <https://doi.org/10.1002/bbb.1753>
- Dale et al. 2019 Landscape Ecology **34**, 1199-2018



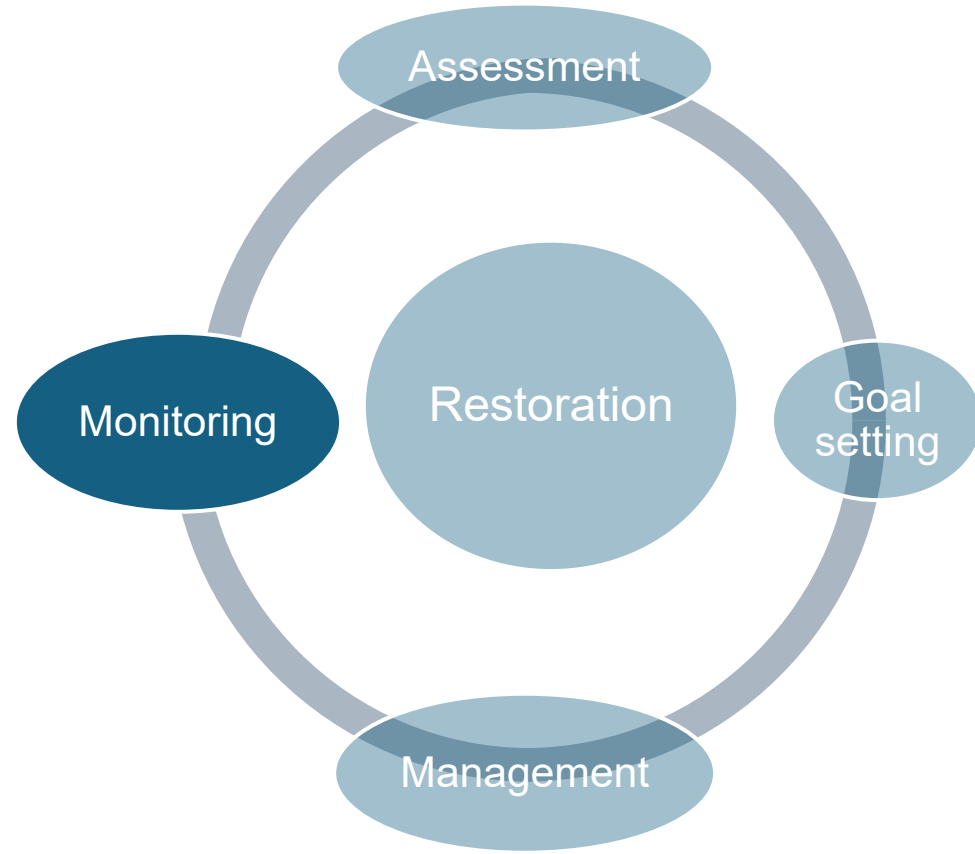
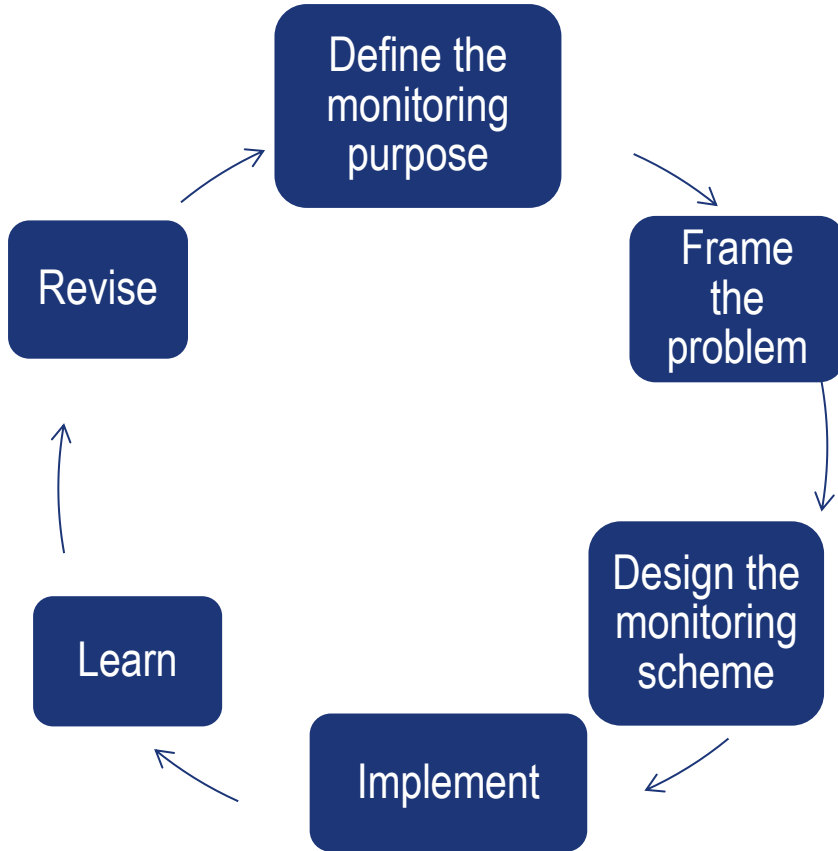


Management is

- Context specific
- Requires investments in
 - Planning
 - Analysis
 - Implementation
 - Evaluation
 - Reporting
 - Incorporating feedback
- Continual adaptation and improvement



Adaptive Monitoring Steps



Key lessons

Required conditions for effective restoration

- Communication & trust
- Engagement & local champions
- Capacity building
- Long-term commitment



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Means to achieve conditions

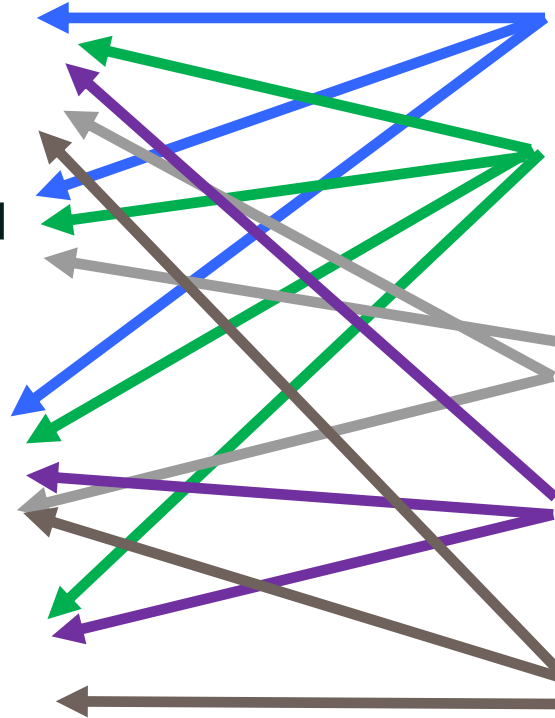
Understand context, local presence

Coordinate with & get buy-in from local, regional, & national entities

Engage stakeholders

Acquire adequate funding & technical assistance

Institutionalize monitoring & information sharing



Common Challenges

- Continuity – due to time and resource constraints
- Implementing best practices in stakeholder engagement, monitoring, and verification
- Trying to achieve too many goals and measure too many indicators – it is critical to prioritize and keep approaches practical
- Maintaining flexibility - while remaining true to iterative process.



Kline et al. (2020)



Thank you!

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