

No net loss in a changing landscape?

The challenges of ecological restoration

Land Use 2021: Session 2:



MOUNTAIN LEGACY PROJECT

Capturing change in Canada's mountains

mountainlegacy.ca

[Home](#) / [News and Stories](#) / [Press release](#)

01 MAR 2019 | [PRESS RELEASE](#) | [ECOSYSTEMS](#)

New UN Decade on Ecosystem Restoration offers unparalleled opportunity for job creation, food security and addressing climate change



©FAO Giulio Napolitano

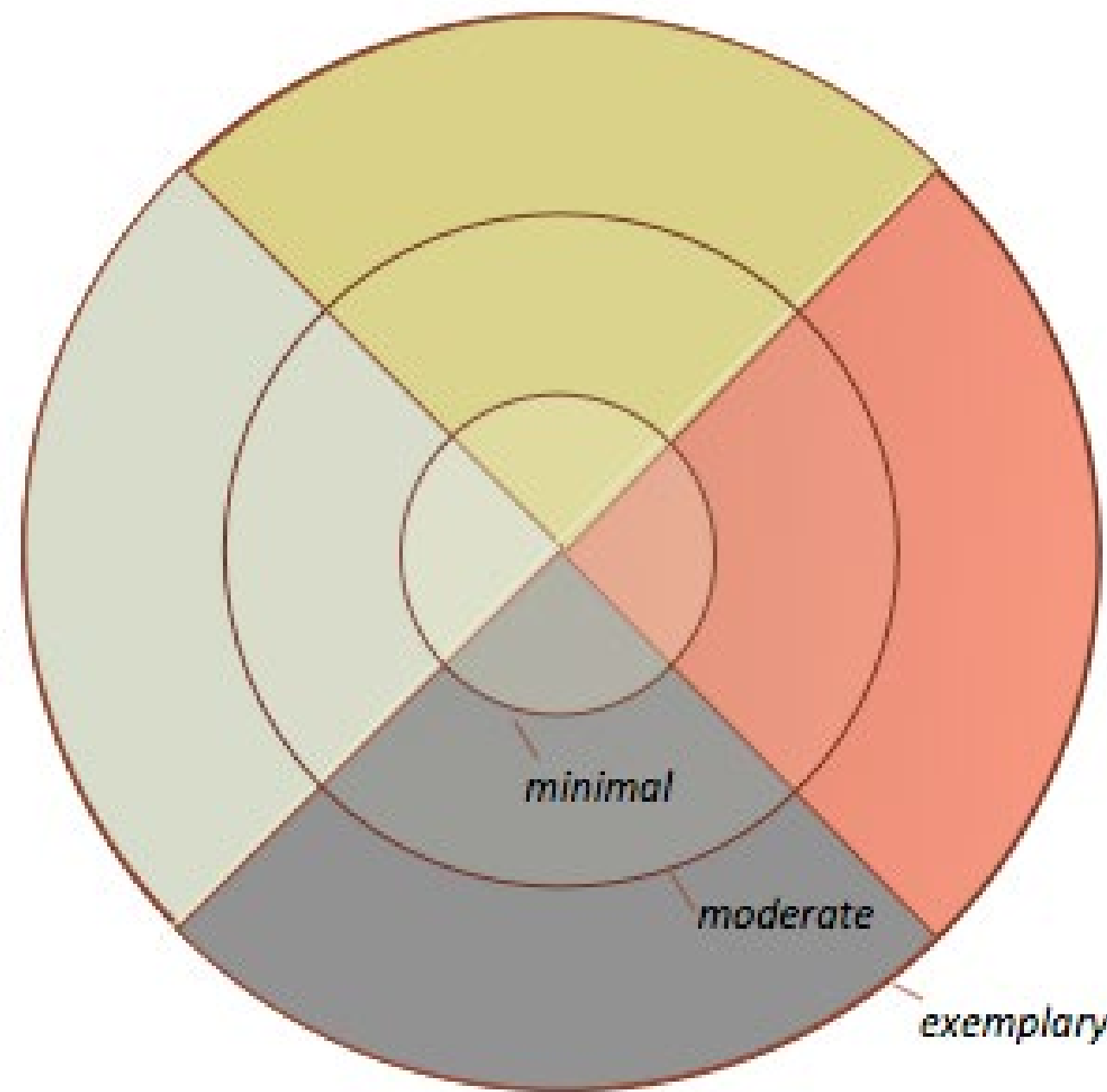
- The United Nations General Assembly declared 2021 – 2030 the UN Decade on Ecosystem

“the process of assisting the recovery of an ecosystem that is damaged, degraded, or destroyed.”

–Society for Ecological Restoration

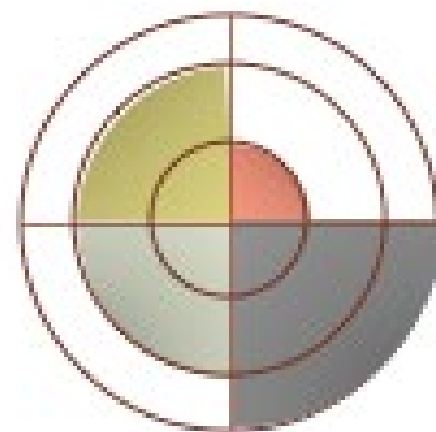
Ecological Integrity

Informed by
Past & Future



Long-term
Sustainability

Benefits & Engages Society



INSIGHTS | PERSPECTIVES

CONSERVATION

Committing to ecological restoration

Efforts around the globe need legal and policy clarification

By Katharine Suding,^{1*} Eric Higgs,² Margaret Palmer,³ J. Baird Callicott,⁴ Christopher B. Anderson,⁵ Matthew Baker,⁶ John J. Gutrich,⁷ Kelly L. Hondala,⁸ Matthew C. LaFavor,⁹ Brendon M. H. Larson,¹⁰ Alan Randall,^{11,12} J. B. Ruhl,¹³ Katrina Z. S. Schwartz¹⁴

