

Integrating Conservation and Development Planning at Jurisdictional Scales



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Development by Design:

***Solution for
Development &
Conservation***

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Director

Development by Design

The Nature
Conservancy



Protecting nature. Preserving life.™



Development on the Horizon



Population to reach 9 billion by 2050

(United Nations 2012)



Food crop demand up >100% in 2050

(Tilman et al. 2012)



Global economic growth to double by 2030

(World Bank 2013)



Global energy demand to rise 35% by 2040

(Exxon, Outlook for Energy 2013)



Global mineral demand to rise 60% by 2050

(Kesler 2007)

Forecasting to Mitigate Potential Future Development



Urbanization



Agriculture

- Cropland
- Pasture



Fossil Fuels

- Conventional oil & gas
- Unconventional shale gas
- Coal



Renewable energy

- Solar
- Wind
- Biofuels

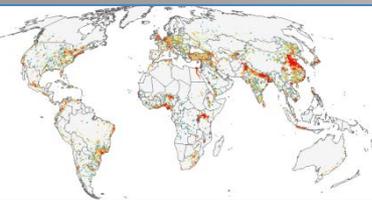


Mining

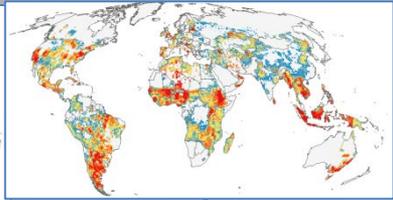
- ~120 minerals & geologic materials

Cumulative Future Development Threat

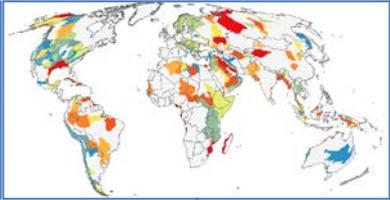
Urban Expansion



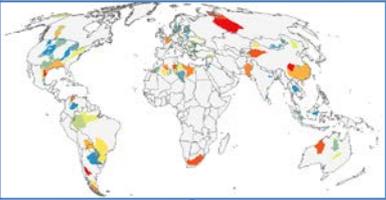
Agricultural Expansion



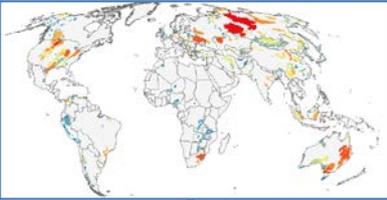
Conventional O&G



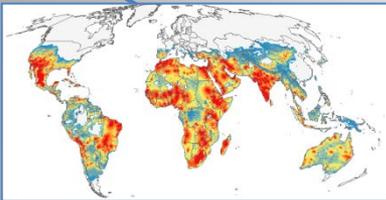
Shale Gas



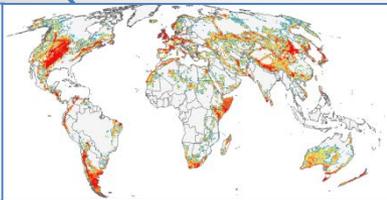
Coal



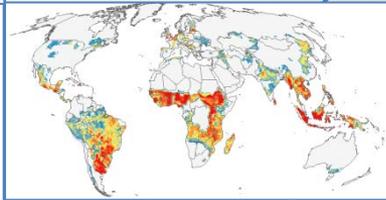
Solar



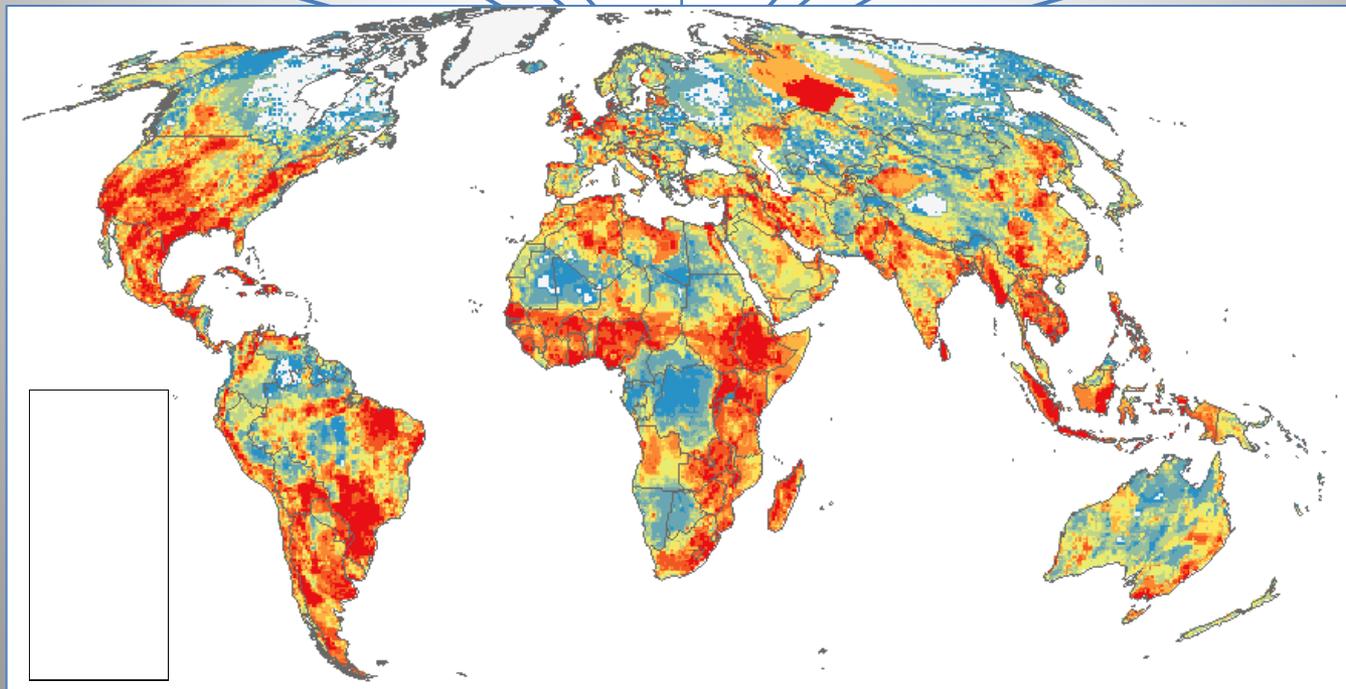
Wind



Biofuels

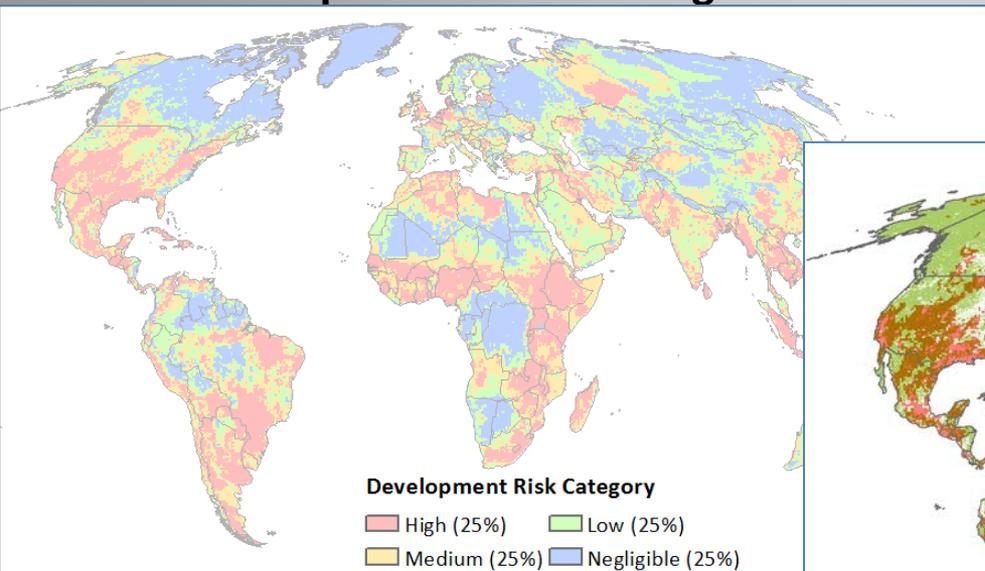


Mining

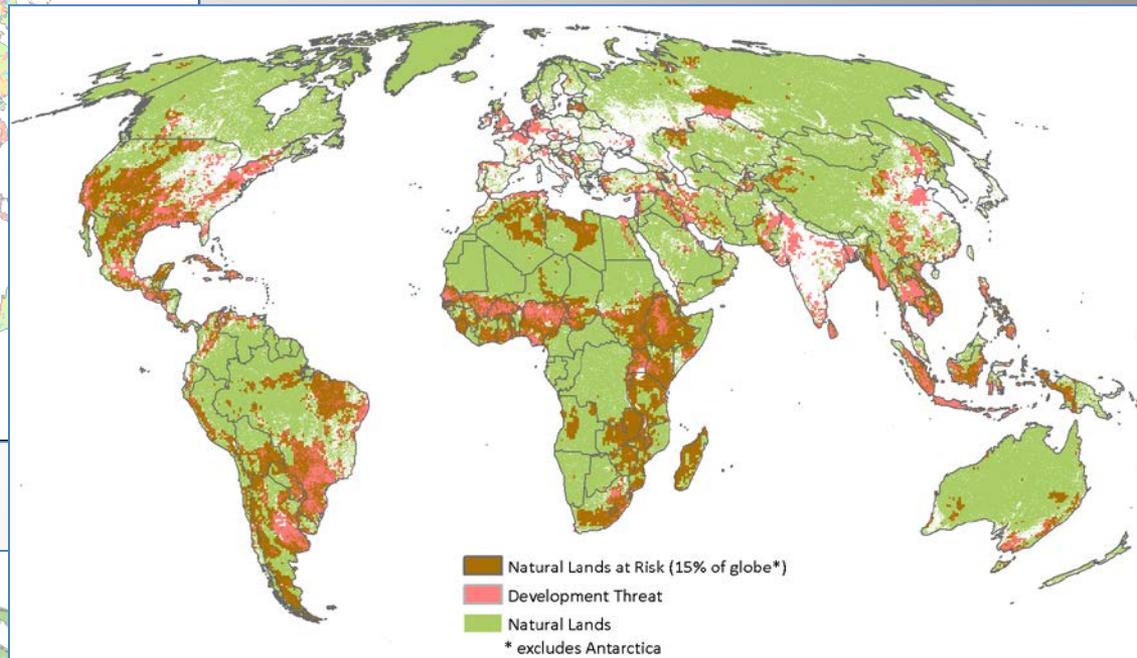


Future Development Risk to Natural Lands

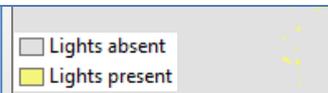
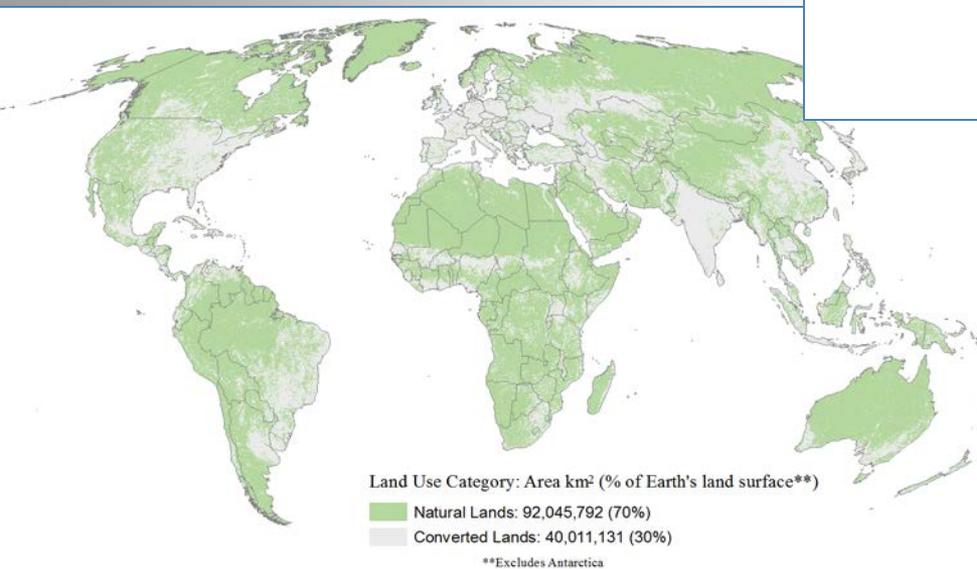
Development Threat Categories



Natural Lands at High Risk = 20%



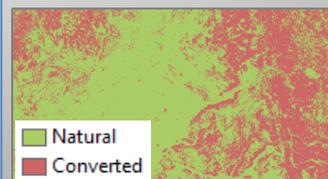
+
Natural lands =



(Nighttime Lights of the World 2010)



Global Roads
(Global Roads Database 2012)



Land cover
(GlobCov 2008)

