Chapter 11
Integrating Expert Judgment into Systematic Ecoregional Conservation Planning

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Abstract This chapter offers insights on integrating expert judgment into ecoregional conservation planning. We describe three examples that focus on benefits and challenges of (1) delivering GIS-based expert systems in stakeholder-based contexts, (2) integrating expert judgment and computer-based site selection scenarios, and (3) reaching expert consensus on delineating conservation planning areas across a diverse ecoregion. The examples highlight several important lessons. First, engagement of experts should not be simply about gaining approval. To maximize the extent of buy-in by experts, they need to be legitimately involved in the creation of methodology and results. Second, experts need to be distinguished in the planning process from stakeholders and local residents. While precise definitions are elusive and likely to vary from one region to another, a transparent methodology for assessing and weighting each group's input is important. Finally, the methods used for engaging expert participation need to match the experts' technological capabilities and conceptual understandings. While a lack of familiarity with certain aspects should not disqualify an expert from participation, it does highlight the importance of advanced preparation on the part of those facilitating the process. Beyond these more technical issues are those related to the social sciences of expert engagement. Social and qualitative forms of data are needed to build this understanding.

Keywords Collaboration • consensus • expert • ecoregional conservation planning • participation

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11.1   Introduction

Despite its ecological cohesion, the Northern Appalachian/Acadian ecoregion is culturally complex, characterized by two dominant languages (French and English); multiple overlapping political systems; a mix of large cities, small towns, and villages; and land-use patterns shaped by rural forestry, agricultural areas, remnant large tracts of wilderness, both public and private land holdings, and many extractive industries. Numerous collaborative initiatives have been developed over many years to promote conservation throughout this ecoregion, initiatives that at their core involve careful planning that considers the views of experts, stakeholders, local residents, spatial diversity, temporal changes, and multiple scales of perspective.

Our intention in this chapter is to offer insights on various approaches to and challenges of integrating expert judgment into ecoregional conservation planning. We draw on examples from the Northern Appalachian/Acadian ecoregion to focus on specific issues, methodological approaches, participatory processes, and tools associated with such engagement. We also provide recommendations that should be of value to those outside of this ecoregion who themselves wish to integrate expert judgment into ecoregional conservation planning and are looking for lessons and strategies on how this might be done effectively.

Expert input is often sought in conservation planning, in part to compensate for deficiencies in data and to benefit from their tacit knowledge gained from experience in conservation-related initiatives and landscapes. Experts can lend greater legitimacy and robustness to the planning process and broader buy-in to its results. At the same time, conservation practitioners are increasingly using computer-based expert systems, particularly geographic information systems (GIS; Chap. 12) and site-selection software (Chap. 14), while recognizing that these are decision support tools rather than decision makers themselves. Although such tools can generate a range of planning scenarios and efficient solutions, they themselves do not indicate which solution would work best in a particular context or location. Given the multiple factors at play in broad regional or landscape-scale planning, a broader expert engagement in decision making is often warranted.

Given the benefits of expert engagement, many conservation planning efforts aim to incorporate it; however, it is not without its challenges and some applications are more successful than others. Since conservation planning is a relatively new venue for expert engagement, particularly in the integration of expert judgment and expert systems, effective methods of engaging and integrating experts are generally not well developed. Expert engagement is often presented as a 'black box,' with little or no methodological description or analytical reflection on its successes and limitations. To advance the discussion, we describe three examples of expert engagement in conservation planning that focus explicitly on benefits and challenges associated with (1) delivering GIS-based expert systems in stakeholder-based contexts, (2) integrating expert judgment and computer-based site selection scenarios, and (3) reaching expert consensus on delineating conservation planning areas across a diverse ecoregion.

