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Research article

Beyond protection: Expanding "conservation opportunity" to redefine conservation planning in the 21st century

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ABSTRACT

The protected lands estate increased dramatically during the 20th century and forms the backbone of current fisheries and wildlife conservation in North America. However, there is increasing evidence that modern conservation goals cannot be achieved by only focusing on adding new acreage, particularly with opportunistic protection. In the 21st century, flexibility and adaptability of conservation options can be accomplished by expanding the vocabulary of conservation planning beyond protection. We suggest a conceptual framework that considers suites of objectives to translate the broad goal of "conservation" into multiple implementation-specific objectives. These objectives form the "PCRM-PI" approach: protect, connect, restore, manage, partner, and inform. We use a case study to illustrate the limitations of protection-centric planning and how expanding the definition of conservation opportunity can help planners do more on the landscape. We suggest that the PCRM-PI approach with implementation-specific objectives is an effective way to bridge planning-implementation gaps and translate broad, landscape-level conservation goals into implementable actions.

1. Introduction

The 20th century was a period of exceptional environmental activism and policy implementation that heralded a previously unmatched emphasis on conservation. The global protected lands estate increased dramatically during this time (Watson et al., 2014), and in North America, these public lands form the backbone of fisheries and wildlife conservation. Early conservation efforts, while invaluable, often involved opportunistic protection that was biased towards areas of high elevation and low productivity (Joppa and Pfaff, 2009). In the 1970s, conservation planning developed systematic approaches to locating and designing protected area reserves (e.g., Margules and Pressey, 2000). Contemporary conservation planning has generally focused on identifying conservation opportunity areas, which generally are priority areas yet to be protected, that would maximize a given conservation objective while also minimizing the spatial extent that needs to be protected.

An implicit goal of modern conservation planning is to increase the protected lands estate across representative biogeographies, ecosystems, and biodiversity hotspots. Here we define protection as the movement of a land parcel into a legal status to permanently prevent development or other transformation that would outwardly change the major ecological characteristics. While land protection can and does happen in a variety of ways globally, it is typically accomplished through transfer of ownership (purchase), change in purpose (inclusion in a park system), or restriction of deed (easement). Much scientific effort has been expended to understand effective configurations of protected lands and at which spatial scales desired conservation outcomes are likely achieved (e.g., Sarkar et al., 2006). However, there is increasing evidence that protection alone will not achieve conservation goals. A recent global assessment of tropical reserves revealed more 'suffering' reserves than those 'succeeding' (Laurance et al., 2012). The successful reserves tended to be those that received the most management. We do not debate the value of land protection as one of the primary goals of conservation design and planning activities. However, we recognize that we have inherited a large protected lands estate globally, and it needs attention in the 21st century beyond adding to its acreage.

Analytical and methodological advancements in design and prioritization of protected lands do not necessarily lead to better implementation of this conservation action. Explicit or implicit use of opportunistic land protection is often used as way to bridge the implementation gap between planned and actual land protection

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actions. This opportunistic approach is rationalized by conceding that protection opportunities may not arise in an orderly sequence that parallels conservation plans (Noss et al., 2002; Knight and Cowling, 2007). However, opportunistic conservation leads to inefficient allocation of resources and actions that further bias the protected lands estate (Pressey et al., 1993). Carter et al. (2014) assessed the effectiveness of four consecutive plans developed for wildlife conservation by the state of Wisconsin based on their ability to establish land protection projects. They found that the plans had no discernible impact on rate of protection and that the majority of resulting land protection occurred outside of plan boundaries (58%) and within habitat types already well represented within the state's protected lands estate (Carter et al., 2014). The Wisconsin plans included conservation actions that were not based on land protection but their implementation was inherently protection-centric. With this limited focus, these planning efforts may struggle to reach planning goals and risk unintentionally utilizing opportunistic land protection which is unlikely to fully address conservation concerns or planning goals.

Ultimately, protected lands networks and protection-centric planning will be insufficient to address contemporary natural resources issues regardless of the sophistication of the planning methods (Margules and Pressey, 2000; Wilson et al., 2007). Flexibility and adaptability of conservation options is a key aspect of contemporary conservation efforts that are constrained by financial and political capital (Pressey et al., 1993). Wilson et al. (2007) suggest "ecoactions" (i.e., protection) that follow flexible and time-varying investment schedules. In the 21st century, this can also be accomplished by expanding the vocabulary of conservation planning beyond protection. We believe the techniques and methods used in conservation planning, like those suggested by Wilson et al. (2007), can and should be effectively applied to a wider swath of conservation activities than primarily identifying places to protect.