At the September 2014 United Nations Climate Summit, governments rallied around an international agreement—the New York Declaration on Forests—that underscored restoration of degraded ecosystems as an aspirational solution to climate change. Ecosystems committed to restore more than one sixth of their land. Uganda, the Democratic Republic of Congo, Guatemala, and Colombia Republic of total, parties committed to restore a staggering 350 million hectares by 2030. The ambition affirms restoration's growing importance in environmental policy. These new commitments follow the 2010 Aichi Convention on Biological Diversity (to restore at least 15% of degraded ecosystems globally) and the 2011 Bonn Challenge (to restore 150 million hectares). Particularly when accompanied by policies to reduce further losses (as in the New York Declaration), restoration of such magnitude holds promise to address global environmental concerns.

Achieving this promise requires careful thought about how we restore ecosystems scientifically based, workable, and comprehensive restoration (2) that can provide appropriate best practice guidelines in legal, and planning efforts. There is little question that ecological restoration can provide substantial benefits

POLICY

that enhance quality of life (4). A considerable body of science suggests that restoration can guide establishment of complex self-sustaining interactions between biophysical features, and processes that compose an ecosystem (5, 6). The science of the endeavor: Our interventions rarely achieve full recovery, and uncertainty is to be expected in dealing with natural recovery processes (7, 8). Continuing environmental change further challenges the

Some have thus questioned whether decadal or longer term restoration of degraded ecosystems is sustainable (9). Others have cautioned that these declarations may spur actions that compromise biodiversity: for instance, by replacing ancient grassy biomes with forest plantations (7) or by planting species in specialized zones where they may not persist (10). Others emphasize that a focus on one goal (e.g., climate change mitigation) might not deliver intended benefits in ways and over time scales not fully understood (14, 15).

Specialized programs such as compensation, and ecosystem service delivery can be a useful contribution to—but are not synonymous with—ecological restoration (16, 17). Such distinctions are not trivial be-

cause projects undertaken in the name of restoration may in fact be something differentiated to achieve neither restoration nor their intended purposes (17, 18). Delivery of diverse benefits will depend on how on-the-ground efforts are conceived and implemented (7, 8). Avoiding mistakes on a grand scale requires clear practice principles (19).

FOUR PRINCIPLES. We advocate considering four principles when planning restoration. The degree to which each principle is achievable will vary on the basis of social and ecological context. By taking into account these comprehensive principles, trade-offs inherent in specialized projects are avoided, which increases the prospect of sustainable and valuable overall outcomes (see the figure).

1. Restoration increases ecological integrity. Restoration initiates or accelerates recovery of degraded areas by prioritizing the complexity of biological assemblages, including species composition and representation of all functional groups, and as the features and processes needed to sustain these biota and to support ecosystem function (3, 4).

2. Restoration is sustainable in the long term. Restoration aims to establish systems that are self-sustaining and resilient. Thus, they must be consistent with their environmental context and landscape setting. Once a restoration project is complete, the goal should be to minimize human intervention over the long term. When intervention is required it should be to simulate natural processes that the landscape no longer provides (e.g., fire or invasive species removal) or to support traditional practices of local communities (8, 9).

3. Restoration is informed by the past and future. Historical knowledge, in its many forms, can indicate how ecosystems functioned in the past and can provide references for identifying potential future trajectories and measuring functional and compositional success of projects (19). However, the unprecedented pace and spatial extent of anthropogenic changes in the present era can indicate how ecosystems part strongly from historical trends (9). Often, history serves less as a template and more as a guide for determining appropriate restoration goals (19, 20).

4. Restoration benefits and engages society. The use of our principles identifies trade-offs in the planning process and the extent of departure from the full opportunities presented by comprehensive ecological restoration (example after (25)).

Four principles for planning restoration. The use of our principles identifies trade-offs in the planning process and the extent of departure from the full opportunities presented by comprehensive ecological restoration (example after (25)).