Sustainable Development Principles

Avoid



Minimize



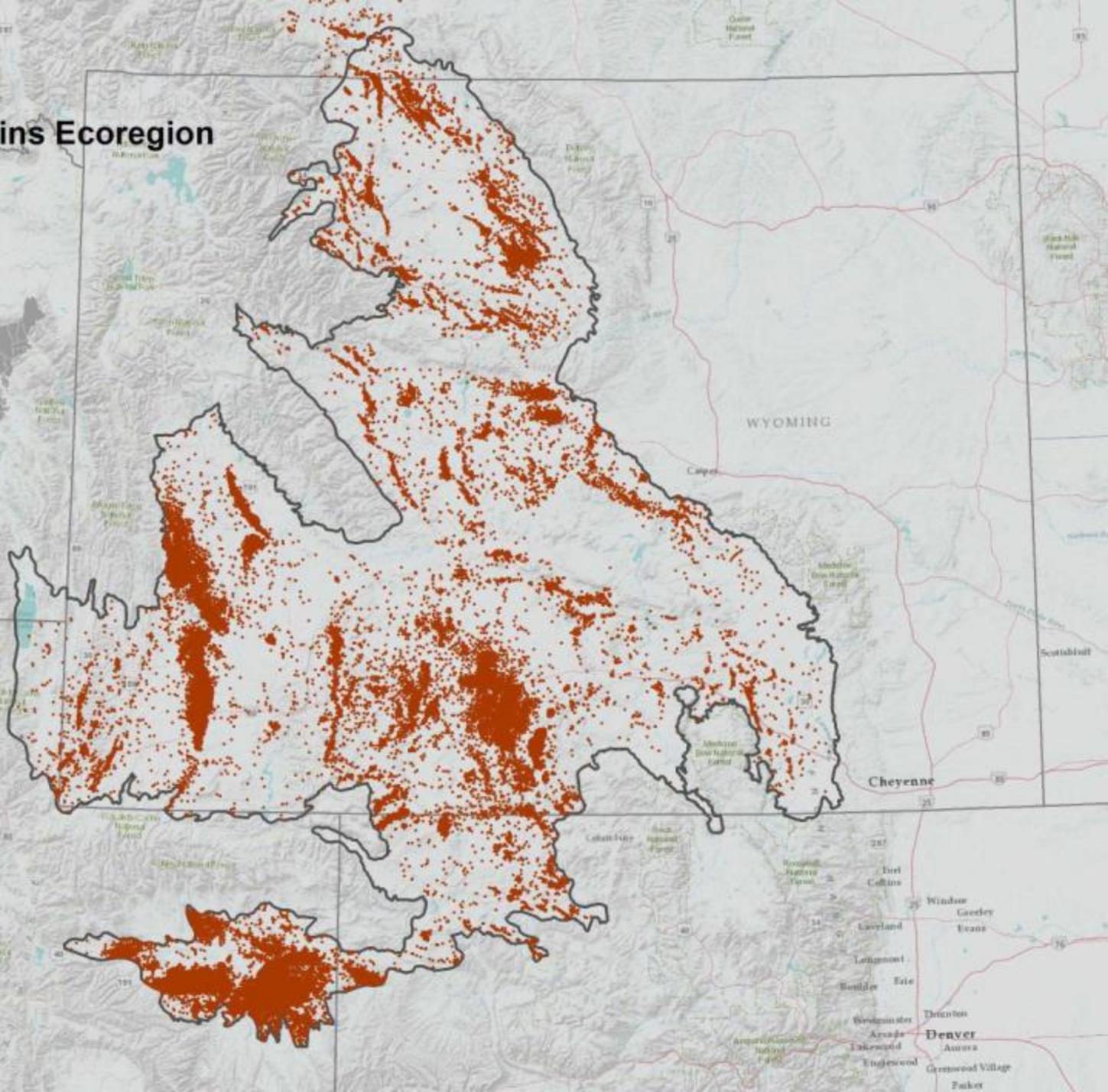
Restore

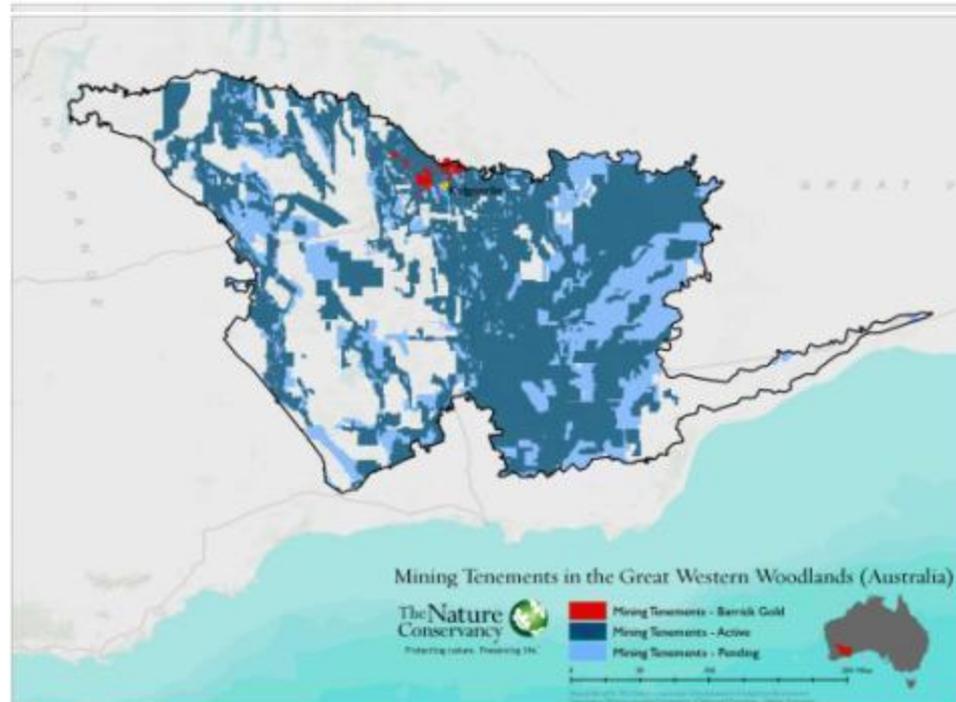
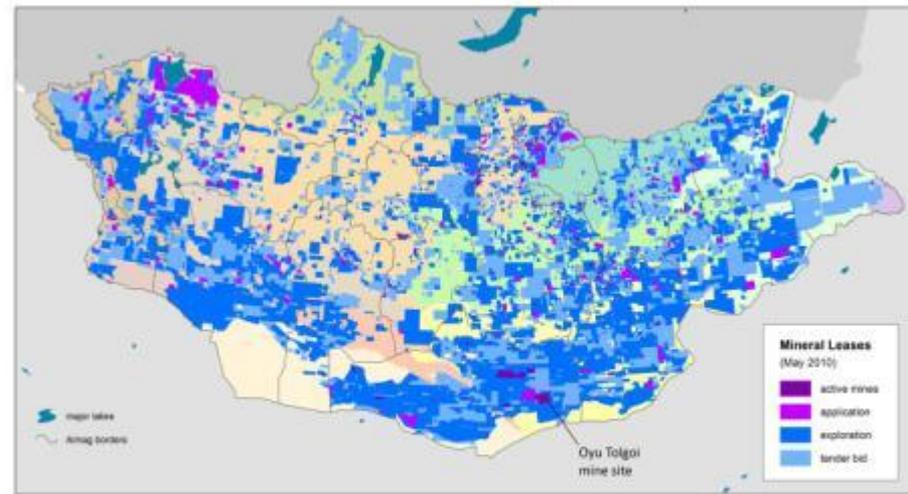
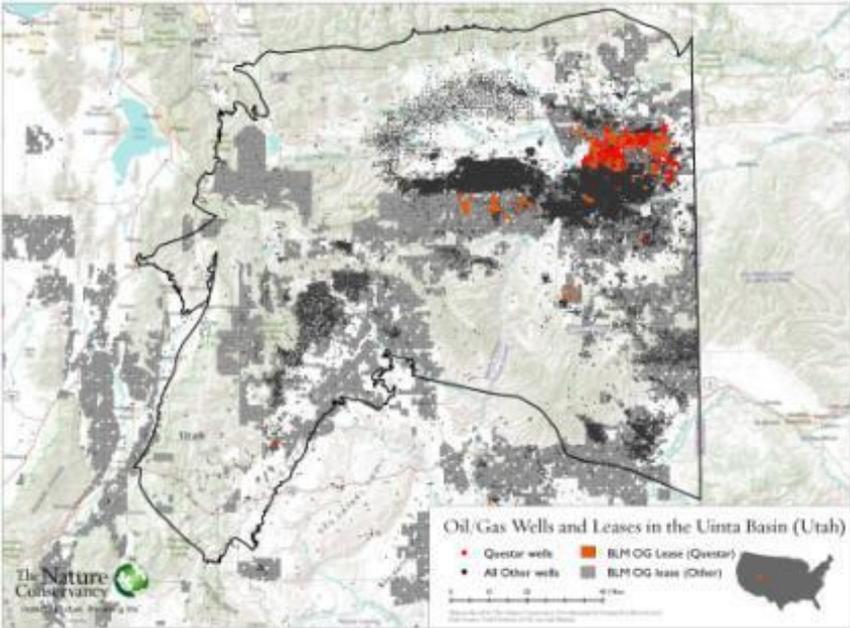