11.2 Methods

We examine here three examples of expert engagement in systematic regional conservation planning across the Northern Appalachian/Acadian ecoregion, in which one or more of us had been involved: (1) assessing protected-area potential in the Nova Forest Alliance landbase in Nova Scotia (Anderson et al. 2009); (2) a Wildlands Network Design for the Greater Northern Appalachians (Beazley et al. 2010; Reining et al. 2006); and (3) delineating planning areas for ecoregional conservation planning in the Northern Appalachian/Acadian ecoregion. Each of these cases aimed to integrate expert systems, such as site selection software (e.g., MARXAN [Ball and Possingham 2000; Possingham et al. 2000]), and expert judgment into decision making for systematic conservation planning. We briefly describe the intent and methodological approaches of each, assess each in terms of the pros, cons, and lessons learned, and identify the broader issues that emerge when considering all three together, along with other examples and findings reported in the literature.

For the purpose of this research, we use the term 'integrating expert judgment,' and we differentiate experts from both stakeholders and local residents. Each of the following examples uses a different configuration of inclusion, from all three groups of potential participants to only one. We define experts as those who can integrate multiple elements of a whole system in their decision making and have detailed expertise related to topics of interest, and therefore require little education from planners to engage with decision making (Tynjälä 1999). Stakeholders are those that own affected businesses or land, or who otherwise self-define as having a 'stake' in the outcome of a conservation plan. They and local residents in an area offer more detailed input at a smaller scale on specific elements of the system that may otherwise go undetected by larger scale inclusion of experts (Hmelo-Silver and Pfeffer 2004). All three groups offer valuable information and knowledge; however, costs are associated with the inclusion of each. We address here primarily the inclusion of experts with an assessment of the pros and cons of that inclusion, referencing other groups to the extent that the consequences of their inclusion intersect with that of experts.

11.3 Integrating Expert Judgment in the Northern Appalachian/Acadian Ecoregion

11.3.1 Assessing Protected Area Potential in the Nova Forest Alliance Landbase in Nova Scotia

The Nova Forest Alliance (NFA) is part of the Canadian Model Forest Network and is located in Central Nova Scotia. The NFA community (including private woodland owners, government agencies, forest companies, non-government organizations,

and academics) initiated a process to assess the protected-area potential of land parcels within the NFA landbase, with potential application within other model forests in Canada. Accordingly, we (Anderson et al. 2009) sought to create an integrated GIS-based decision-support tool for conservation assessment within the NFA. The use of decision-support tools such as GIS for conservation planning can be an effective means of engaging experts and other communities (Jordan 1998; Sieber 2000). Our objective was to develop a GIS application to compile relevant data, create a spatially explicit database, display potential values for protected areas across the study region, and provide a preliminary ranking of sites based on biological diversity. Such applications can provide decision support for community-focused decision making and provide spatially explicit representations of conservation values and land-ownership patterns. Our intent was that the resulting maps effectively communicate conservation knowledge to individual property owners, potentially motivating their engagement in conservation, to bring credence to the decision-making process by generating and visualizing conservation alternatives, and thus facilitate a collaborative approach for integrating expert and community judgment in the NFA.

From a participatory perspective, however, our GIS-based application in the NFA faced challenges that influenced the effectiveness of its implementation (described in Anderson et al. 2009). Despite the opportunities we initiated for participation by the NFA partnership, these proved insufficient to achieve adequate engagement and support for our process and its outcomes. This and other challenges associated with data sharing and lack of local GIS expertise limited the ongoing use of this tool in the NFA and its potential usefulness in other model forests. While not overly successful at integrating expert judgment, the experiential knowledge we gained through this application can be used to address questions about the effectiveness of participatory GIS applications for ecoregional conservation planning. Accordingly, we now strongly believe that expert as well as stakeholder engagement in the initial project design, goal-setting, and all subsequent stages is critical, even if this requires extensions to preferred or anticipated timelines.