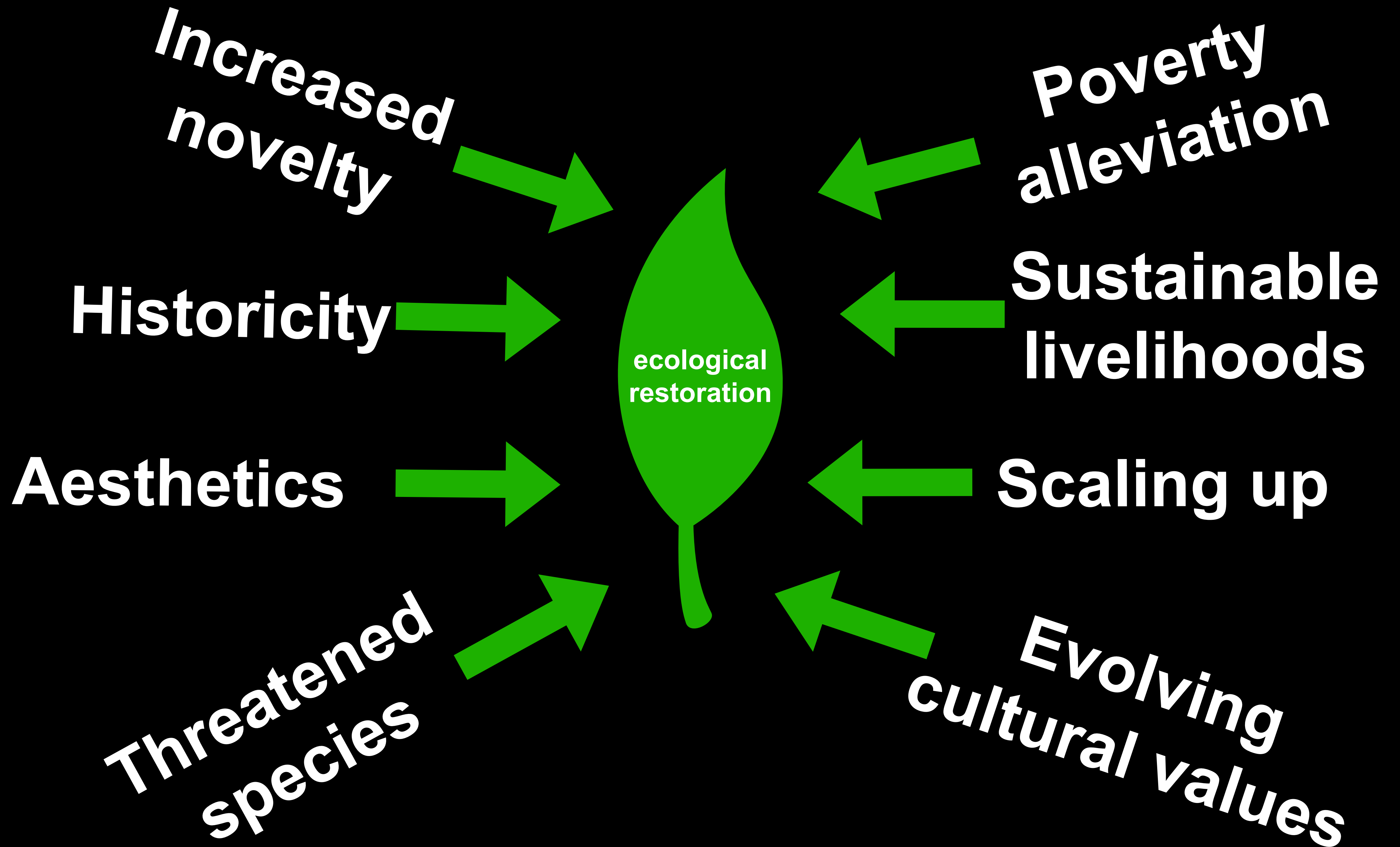
Ecological Integrity
Long-term sustainability
Benefits and engages society
Informed by past & future