We suggest a conceptual framework that considers suites of conservation objectives used within broader planning strategies as a way to bridge implementation gaps between planned and actual conservation actions. Conservation planning, and ultimately implementation, can be improved by considering multiple pathways to conservation that extend beyond protected areas and reserve selection (Mora and Sale, 2011). Our conceptual framework will help planners expand the definition of conservation opportunity in order to do more on the landscape. Conservation Opportunity Areas (COAs) are visualizations of an area - a map - that identifies location(s) where a conservation action (often protection) should take place. However, COAs can do more than identify where to take action, they can also help planners prioritize what conservation actions to take in a given location. COAs are typically identified through a prioritization or (multi)criterion based process that matches location suitability with intended actions.

Our framework translates the broad goals of "conservation" into implementation-specific objectives and the following actions: protect, connect, restore, manage, partner, and inform (Fig. 1). We call this the "PCRM-PI" approach. These implementation-specific objectives are then identified spatially in order to match location suitability with the intended action (i.e., COAs). We then illustrate how a Multi-Criteria Decision Making (MCDM) approach can be used to prioritize single objectives and inform the development of a multi-objective conservation strategy. We demonstrate the utility of applying the PCRM-PI approach within our conceptual planning framework with a case study for a species of regional conservation concern in the eastern United States. Protection will not be enough to address contemporary conservation goals for this species within social-ecological systems. This case study illustrates the limitations of protection-centric planning and how building multiple bridges to implementation can improve the application of planning efforts. Although we define our problem in terms of species-specific planning, our approach has application in many other situations where there is interest in developing spatially explicit conservation opportunities, where multiple conservation partners seek collaborative conservation opportunities, and where conservation actions that rely only on protection via land acquisition or easements may be cost prohibitive or unfeasible. These situations include conservation planning by state (e.g., State Wildlife Action Plans) and federal agencies (e.g., U.S. Fish and Wildlife Service Landscape Conservation Cooperatives), as well as non-governmental organizations and the private sector. We suggest that the PCRM-PI approach, nested within the following framework, is a way to expand the COA concept, bridge implementation gaps, and make 21st century conservation planning efforts more effective.

2. Methods

2.1. A framework for redefining COAs

Our framework has three key phases (Fig. 1). The first phase, and perhaps most influential, is using implementation-specific objectives from the PCRM-PI to develop single-objective COAs (SCOA). This phase involves creating multiple unique, spatially specific COAs for objectives in the PCRM-PI approach. Multi-criteria decision methods are used in the second phase of the framework to compare and systematically evaluate tradeoffs between the SCOAs. Tradeoffs between SCOAs can be evaluated with a variety of MCDM tools such as weighted performance measures. In the final phase, multiple SCOAs are purposefully integrated to develop conservation strategies based on relative prioritization during the MCDM process. The resulting multi-objective COA (MCOA) maps provide geospatial representation of the conservation strategies.

2.2. Case study: American woodcock

We demonstrate the utility of this framework with a case study focused on conservation of American woodcock (*Scolopax minor*; hereafter, woodcock) in Connecticut, USA. Woodcock is listed as a species of conservation concern by state and non-government organizations in most New England states, including by the Department of Energy and Environmental Protection (DEEP) in Connecticut (e.g., Bull et al., 2009; CT DEEP, 2015a). Population declines have been linked to loss of early successional habitats across the species' range (King and Schlossberg, 2014). Woodcock rely on early successional and young forests (<20 yr) with mesic soils that allow woodcock to probe for invertebrates (Dessecker and McAuley, 2001). Woodcock also prefer these habitats to be in close proximity to open, undeveloped areas that are used for roosting, foraging, and male breeding displays (McAuley et al., 2013). The woodcock's reliance on multiple, relatively ephemeral habitat types that are also regionally rare makes woodcock a challenging species to manage.

The goal of the American Woodcock Conservation Plan (Kelley et al., 2008) is to return woodcock population density to 1970 levels by increasing habitat availability within U.S. Bird Conservation Regions (BCR; Kelley et al., 2008), two of which occur in Connecticut (BCR 14: Atlantic Northern Forest; BCR 30: New England/Mid-Atlantic Coast). Statewide, Connecticut needs to create 137,036 ha of new woodcock habitat to restore woodcocks to 1970 population levels (BCR 30 = 114,656 ha; BCR 14 = 22,471 ha). Connecticut developed a woodcock management plan (CT DEEP, 2012) with a higher acreage goal (153,781 ha) that also designated spatially explicit focus areas for targeted management efforts. Given extensive human development and high costs of land