Offset

Oil and Gas Wells in the Wyoming Basins Ecoregion

2011





Common Problems with Development Planning Process

Problems

- Arbitrary, opaque and ad hoc approach
- Reactive piecemeal planning
- Improper ecological scale
- Lack of defined outcome
- Assessments often time/cost-prohibitive

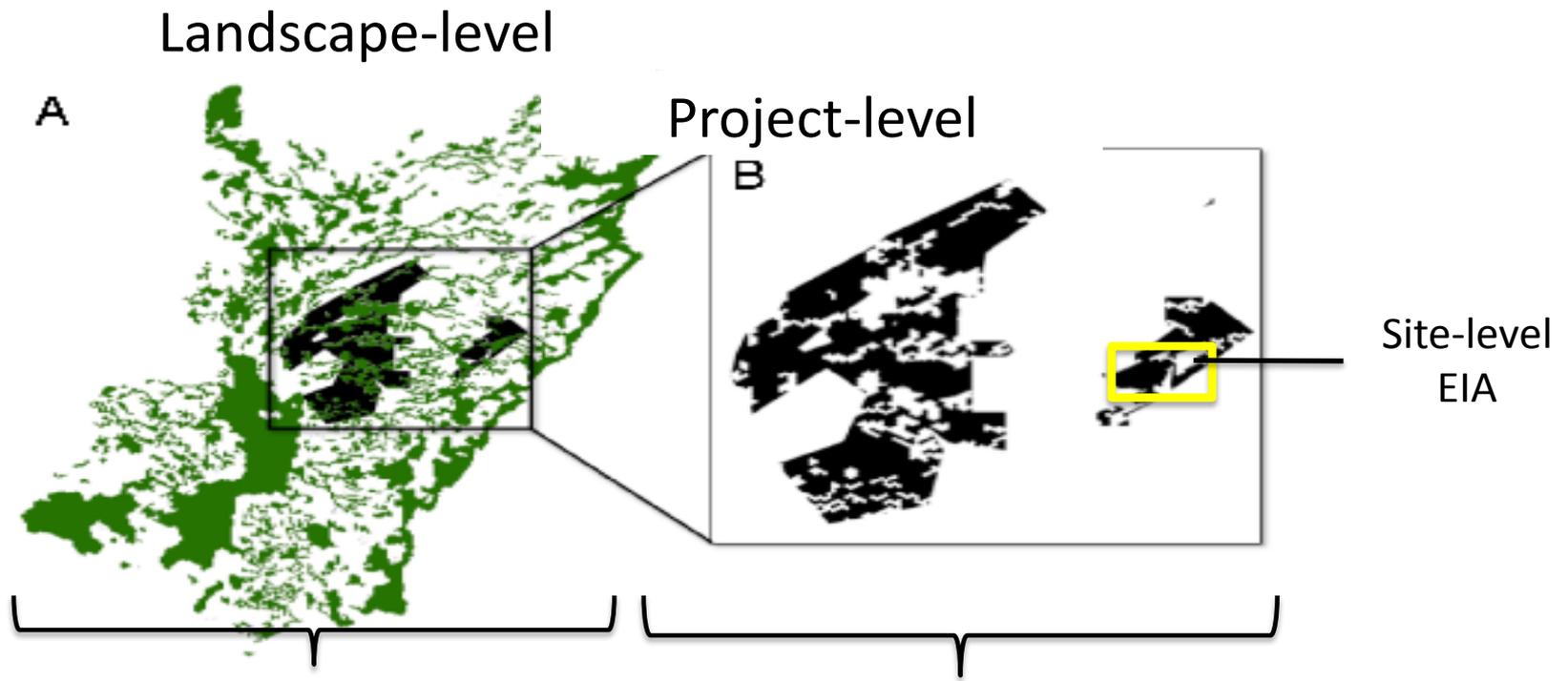
Avoid

Minimize

Restore

Offset

Development by Design



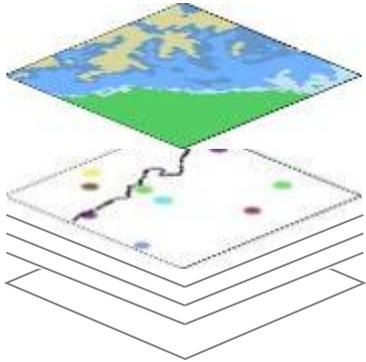
Siting
Decisions

Offset
Design

Impact &
Offset
Accounting

Development by Design Process

Select BIODIVERSITY ELEMENTS



COARSE FILTER
Vegetation Types

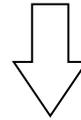
FINE FILTER
Species

Other Goals i.e. Eco. Services
Social/Cultural

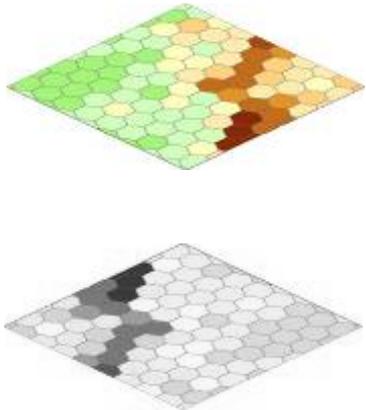
Set GOALS

(X) Acres of habitat needed to maintain viability

(Y) Acres of habitat or point locations (i.e. nests)
needed to maintain viability