minimal
moderate
exemplary

minimal
moderate
exemplary

Downloaded from www.sciencemag.org on May 13, 2015

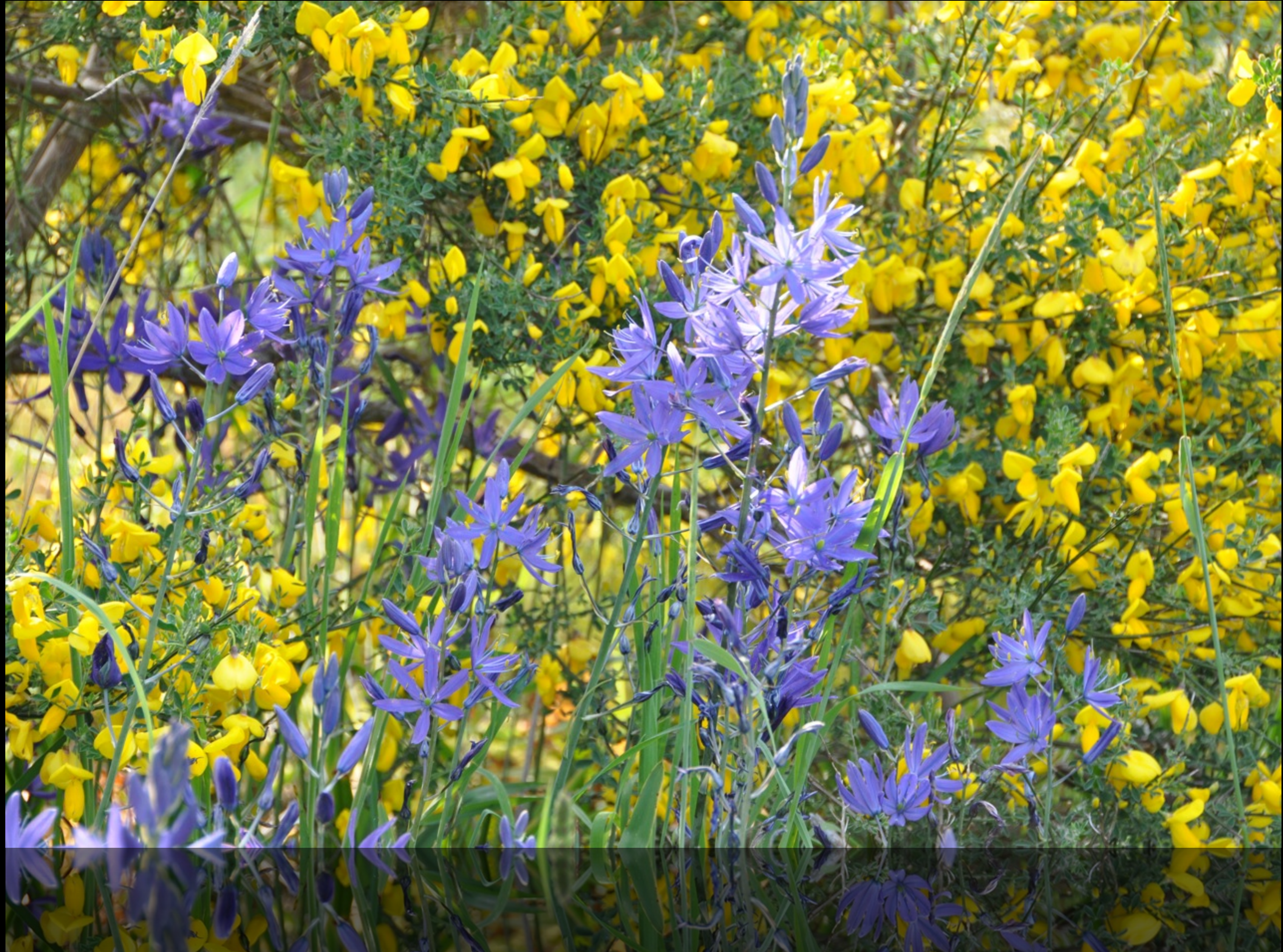
638 • MAY 2015 • VOL 348 | ISSUE 2325





Higgs E, Falk D, Guerrini A, Hall M, Harris J, Hobbs R, Jackson S, Rhemtulla J, and Throop W. 2014. The changing role of history in restoration ecology. *Frontiers in Ecology and the Environment*.

Regional threatened Garry oak (*Quercus garryana*) ecosystems



Novel Ecosystems

Intervening in the New Ecological World Order

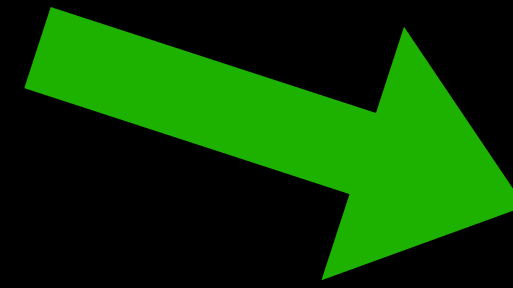
Edited by Richard J. Hobbs, Eric S. Higgs and Carol M. Hall



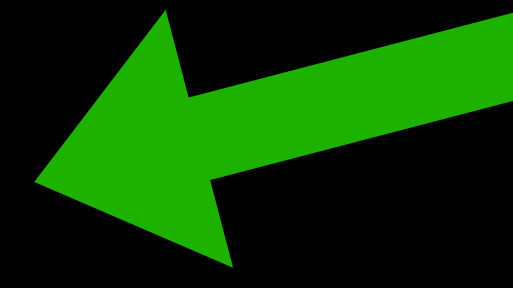
WILEY-BLACKWELL. 2013

1. **Difference** in ecosystem composition, structure or function
2. **Thresholds** in these attributes that are currently irreversible
3. **Persistence** or self-organization