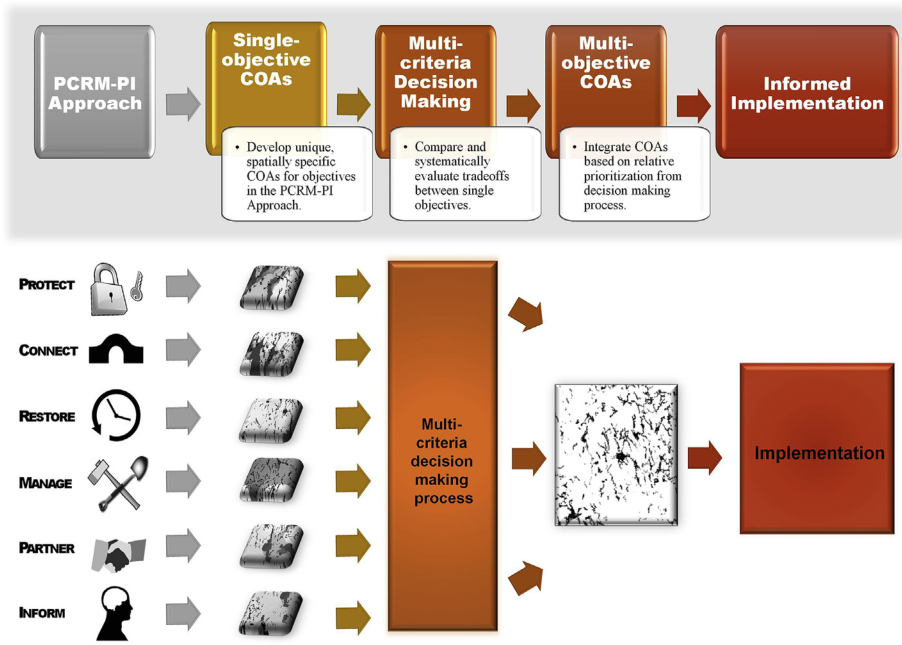

Fig. 1. A visualization of our conceptual conservation planning framework that uses the PCRM-PI approach to expanding the definition of conservation opportunity. The grey box illustrates the stepwise workflow and the lower diagram demonstrates an expanded operationalization of the planning framework.

protection in the state of Connecticut, it will be imperative for planning efforts to explore alternatives beyond protection to meet the habitat goal for woodcock and other species of conservation concern.

2.3. The PCRM-PI approach

The PCRM-PI approach integrates popular conservation actions into a single planning effort. None of these objectives are new to conservation planning but they have previously lacked deliberate integration. Creating a portfolio of actionable options that includes, but is not limited to, protection will be more likely to result in implementation. The concept of conservation portfolios can apply to objectives as well as protected lands estates (Dietz and Czech, 2005) because objectives are more likely to be effective if they are not attempted in isolation.

The PCRM-PI Approach is critical to the first phase of our framework during which each objective is operationalized into their corresponding SCOAs. We used an existing habitat suitability index (HSI) for woodcock (Rittenhouse et al., 2007) as the foundation for modeling three of the SCOAs (Protect, Restore, and Manage; described below). Additional information on the development of the HSI is provided in online supporting information (Appendix A). Definitions of PCRM-PI objectives and descriptions of how they were interpreted and integrated into our case study are discussed below.

2.3.1. Protect

Protect refers to the movement of a land parcel into a legal status, permanently preventing development or other transformation that would outwardly change the major ecological characteristics. This is typically accomplished through transfer of ownership (purchase) or restriction of deed (easement). We identified currently protected areas within Connecticut from the Protected Areas Database (USGS, 2012) and prioritized all other areas based on their proximity to existing protected areas. We believed it would be beneficial to concentrate future protected lands adjacent or proximate to existing lands because a single, larger protected area is generally preferred over small, isolated areas (i.e., SLOSS debate; e.g., Prendergast et al., 1999). We then defined Protect COAs by identifying the top 25% (HSI >0.749; Appendix A) of cells in the final HSI layer.

2.3.2. Connect

Connect addresses conservation opportunities that facilitate natural processes, population dynamics (i.e., dispersal), and landscape continuity. Connectivity is an important consideration for species that require diverse habitats to fulfill life history needs and for species to be able to respond to changing climate (e.g., Lawson et al., 2014). Connectivity for woodcock occurs at two biologically relevant spatial extents. At the home range level, woodcock require open spaces adjacent (connected) to young forest areas. We included connectivity at this smaller extent via the HSI model (Rittenhouse et al., 2007). Woodcock also are a migratory species with well defined, north-south flyways across North America (Coon et al., 1977). Identifying conservation opportunities to increase connectivity at the flyway level was outside the scope of this case study. Thus, we excluded connectivity as a SCOA because migratory connectivity for woodcock is better addressed at national or regional, rather than state-level spatial scales.