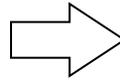


assess ECOLOGICAL CONDITION



Cost / Suitability Index

- Road & RR Density
- Population Density
- Converted Land Cover
- Irrigated Land Cover
- Housing density

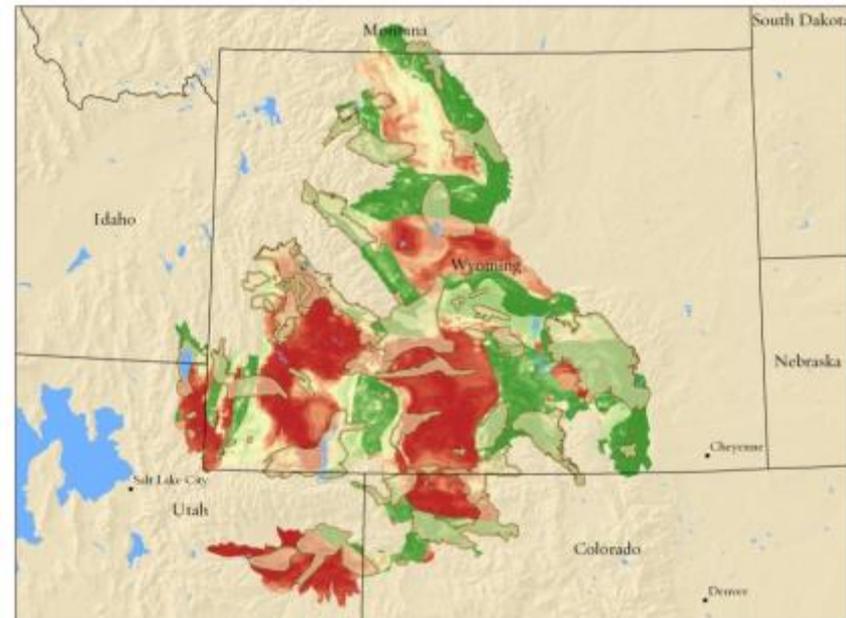


Future development pressure

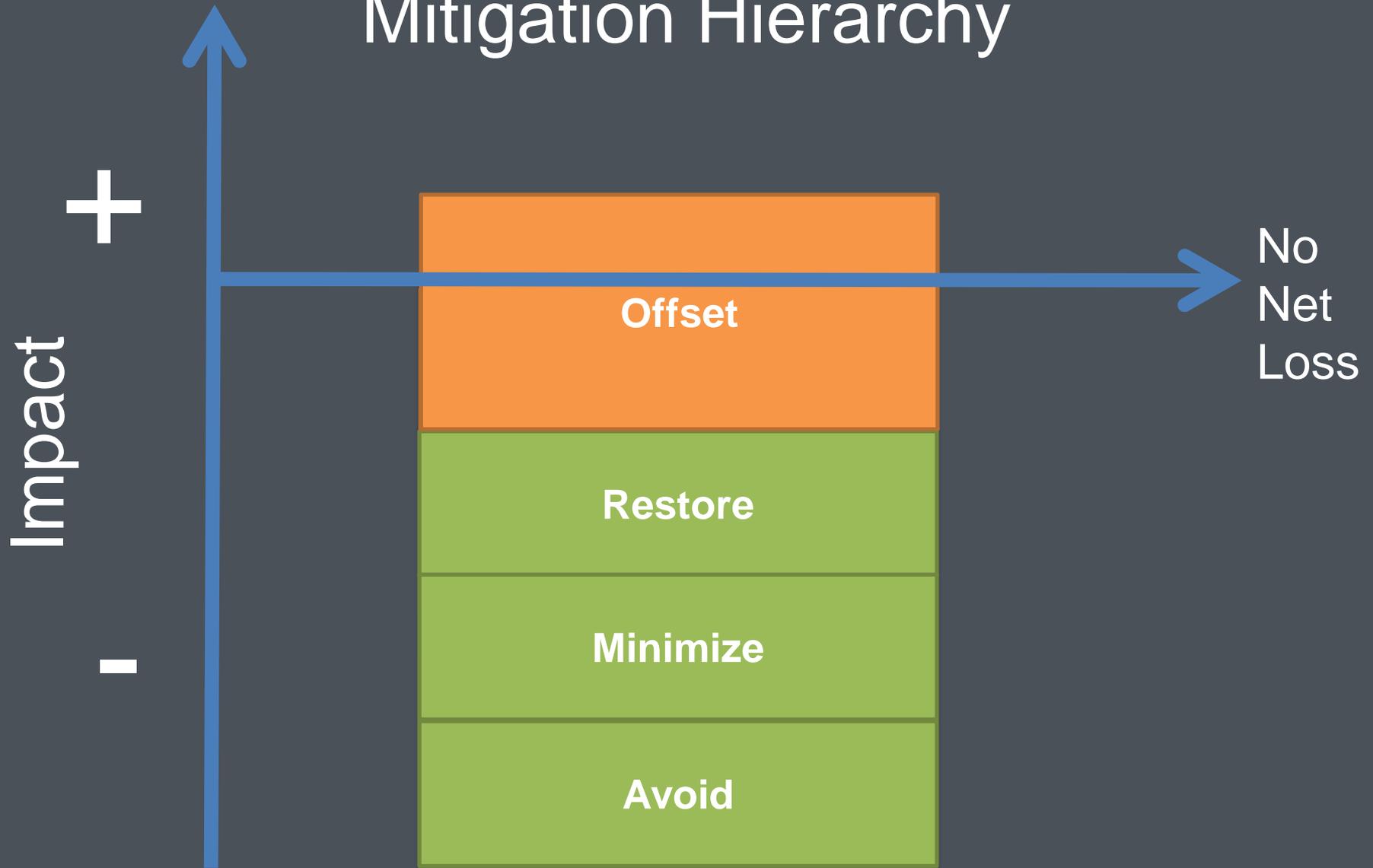
(Z) Amount of production

Conservation Portfolio Design:
Development Portfolio Design:

automated
site selection
(MARXAN with ZONES)