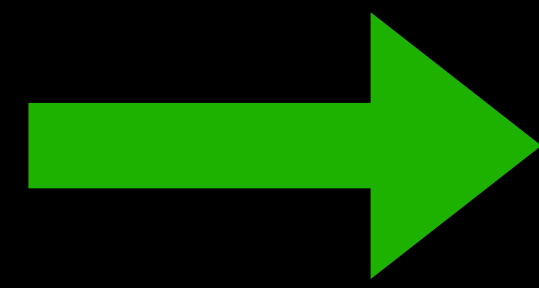
Species re-introductions



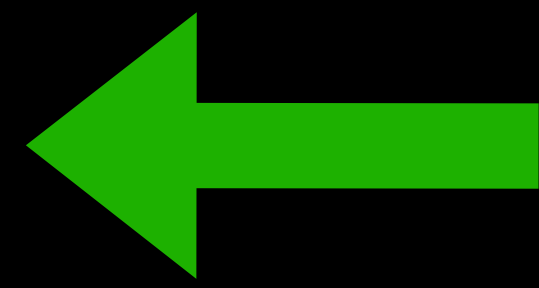
Bio-novelty



Rewilding

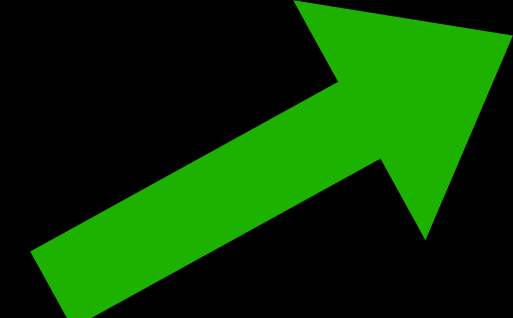


ecological restoration

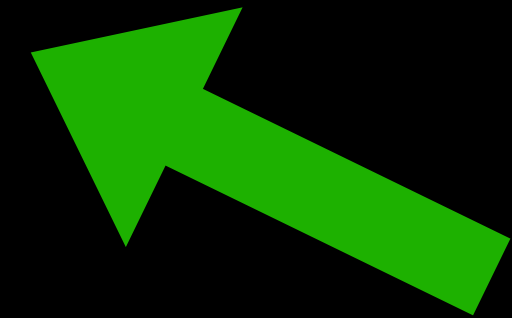


Forest Landscape restoration

Reclamation

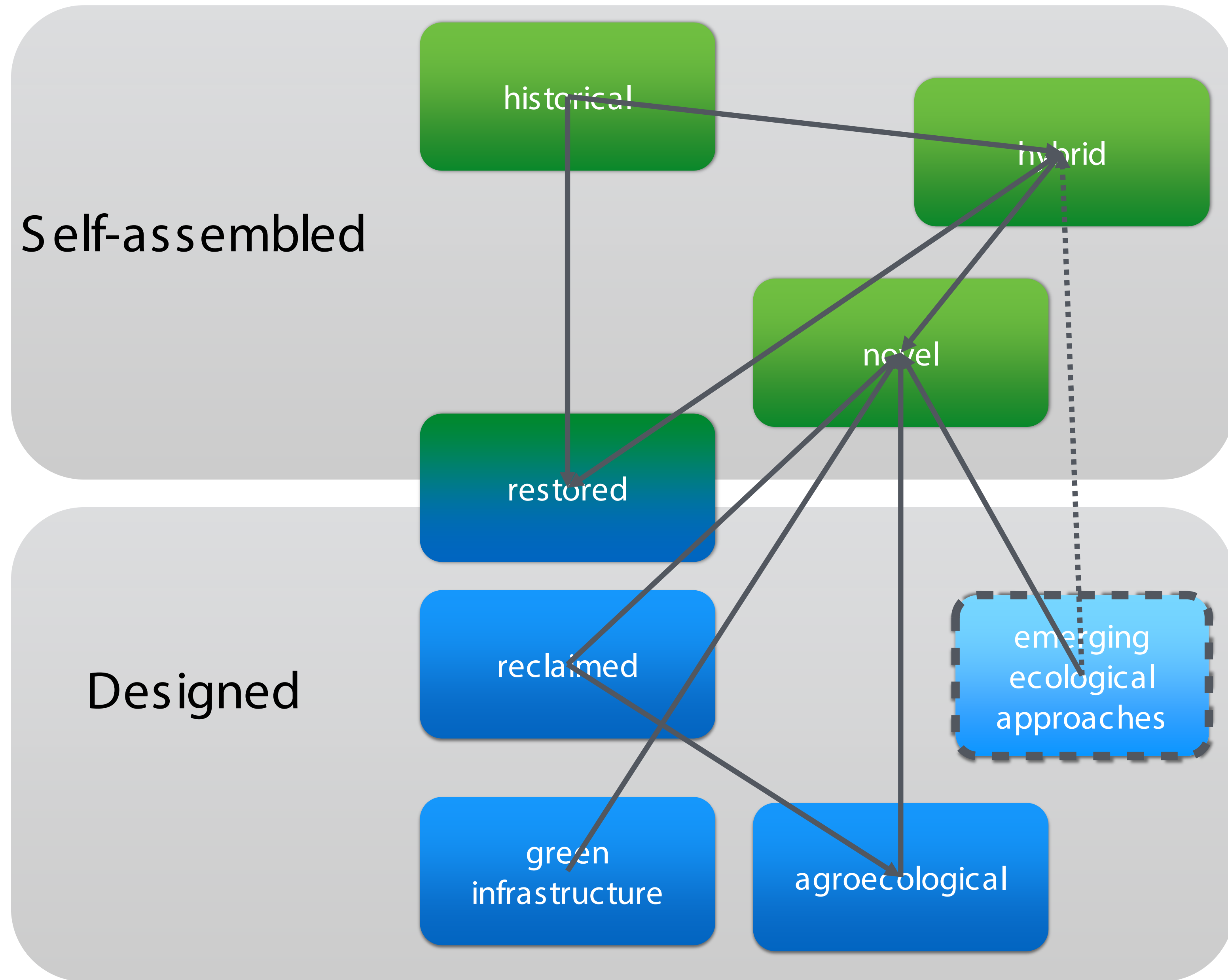


Ecological design

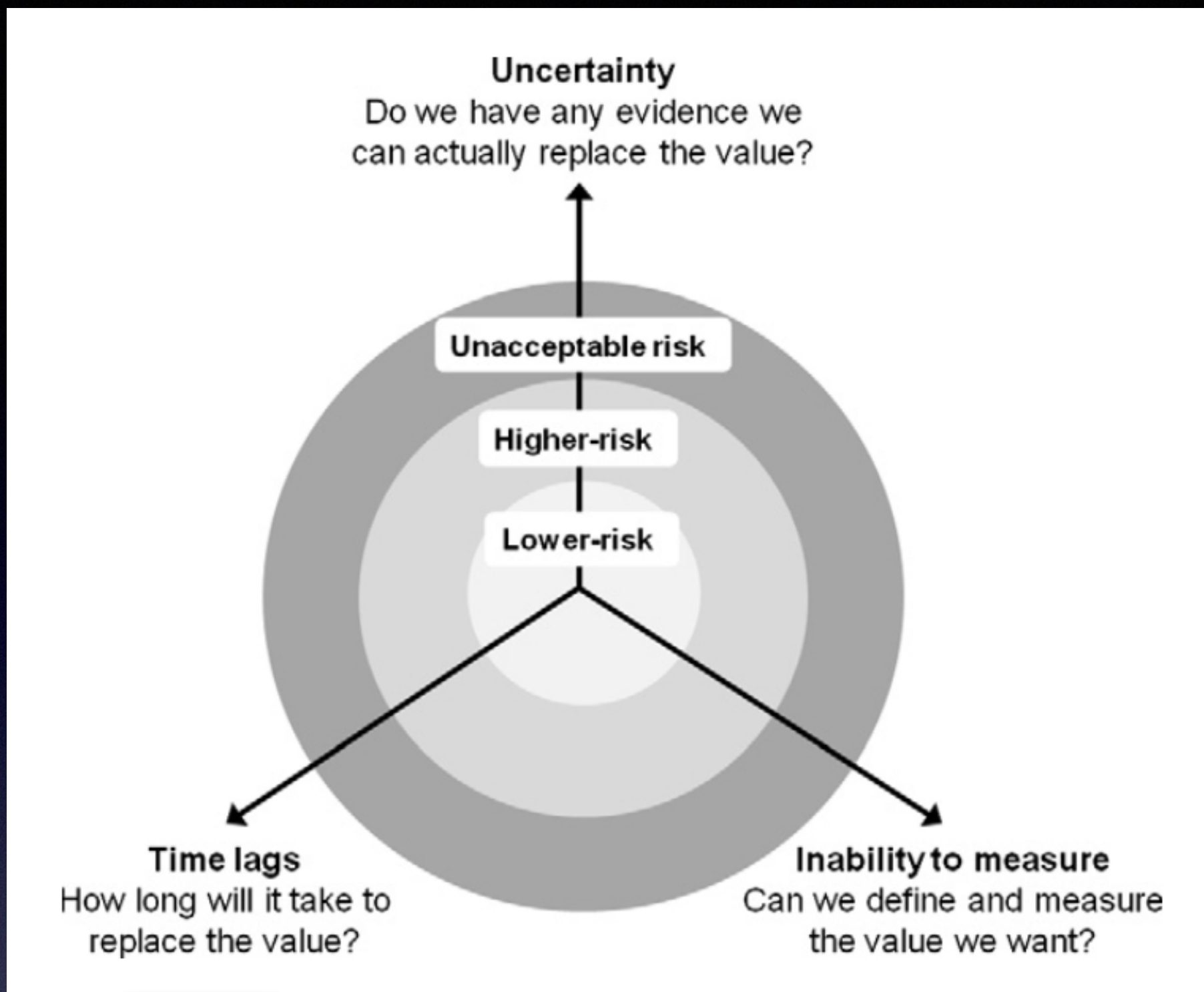


An aerial photograph of a massive white restoration tent. The tent features a series of five prominent peaks along its length, with numerous vertical support poles and guy lines extending to the ground. The base of the tent is lined with a series of arched openings. The tent is situated on a large, flat, brownish