2.3.3. Restore

Restore focuses on reestablishment of a historic or desired ecological condition or community. Restoration actions generally occur over short time frames and are more likely to be discrete events. For example, planners may suggest restoration of water flow to a river by removing a dam versus suggesting longer-term management efforts for reducing runoff from a surrounding watershed.

For woodcock, opportunities for restoration were identified as areas with mesic soils but mature forest conditions, where timber harvest could be used to restore early succession conditions. We identified potential restoration sites by including all wet forests (>25 yr) in the HSI model as opposed to wet forests in young age classes (i.e., early successional habitat). Only those cells with HSI values in the top 25% were retained (i.e., HSI values >0.75; Appendix A). These areas represented high priority COAs where areas with mature wet woods could be restored to wet early successional habitat.

2.3.4. Manage

Manage identifies areas where it is desirable to maintain an ecological condition or community. This objective often involves a long-term commitment, particularly for early succession habitats that are relatively ephemeral. For example, a 29 acre demonstration area for woodcock management with hiking trails and education signage was created on the Roraback Wildlife Management Area in Connecticut. This would be a high priority area for maintaining young forest through management actions such as timber harvest. The land classification would remain as forest but the seral stage of the forest could be managed to benefit woodcock. The Manage objective for woodcock identified wet forests that were close to (15–20 yr) or had just succeeded past a suitable age (20–25 yr) for the species.

2.3.5. Partner

Partner identifies opportunities to collaborate across disciplines, specializations, stakeholders, and types of institutions to achieve conservation goals. The Partner SCOA for our case study identified hotspots of conservation attention from stakeholders by including areas that are owned and/or managed by Connecticut DEEP, federal agencies, Connecticut Audubon Society, The Nature Conservancy (TNC, 2015), and land trusts. We also included Audubon Important Bird Areas and focus areas for woodcock and New England cottontail management. New England cottontail focal areas were included because management objectives for cottontails often align with those for woodcock and management targeting one species will often benefit the other (CT DEEP, 2012). Data layers were retrieved or developed from information provided by the Protected Areas Database (USGS, 2012) and Connecticut DEEP (2015b). Compilation of partner layers was completed with Zonation software (Moilanen et al., 2014).

2.3.6. Inform

Inform provides information to assess the need for, or monitor the progress of conservation actions. This objective can include actions that range from public outreach to monitoring for adaptive management efforts, all of which can be made spatially explicit. The Inform SCOA for our case study identified existing hotspots of woodcock information in Connecticut. Federal and state singing ground survey points for displaying, male woodcock were digitized and buffered to 1 km. We also incorporated eBird observations (eBird, 2015) of woodcock in Connecticut from Jan 2005 to May 2015 from complete submissions that were not casual observations (Fink et al., 2010). We retained 1653 of 2004 of woodcock observations submitted through eBird from Jan 2005 to May 2015 in Connecticut, which were also buffered to 1 km (Bonter et al., 2010). The relative information value of each pixel was based on the number of buffers that overlapped it (range 0–224 observations).

2.4. Multi-criteria decision methods

Conservation planning and natural resource management decisions need to be informed, defensible, and transparent. We used methods similar to Structured Decision Making, a type of MCDM process, to address these concerns and to provide transparent identification of values and a common understanding of decision tradeoffs (Gregory et al., 2012). Structured Decision Making suggests the following decision making steps: 1) clarify the decision context, 2) define objectives and evaluation criteria, 3) develop alternatives, 4) estimate consequences, 5) evaluate trade-offs and select, and 6) implement and monitor.

Our decision context was to address woodcock conservation acreage goals within the eastern-most woodcock focal area in Connecticut. Six performance measures that reflected metrics of interest for early successional habitats were used to evaluate tradeoffs between the five PCRM-PI objectives under consideration (Table 1). We calculated the area of each SCOA that fell within the focal area, the number of partners that overlapped with the SCOA, and identified risk level based on the authors' perception of land-use security. The cost of protection was based on purchase values for land preservation in Connecticut determined by public surveys (Johnston et al., 2007). The cost of restoration was determined by National Resource Conservation Service's (NRCS) Working Lands for Wildlife (WLFW) program for high intensity, heavy machinery treatment for early succession habitat development and management (NRCS, 2015). The cost for the management objective was based on the WLFW cost share for small patch clearcuts for forest stand improvements (NRCS, 2015). Partnerships are likely not without cost; for example, personnel time is needed to coordinate activities. However, we believe these costs are generally minimal compared to land acquisition for most organizations and would likely be offset by cost savings that would result from sharing financial, personnel, or equipment resources. Monitoring cost was based on travel and personnel costs for the authors to visit Singing Ground Survey routes in Connecticut.