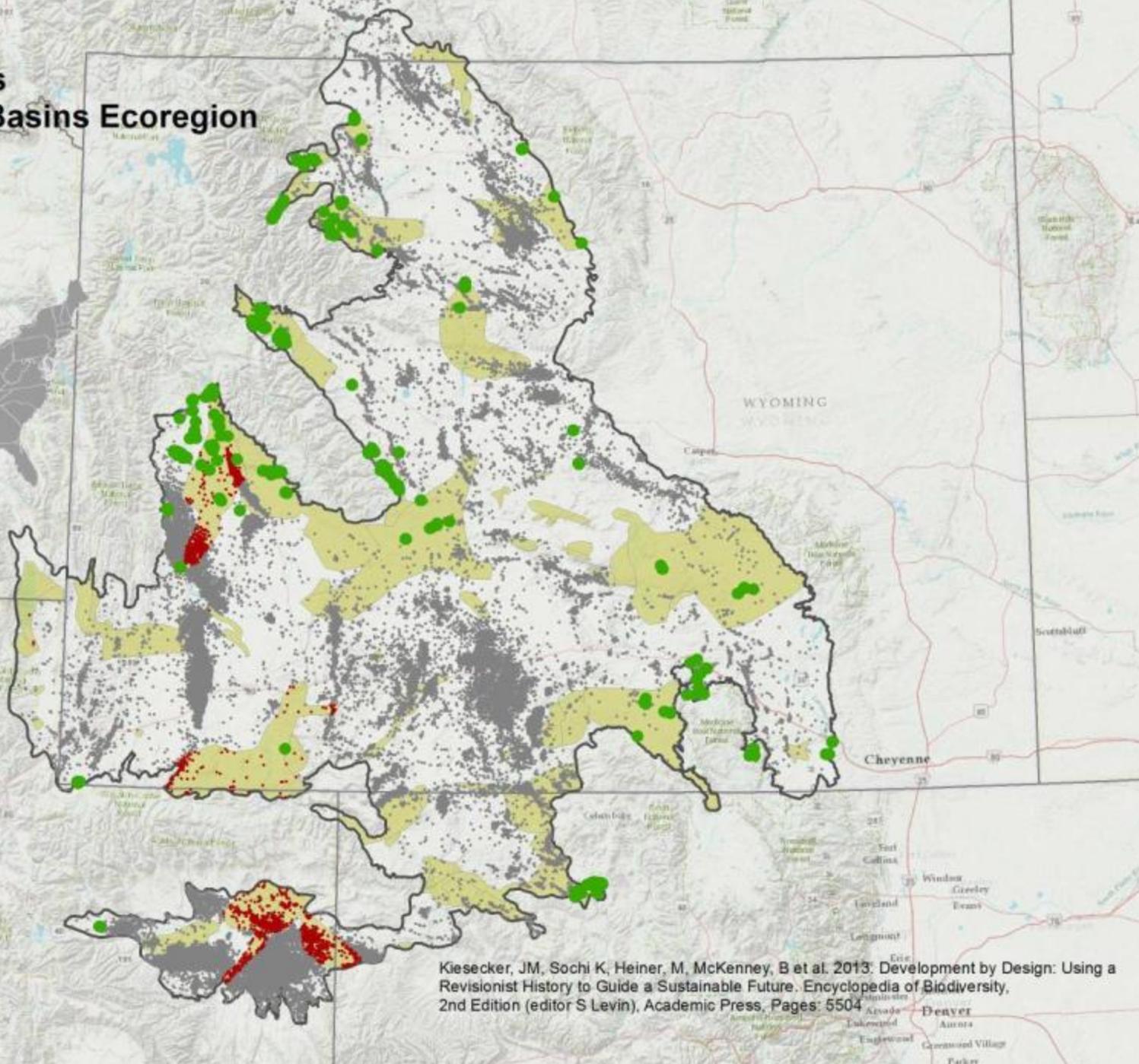


Mitigation Hierarchy



Oil and Gas Wells in the Wyoming Basins Ecoregion

2011



- Conservation areas
- Wells
- Wells in avoid areas
- Offsets

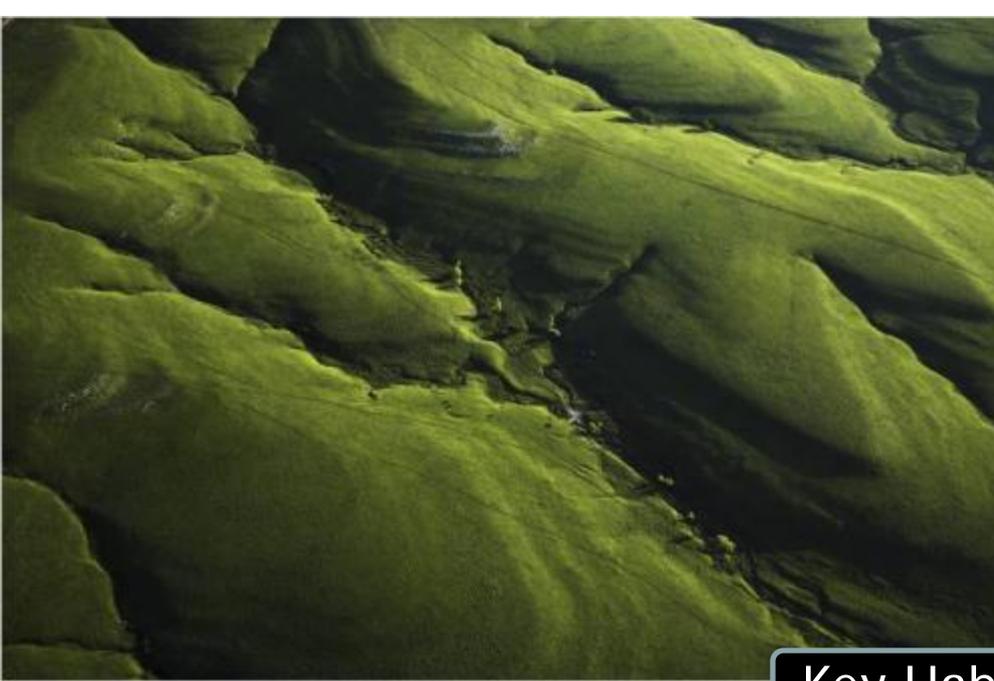
Kiesecker, JM, Sochi K, Heiner, M, McKenney, B et al. 2013. Development by Design: Using a Revisionist History to Guide a Sustainable Future. Encyclopedia of Biodiversity, 2nd Edition (editor S Levin), Academic Press, Pages: 5504