ground area, possibly a construction site or a cleared field. In the background, there are several buildings, including a large white warehouse-like structure on the left and a smaller house-like building. A road and some trees are also visible. In the foreground, there is a blue sign that reads "GENERATIONS IN JAZZ" and a white bus parked on the right side.

How big is the restoration tent?

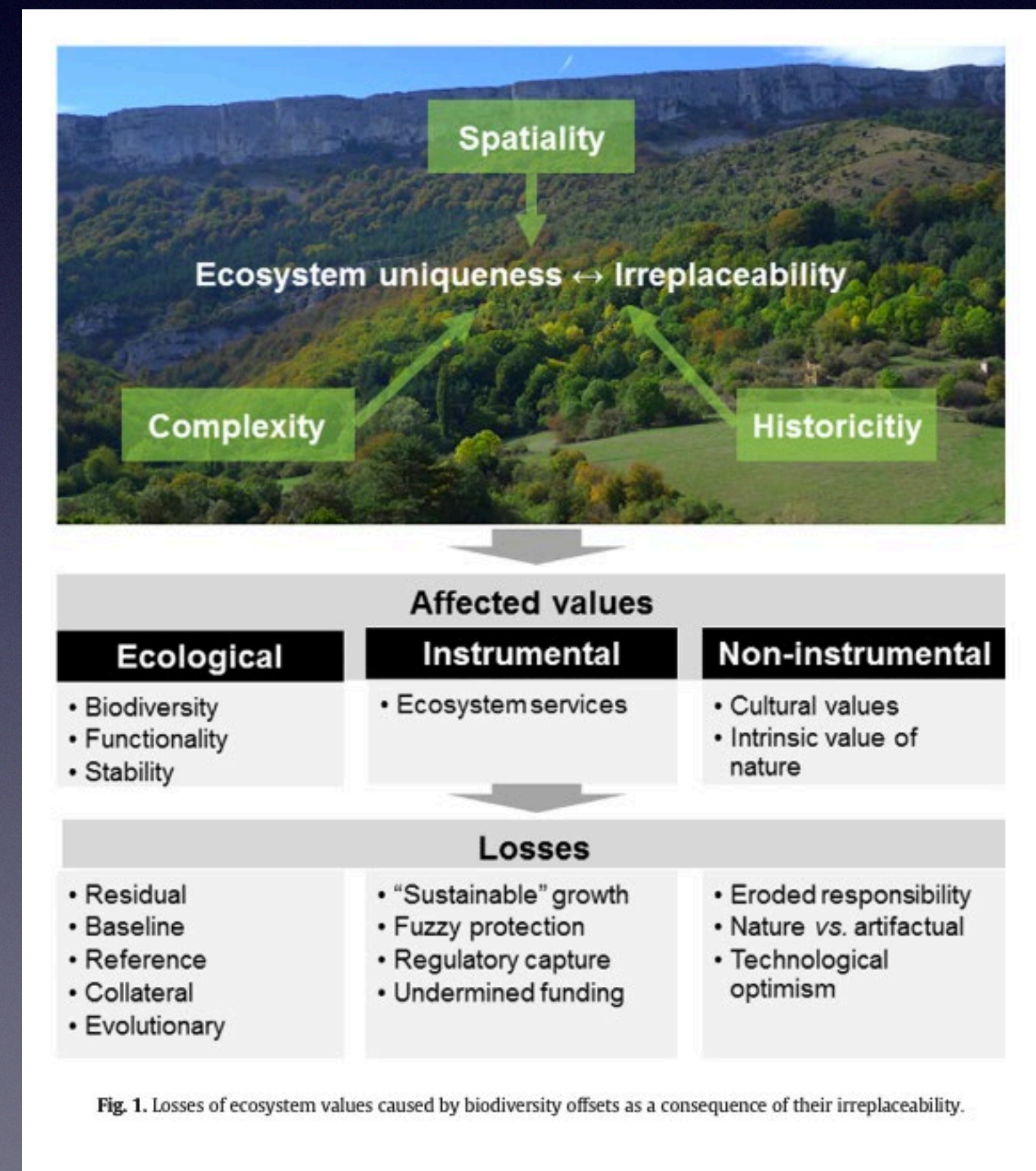


Maron, M., R. J. Hobbs, A. Moilanen, J. W. Matthews, K. Christie, T. A. Gardner, D. A. Keith, D. B. Lindenmayer, and C. A. McAipine. 2012. Faustian bargains? Restoration realities in the context of biodiversity offset policies. *Biological Conservation* 155:141-148.