Stakeholder participation is an integral part of structured decision making because it increases transparency, acceptance, and understanding of planning outcomes and results in better implementation and progress towards conservation goals. In addition to the decision-making steps outlined above, stakeholders can assign weights as a proxy for the importance of an objective. In our case study, we weighted performance measures to reflect influential concerns in natural resource management decisions and used the resulting rankings to evaluate tradeoffs among alternatives (Table 2). Weights and other prioritization metrics are an inherently subjective and value-laden component of conservation planning. Multi-criteria Decision Making methods increase transparency and objectivity in conservation planning by making these value-based decisions an explicit part of the process and therefore subject to discussion. We selected the most supported alternative(s) based on the weighted performance measures, and included those alternatives in Multiple-objective COA strategies.

2.5. Multi-objective COAs as conservation strategies

Multi-objective COAs represent strategies for achieving conservation goals through integration of two or more SCOAs. We identified three strategies to illustrate how the conservation opportunities they offer vary on the landscape. Strategy A represented a traditional protection-only conservation strategy and is effectively a single-objective COA. Strategy B combined Restore and Manage SCOAs to create a strategy that focuses on where habitat can be improved through management or restoration actions. Strategy C combined three SCOAs (Manage, Inform, and Partner) to target areas with relatively high amounts of information on presence of woodcock and areas with opportunities to work collaboratively with partners. The strategies were created by combining SCOAs based on their relative prioritization in structured decision making. All geospatial analyses were completed in ArcGIS (ESRI, 2015).

Table 1
Consequence table with unscaled performance measures.

Performance measures	Single-objective COA alternatives – Unscaled measures				
	Protect	Restore	Manage	Partner	Inform
Area within eastern focus area for woodcock	152 ha	1719 ha	4878 ha	42,667 ha[b]	5890 ha
Cost of implementing conservation action per acre	$63,355	$1447	$564	$0	$40
Option to conduct timber harvest	No (0)[a]	Yes (1)	Yes (1)	Maybe (0.5)	No (0)
Collaboration opportunities with conservation partners	2	6	6	6	6
Risk level (0 = low, 10 = high) for land use change due to human development	0	10	10	5	3
Monitoring costs per acre	$55	$55	$55	$0	$0

[a] Timber harvest could be achieved if the area is part of a working lands conservation easement (e.g., through the US Natural Resources Conservation Service).
[b] This is the total area in the eastern focus area for woodcock.

Table 2
Decision matrix with values for each alternative that represent the product of the assigned weight and the scaled value for that measure (Table 1).

Performance measure	Weight	Single-objective COA alternatives – Weights × scaled measures				
		Protect	Restore	Manage	Partner	Inform
Area within eastern focus area for woodcock	0.50	0.00	0.02	0.06	0.50	0.07
Cost of implementing conservation action	0.25	0.00	0.24	0.25	0.25	0.25
Option to conduct timber harvest	0.10	0.00	0.10	0.10	0.05	0.00
Collaboration opportunities with conservation partners	0.05	0.00	0.05	0.05	0.05	0.05
Risk level (0 = low, 10 = high) for land use change due to human development	0.05	0.05	0.00	0.00	0.03	0.04
Monitoring costs	0.05	0.00	0.00	0.00	0.05	0.05
Sum for alternative		0.05	0.41	0.46	0.93	0.46
Rank		**4**	**3**	**2**	**1**	**2**

3. Results

The case study analysis was conducted for the entire state of Connecticut but we present results for the eastern focus area for woodcock only. Limiting the spatial extent represents a more realistic spatial scale at which management is likely to occur and makes it easier to demonstrate differences between the COAs. Within the focus area, SCOAs had clear differences in extent and configuration of the COAs (Fig. 2). The SCOA for Protect provided the smallest total acreage at the greatest cost of implementation (Table 1). The next smallest COA (Restore) provided 11 times more acreage than the Protect COA. Restore was also the next most expensive alternative but was 43 times less expensive than Protect. Restore also had the option to conduct timber harvest which could help offset costs for that action. Partner opportunities were available through the entire focus area so this COA covered the greatest spatial extent. Protect was rarely the preferred action (red) when it was compared to the prioritization of the other alternative (blue; Fig. 2). Yellow indicates areas that are prioritized equally (or not at all) by both objectives.

We scaled and weighted performance measures for each SCOA to determine the relative support for each alternative (Table 2). Partner received the most support from the Structured Decision Making analysis because of its broad spatial extent and the absence of cost for implementation. Manage and Inform were tied as the next most supported alternatives, with Restore a close third. Protect was the least support alternative with >18 times less support than Partner and >8 times less support than Restore.