Development by Design: Mitigating Wind Development's Impacts on Wildlife in Kansas

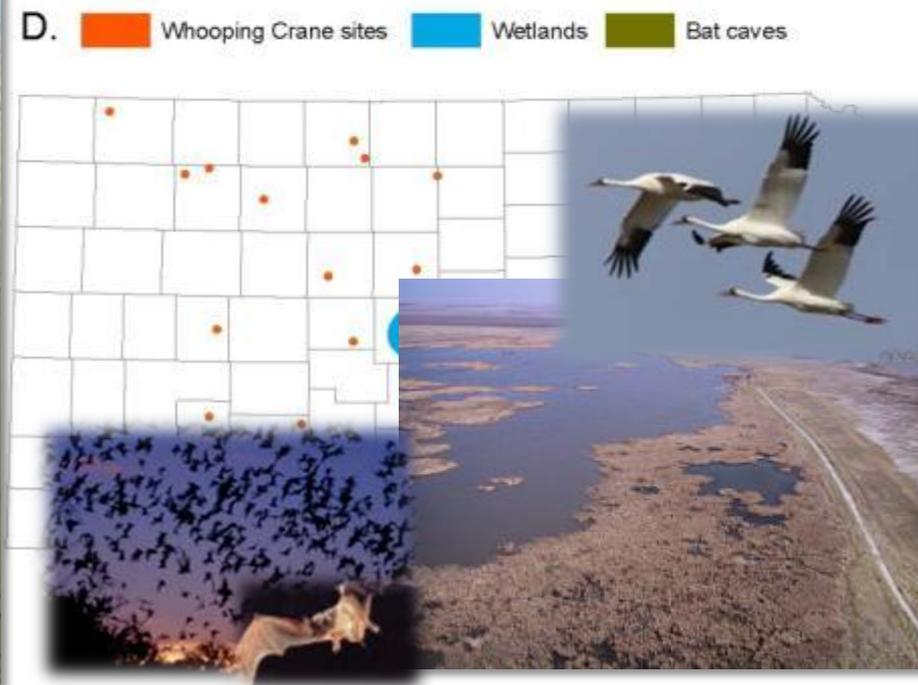
Brian Obermeyer¹, Robert Manes², Joseph Kiesecker³, Joseph Fargione^{4*}, Kei Sochi⁵

¹The Nature Conservancy, Cottonwood Falls, Kansas, United States of America, ²The Nature Conservancy, Topeka, Kansas, United States of America, ³The Nature Conservancy, Fort Collins, Colorado, United States of America, ^{4*}The Nature Conservancy, Minneapolis, Minnesota, United States of America, ⁵The Nature Conservancy, Boulder, Colorado, United States of America