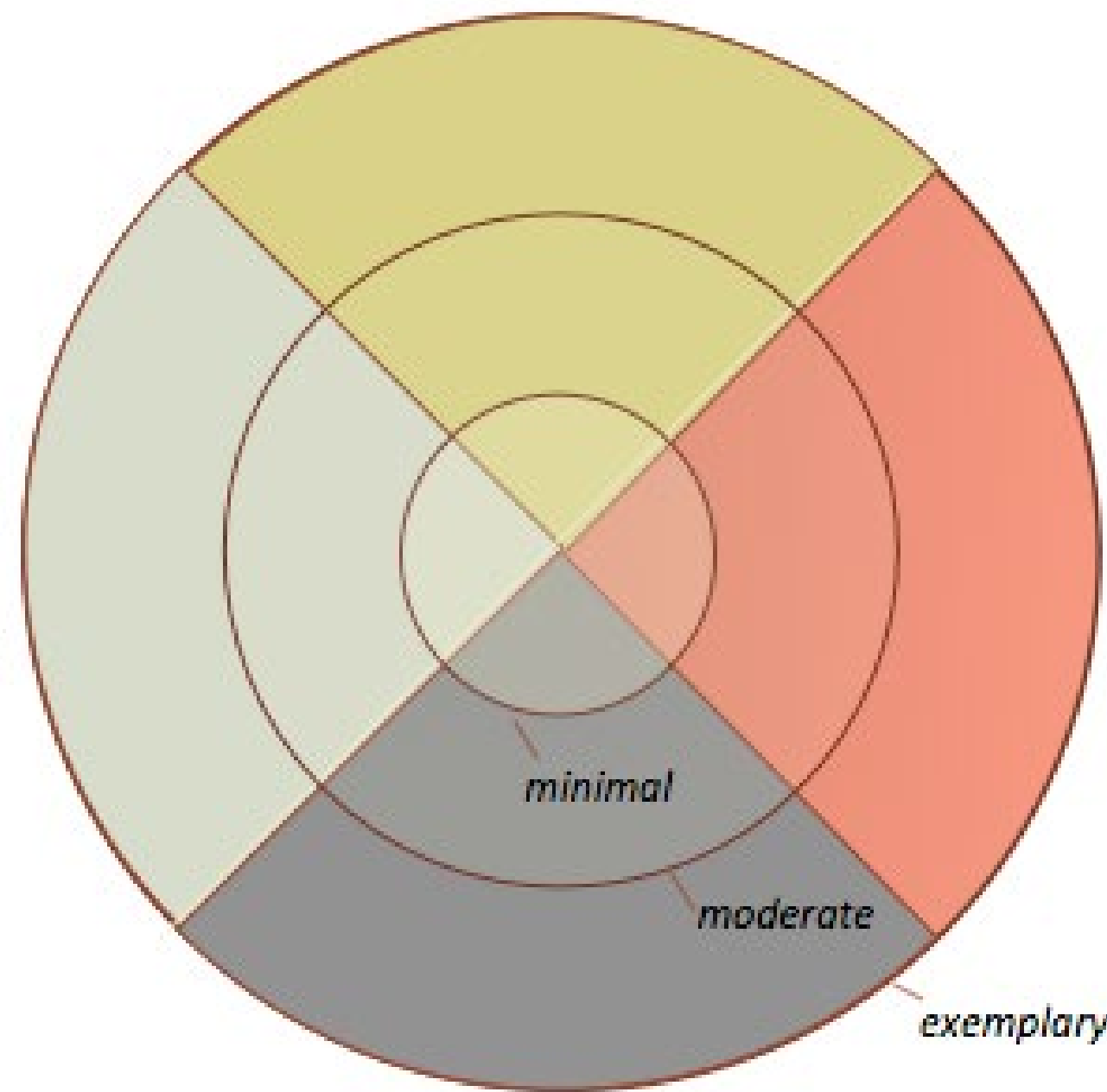
Restoration ecologists are hard on biodiversity offsets and no-net loss.

Moreno-Mateos, D., V. Maris, A. Béchet, and M. Curran. 2015. The true loss caused by biodiversity offsets. *Biological Conservation* 192:552-559.



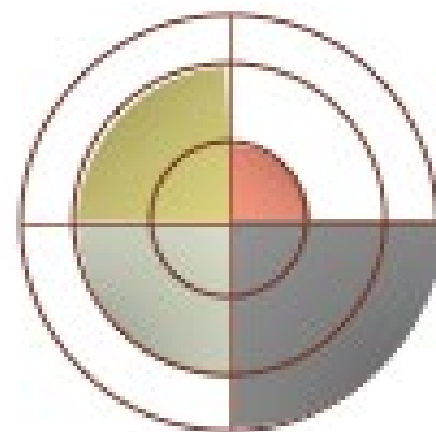
Ecological Integrity

Informed by
Past & Future



Long-term
Sustainability

Benefits & Engages Society



INSIGHTS | PERSPECTIVES

CONSERVATION

Committing to ecological restoration

Efforts around the globe need legal and policy clarification

By Katharine Suding,^{1*} Eric Higgs,² Margaret Palmer,³ J. Baird Callicott,⁴ Christopher B. Anderson,⁵ Matthew Baker,⁶ John J. Gutrich,⁷ Kelly L. Hondala,⁸ Matthew C. LaFavor,⁹ Brendon M. H. Larson,¹⁰ Alan Randall,^{11,12} J. B. Ruhl,¹³ Katrina Z. S. Schwartz¹⁴