There were also striking differences in spatial extent and configuration among the three conservation strategies (Fig. 3). Strategy A reflects a protection-only approach so the COAs in this strategy were equivalent to the single-objective COAs for Protect (Fig. 2). Strategy A was never prioritized over the other strategies (no red areas; Fig. 3). Strategies B and C were always prioritized over Strategy A. Strategy C received the highest levels of prioritization which was driven largely by the inclusion of the Partner objective within the strategy.

4. Discussion

The PCRM-PI approach nested within a planning framework clearly demonstrates opportunity areas for conservation that can expand implementation strategies beyond protection-only options. While protection should remain as an objective to advance conservation, it is not a panacea. Species with large home ranges, species with uncertain habitat requirements, and areas with high land costs (e.g., Burgman et al., 2005) are all scenarios in which conservation actions will be intractable under a protection-only mindset. Expansion of the conservation vocabulary beyond protection adds more options to the conservation toolbox. It will allow conservation planning to meet the conservation needs for a larger suite of species and natural resource issues than under protection alone.

Conservation efforts have been plagued by implementation gaps for decades and planning efforts have had mixed-success at addressing those gaps (Carter et al., 2014). In our case study, Connecticut was unlikely to reach its acreage goal for woodcock under the national conservation plan (Kelley et al., 2008) by focusing on protection alone. There are simply not enough Protect COAs available within the state, regardless of the state's ability to purchase land or easements. By approaching these broad goals with a variety of conservation objectives, multiple bridges towards conservation can be established to increase the flexibility and creativity of conservation actions to meet planning goals. Developing conservation strategies that integrate multiple SCOAs can translate daunting range-wide goals, like those set by the American Woodcock Conservation Plan, into actionable conservation strategies.

Our case study focused on single-species planning because this is often a focus of state agencies and local management efforts and is sometimes legally mandated (e.g., US Endangered Species Act). However, our framework is certainly capable of being applied to broader or finer scales and to planning issues with greater or less complexity. For example, climate change represents a particularly difficult challenge for planners (Heller and Zavaleta, 2009) because of the high degree of spatial uncertainty between climate scenarios. Integration of lower-cost actions to conservation strategies could