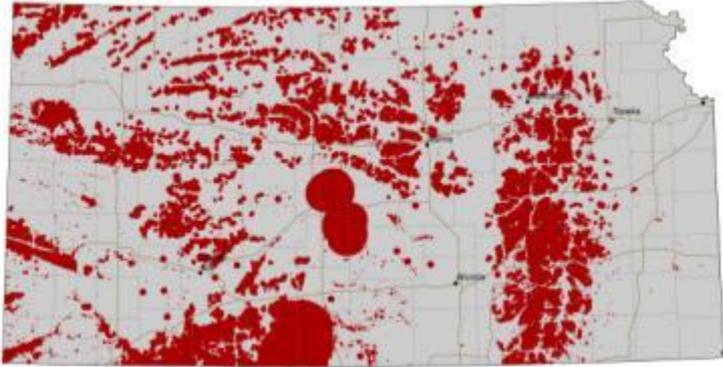


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www.BirdsInFocus.com

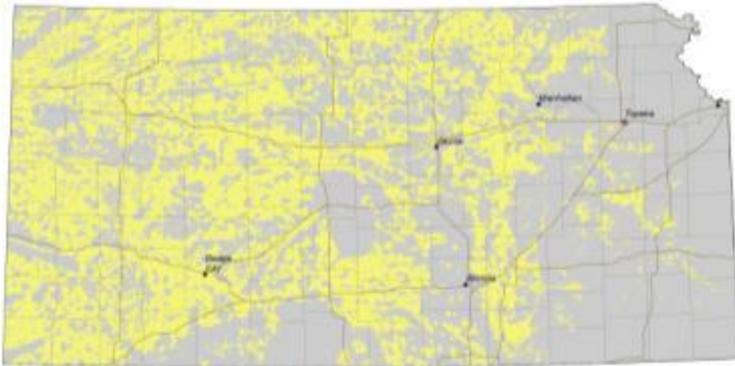
Key Habitats



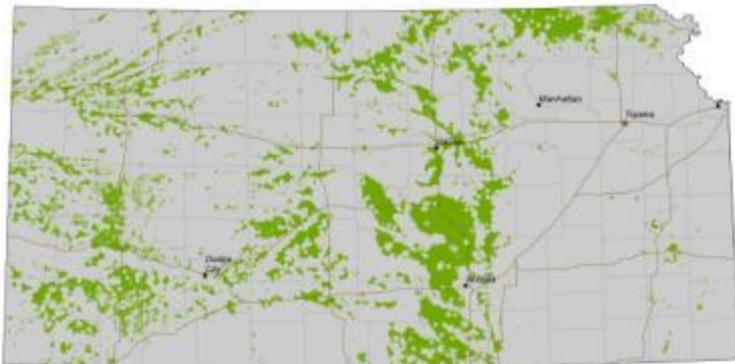
Development by Design for Wind



AVOID



OFFSET



No Mitigation

Mitigation Costs

Based on actual costs of restoring and protecting

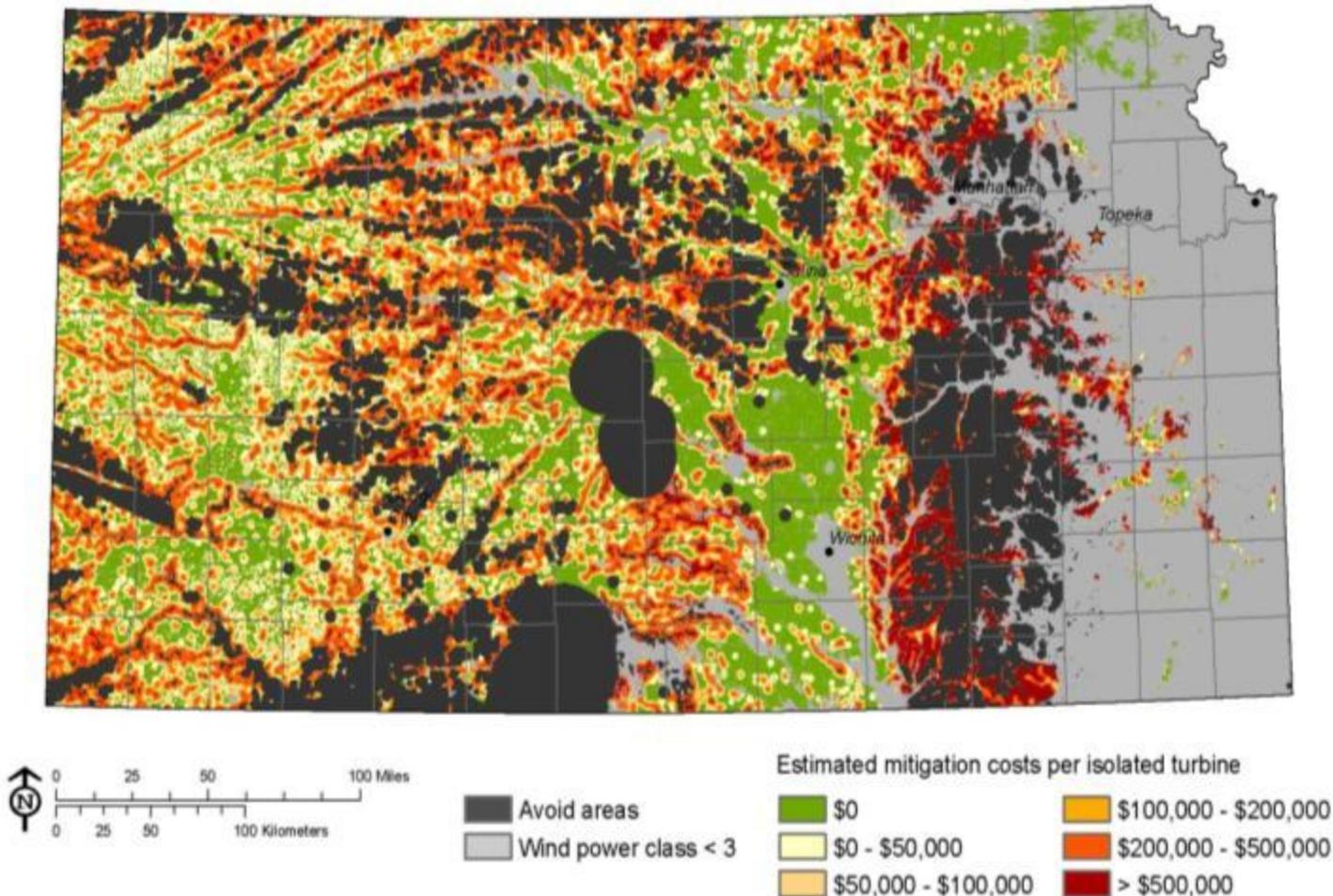
Grassland

Prairie chicken

Playa lakes



MITIGATION COSTS





- Cerrado, Brazil's tropical savannah, is global biodiversity hotspot, with less than 20% natural habitat and < 2 % protected (Klink & Machado 2005)
- In consolidated agricultural region in Brazil, land devoted to cattle ranching and increasingly to sugarcane production (Lapola et al. 2010)
- Conserving natural areas on agriculture (private) lands is increasingly vital and regulated by Brazilian Forest Code (FC): requiring ~25% of natural vegetation per property in this region (Soares-Filho et al. 2014)
- Goal: Guide business decisions about land use to meet FC and to optimize agricultural production *and* benefits of forest restoration, biodiversity & ecosystem services

Cerrado



Cattle ranching



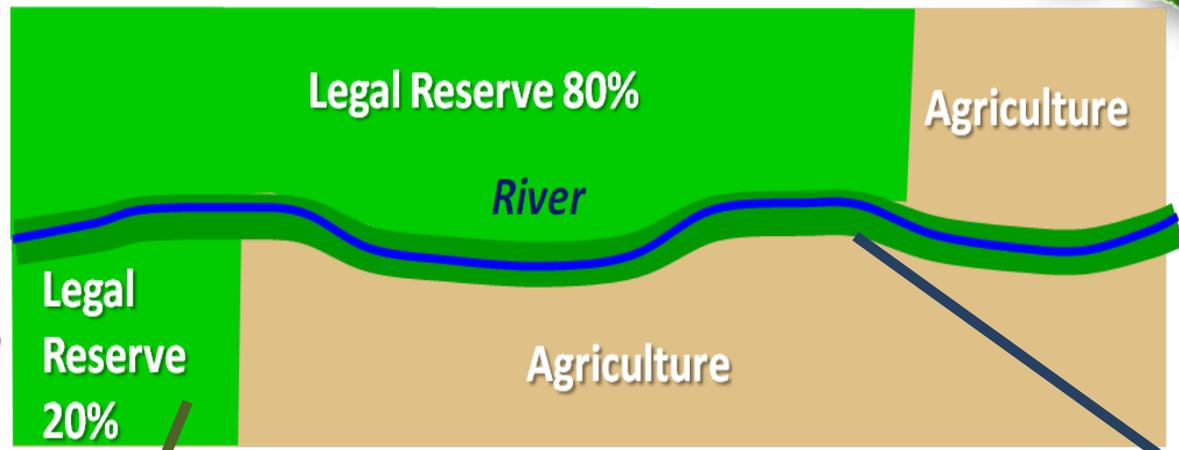
Sugarcane



Brazilian Forest Code



LEGAL AMAZON



NON LEGAL AMAZON

Legal Reserve

Permanent Preservation Area (PPA)



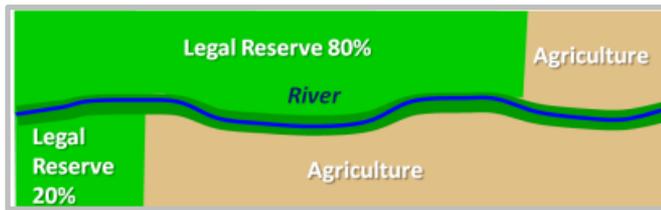
Optimizing Land Use Decision-Making to Sustain Agricultural Profits, Biodiversity, & Ecosystem Services



Agriculture
Cattle ranching
Sugar cane

- Economic return (\$)

- Amount & locations of habitat required (PPAs, LRs)
- Cost of Forest Code implementation (\$)



Forest Code



Biodiversity

- # of birds & mammals landscape will support



Terrestrial surface water quality
&
Carbon sequestration

- Nutrient (nitrogen, phosphorus) & sediment loads into waterways
- Carbon sequestration from habitats

ABCs for Improving Development Planning



- **A**head of the impacts
- **B**igger scale – landscape-level planning
- **C**onservation & Development Outcomes

Development by Design:

www.nature.org/ourinitiatives/urgentissues/smart-development/index.htm