At the September 2014 United Nations Climate Summit, governments rallied around an international agreement—the New York Declaration on Forests—that underscored restoration of degraded ecosystems as an aspirational solution to climate change. Elected leaders committed to restore more than one sixth of their land. Uganda, the Democratic Republic of Congo, Guatemala, and Colombia Republic of total, parties committed to restore a staggering 350 million hectares by 2030. The ambition affirms restoration's growing importance in environmental policy. These new commitments follow the 2010 Aichi Convention on Biological Diversity (to restore at least 15% of degraded ecosystems globally) and the 2011 Bonn Challenge (to restore 150 million hectares). Particularly when accompanied by policies to reduce further losses (as in the New York Declaration), restoration of such magnitude holds promise to address global environmental concerns.

Achieving this promise requires careful thought about how we restore ecosystems: scientifically based, workable, and comprehensive restoration (3) that can provide appropriate best practice guidelines in legal, and planning efforts. There is little question that ecological restoration can provide substantial benefits

POLICY

that enhance quality of life (4). A considerable body of science suggests that restoration can guide establishment of complex self-sustaining interactions between biophysical features, and processes that compose an ecosystem (5, 6). The science of the endeavor: Our interventions rarely achieve full recovery, and uncertainty is to be expected in dealing with natural recovery processes (7, 8). Continuing environmental change further challenges the

Some have thus questioned whether decadal or longer term restoration of degraded ecosystems is realistic. Others have cautioned that these declarations may spur actions that compromise biodiversity: for instance, by replacing ancient grassy biomes with forest plantations (7) or by planting species in specialized zones where they may not persist (10). Others emphasize that a focus on one goal (e.g., climate change mitigation) might not deliver intended benefits in ways and over time scales not fully understood (14, 15).

Specialized programs such as compensation, and ecosystem service delivery can be a useful contribution to—but are not synonymous with—ecological restoration (16, 17). Such distinctions are not trivial be-

cause projects undertaken in the name of restoration may in fact be something different and, in many cases, have been demonstrated to achieve neither restoration nor their intended purposes (17, 18). Delivery of diverse benefits will depend on how on-the-ground efforts are conceived and implemented (7, 8). Avoiding mistakes on a grand scale requires clear practice principles (19).

FOUR PRINCIPLES. We advocate considering four principles when planning restoration. The degree to which each principle is achievable will vary on the basis of social and ecological context. By taking into account these comprehensive principles, trade-offs inherent in specialized projects are avoided, which increases the prospect of sustainable and valuable overall outcomes (see the figure).

1. Restoration increases ecological integrity. Restoration initiates or accelerates recovery of degraded areas by prioritizing the complexity of biological assemblages, including species composition and representation of all functional groups, and as the features and processes needed to sustain these biota and to support ecosystem function (3, 4).

2. Restoration is sustainable in the long term. Restoration aims to establish systems that are self-sustaining and resilient. Thus, they must be consistent with their environmental context and landscape setting. Once a restoration project is complete, the goal should be to minimize human intervention over the long term. When intervention is required, it should be to simulate natural processes that the landscape no longer provides (e.g., fire or invasive species removal) or to support traditional practices of local communities (8, 9).

3. Restoration is informed by the past and future. Historical knowledge, in its many forms, can indicate how ecosystems functioned in the past and can provide references for identifying potential future trajectories and measuring functional and compositional success of projects (19). However, the unprecedented pace and spatial extent of anthropogenic changes in the present era can indicate how ecosystems part strongly from historical trends (9). Often, history serves less as a template and more as a guide for determining appropriate restoration goals (19, 20).

4. Restoration benefits and engages society. The use of our principles identifies trade-offs in the planning process and the extent of departure from the full opportunities presented by comprehensive ecological restoration (example after (25)).

Four principles for planning restoration. The use of our principles identifies trade-offs in the planning process and the extent of departure from the full opportunities presented by comprehensive ecological restoration (example after (25)).

Ecological Integrity
Long-term sustainability
Benefits and engages society
Informed by past & future

minimal
moderate
exemplary

minimal
moderate
exemplary

1. University of Colorado Boulder, Boulder, CO 80309, USA; 2. University of Victoria, Victoria, British Columbia V8W 2Y2, USA; 3. University of Maryland, College Park, MD 20742, USA; 4. Consejo Nacional de Investigaciones Científicas y Universidad Nacional de Tierra del Fuego, Ushuaia, 7500, Argentina; 5. University of Maryland, Baltimore, MD 21201, USA; 6. Southern Oregon University, Ashland, OR 97532, USA; 7. National Socio-Environmental Synthesis Center, University of Maryland, Baltimore, MD 21201, USA; 8. University of Maryland, Baltimore, MD 21201, USA; 9. University of Waterloo, Waterloo, Ontario N2L 3G1, Canada; 10. Ohio State University, Columbus, OH 43210, USA; 11. University of Sydney, Sydney, New South Wales 2006, Australia; 12. Vanderbilt University, Nashville, TN 37203, USA; 13. Howard Wilson International Center for Scholars, Washington, DC 20004, USA; 14. *Corresponding author. suding@colorado.edu

Downloaded from www.sciencemag.org on May 13, 2015

638 • MAY 2015 • VOL 348 | ISSUE 2325