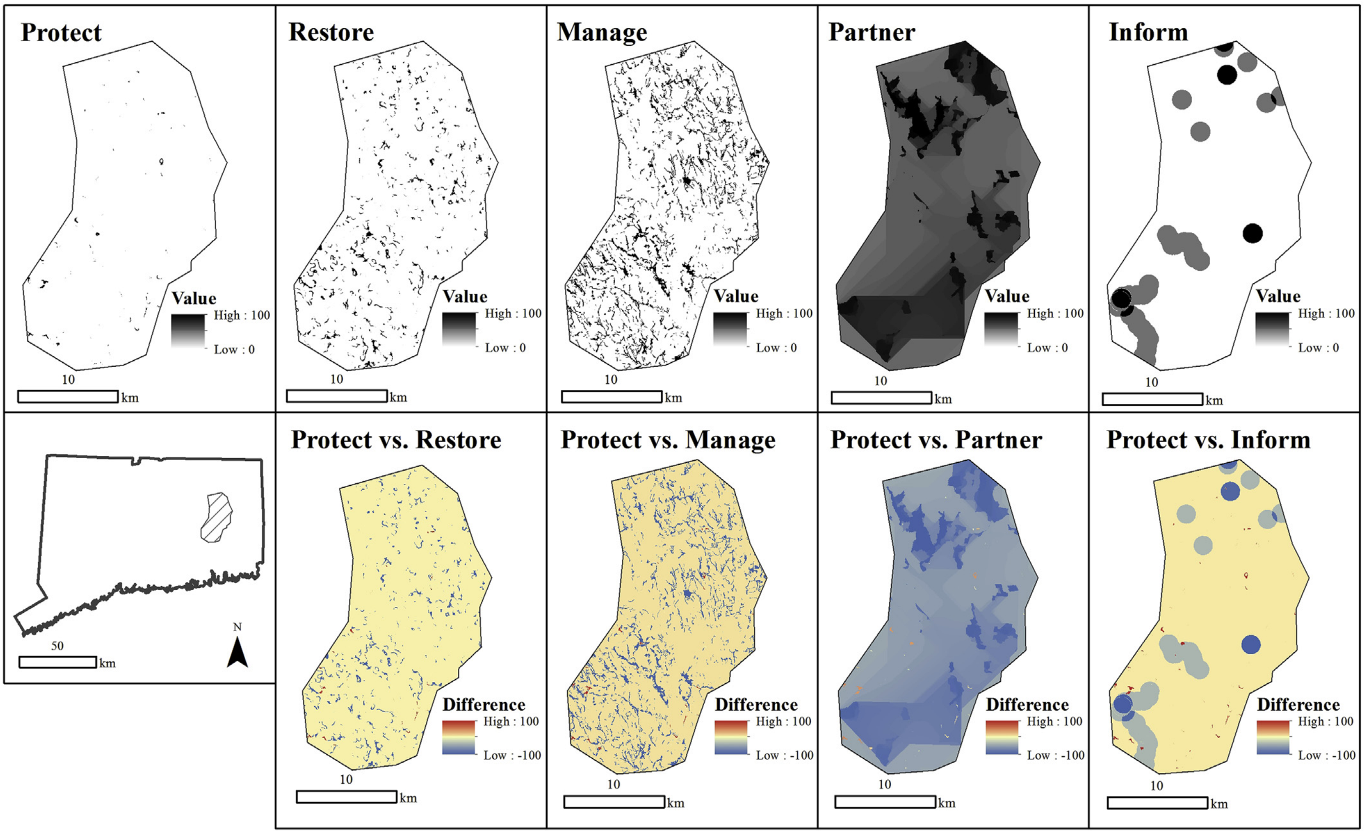

Fig. 2. The first row is single-objective COAs for the eastern focus area for woodcock based on the PCRM-PI approach. The second row compares the Protect COA to the other single-objective COAs. Positive value differences (red) in the comparison maps indicate where the Protect has a higher relative value than the other objective. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

provide flexibility for planning efforts that are concerned with investing in protection in scenarios with high uncertainty. We also recognize that conservation planning in some cases already includes multiple objectives (Restore or Manage) or plans for them to occur concurrently (Restore and Manage; Possingham et al., 2015). There also may be scenarios where protection needs to occur before an area can be restored or easement programs such as the Conservation Reserve Program or Wetland Reserve Program in which management coincides (at no additional cost) with protection. Our framework does not preclude planners from "layering" objectives, instead, we are encouraging them to broaden their conceptualization of conservation objective and to employ a decision making approach that considers tradeoffs between alternatives.

Transparent goals and objectives are hallmarks of decision making approaches such as multi attribute utility theory (MAUT), multi criteria evaluation (MCE), and structure decision making (SDM). An exciting aspect of this planning framework is its use of decision making methods to integrate single-objective COAs into multi-objective strategies. Multi-criteria decision making methods provide planners with objective and transparent ways of developing strategies based on their conservation goals. For example, the consequence tables in our case study (Tables 1 and 2) provided a clear and transparent way of comparing SCOA alternatives before developing the MCOAs that would become the conservation strategies. The performance measures and weighting schemes included in these tables are also easily adjusted to better reflect current or changing values of decision makers.

This case study was developed as an illustration of our conservation framework rather than as a management prescription. Advanced modeling approaches can be integrated into the framework and are encouraged. These include economic optimization approaches (e.g., Perhans et al., 2008) and those that address climate change (e.g., Schmitz et al., 2015). Economic optimization approaches could be expanded to identify not only where protection is most cost effective, but also where it is most cost effective relative to other objectives such as Manage or Restore (Wilson et al., 2007). There are also opportunities to incorporate social information (Butler et al., 2007), human health data (Knight et al., 2008), development tolerance (Bettigole et al., 2014), and policy scenarios (Beaudry et al., 2013) in identification of COAs that would enhance their relevance to conservation planning within social-ecological systems.

We also envision the PCRM-PI approach accommodating planning efforts that span multiple species and taxa. For example, The Northeast Partners in Reptile and Amphibian Conservation (NEPARC) has identified Priority Amphibian and Reptile Conservation Areas (PARCA) which are non-regulatory designations intended to raise public awareness and encourage voluntary action by landowners and conservation partners (Sutherland and deMaynadier, 2012). The PCRM-PI approach would allow PARCA nominated sites to illustrate actionable and spatially explicit conservation actions to address NEPARC conservation objectives. This would be possible because our framework allows almost any objective or goal to be illustrated geospatially, even Partner and Inform. It can be adapted to diverse natural resource issues as long as conservation goals and objectives are specific and well-articulated.

Developing strategies that integrate multiple pathways to

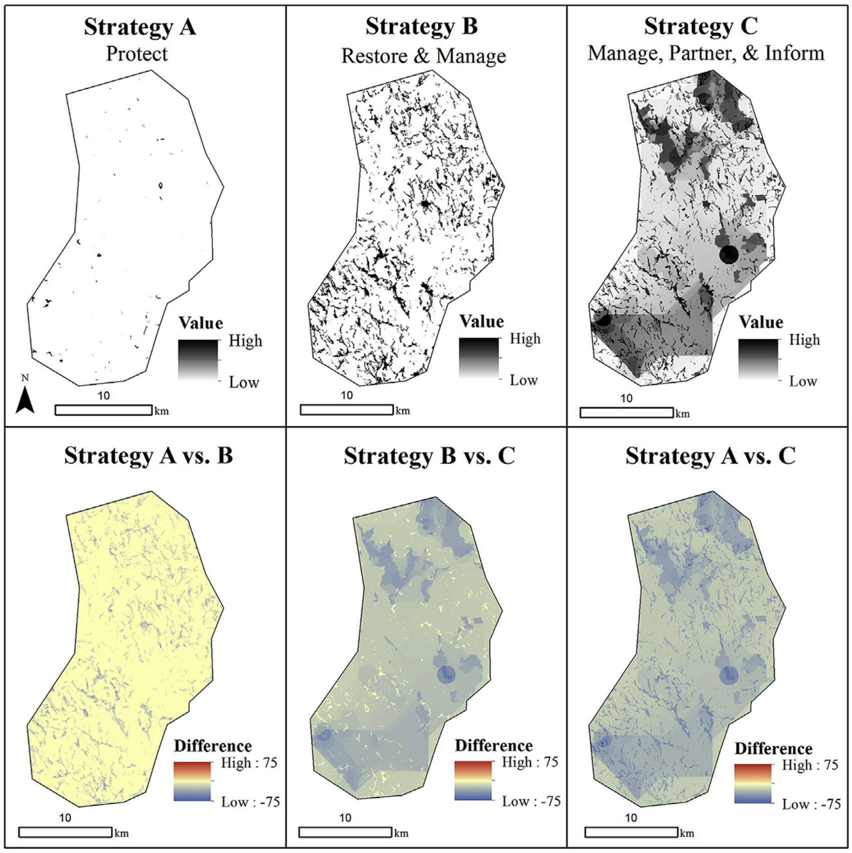

Fig. 3. *Top row*: Potential COAs resulting from a Protect-only strategy (Strategy A) and Multi-objective COA strategies (Strategies B & C). Values for all three strategies were determined by weighting the single-objectives (Fig. 1) of each strategy by their rankings from Table 2. *Bottom row*: Comparisons among strategies where red indicates Protect has higher relative priority values than the alternative strategy. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

conservation provides organizations opportunities to contribute to the advancement of conservation goals without necessitating additional acreage. Budgetary and institutional constraints limit the abilities of many organizations to advance protection-only conservation objectives. Indeed, many of these organizations could contribute to conservation efforts by managing or restoring, rather than adding to, their existing protected lands estates (Laurance et al., 2012). This may be particularly true in southern New England where other strategies may be more effective at advancing conservation due to high human population densities (Shifley et al., 2014) and land costs (Murdoch et al., 2007). Conservation planning will fail to result in implementation unless objectives are feasible for the organization involved and their contribution to the conservation landscapes is illustrated spatially (Prendergast et al., 1999; Flather et al., 2009).

The protect lands estate is the backbone of conservation in North America, but the expectations and demands on these areas by a growing diversity of stakeholders has increased dramatically (Watson et al., 2014). Watson et al. (2014) suggest that under-resourcing for protected lands management is the primary reason for their poor performance and inabilities to meet increasing ecological, social, and economic expectations. There are certainly planning contexts where protection may continue to be prioritized. Some species may benefit most from habitat protection, particularly those that depend on rare habitats or habitats underrepresented in the protected lands estate. However, the PCRM-PI approach provides planning options for managing existing protected lands by expanding conversation to actions that can be implemented within the park, rather than just expanding the edges. The framework also provides opportunities to link and integrate broad scale planning efforts to site-specific management plans. These conservation planning efforts would be more effective if protection and management objectives (among others) were considered concurrently, rather than in isolated planning documents. This framework has the capability of advancing conservation simultaneously within and beyond the existing protected lands estate and is an effective way to bridge planning-implementation gaps and translate broad, landscape-level goals into implementation-specific objectives.

5. Conclusion

Protection-centric planning is an unnecessarily narrow view of conservation in the 21st century. We suggest that broadening the definition of conservation to include popular actions such as connect, restore, manage, partner, and inform will result in improved effectiveness and better implementation of conservation efforts. The PCRM-PI Approach offers an opportunity to create a portfolio of actionable options that includes, but is not limited to, protection. Combined with transparent Multi-criteria Decision Methods, this suite of actions can be used to develop opportunity areas that represent conservation strategies with flexible and practical utility. Protected lands undeniably form the backbone of many fisheries and wildlife conservation efforts, but the realities and limitations of current social-ecological systems make expansion of this network difficult and mayhap unnecessary. The PCRM-PI Approach, nested within our planning framework, offers an effective way to bridge implementation gaps in constrained landscapes. It also provides opportunities to translate broad, landscape-level goals into spatially explicit and actionable conservation opportunities.

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Appendix A. Supplementary data

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