In the NFA, specific methodological processes for engaging experts were not integrated into the study design. Study methods included our participation in regularly scheduled meetings and workshops delivered by the NFA, as well as informal telephone, electronic, and in-person communications with specific NFA partners and data providers. Through these communications, we interacted with knowledgeable NFA experts and stakeholders and attempted to solicit their input concerning conceptual and methodological approaches, the selection of conservation features, and definition of targets, data types, and data availability. While these methods provided opportunities for participation by the NFA partners, we received little input from them apart from the identification of potential data sources and provision of datasets. We used a combination of these recommended and available localized data sources and methodological literature on ecological reserve design (e.g., Beazley et al. 2005; Groves 2003; Margules et al. 1988, 2002; Noss and Cooperrider 1994) to define the relevant data for our conservation assessment. We subsequently developed a spatially explicit decision-support tool (based on both MARXAN

[Ball and Possingham 2000] and C-Plan [The University of Queensland n.d.]) and conducted various analyses to demonstrate the tool and the assessment process, as well as to generate visual map outputs. Written progress and final reports were delivered to the NFA, followed by presentations to experts and stakeholders at the 2004 and 2005 Annual General Meetings, where we sought additional input and feedback, but to little avail. We provided a final NFA in-house demonstration of the GIS-based decision-support tool in June 2005. Through these processes, we delivered datasets, maps, and tools to the NFA, along with key findings relevant to protected-area potential within the landbase. To date, resource limitations at the NFA have limited the adoption of these support tools and materials.

We subsequently identified several issues that contributed to the lack of participation, along with suggestions for overcoming them in future applications (Anderson et al. 2009). Other studies have found that community-based GIS can enhance participation and encourage open communication among participants (Jankowski and Nyerges 2001; Weiner et al. 2001), and thereby increase effective decision making and buy-in from interested groups (Carver 2003; Kyem 2000; Schlossberg and Shuford 2005; Sieber 2000). While this may indeed be the case in some applications, we encountered a significant challenge in stimulating sufficient direct participation among experts and stakeholders, although we observed that experts seemed more willing to offer suggestions than were stakeholders. This translated into a lack of buy-in and inadequate understanding among key participants as to the usefulness, benefits, and operation of the decision-support tool. As a consequence, neither the mapped results showing protected-area potential nor the decision-support tool itself are currently being used by NFA.

We concluded that integrating direct participatory processes earlier may have produced more satisfactory results. 'Involving community members in the selection of conservation features and targets in the early phases of the project might have stimulated more interest in the assessment stage' (Anderson et al. 2009). Subsequent workshops could have garnered more participation, in which experts and stakeholders could witness, discuss, and revise different map-based scenarios and other decision rules that would shape the results. This engagement could have helped to ensure that the decision tool adequately represented the conservation goals of the community and that its potential flexibility and utility were more widely understood, lending greater legitimacy to the process and ownership of the results. This observation is consistent with that of other conservation theorists, who suggest that involving concerned and informed individuals creates more realistic and sound conservation goals when targets are "clear, explicit and defensible" (Groves 2003).

With respect to the utility of the GIS technology, we naively assumed that by de-emphasizing the reliance on GIS expertise – by providing organized data in a readily usable form and by choosing relatively user-friendly programs – the complexity of using the tool would be reduced (Anderson et al. 2009). The lack of adoption of this tool by the NFA, however, forces us to recognize that even relatively simple GIS-based programs are still expert-grounded tools that require a greater degree of technical skill and appreciation than may be p resent among experts or in many communities (Chap. 12), thus limiting its use after project delivery.

The NFA is an appropriate community and geographic region for a collaborative or participatory conservation initiative since it includes a community of experts and stakeholders interested in sustainable development, all of whom have informed views on how land resources can be managed. Paradoxically, this study (Anderson et al. 2009) illustrates the significant challenges to successful implementation of GIS-based community research that include complexities of data acquisition and sharing policies, challenges in initiating and sustaining meaningful engagement by experts and other participants, longevity of resources, and use of the decision-support tool at the local community level.

To overcome these obstacles, active and early participation is critical to community buy-in; this can occur using a variety of methods such as interactive workshops and web forums to share and create knowledge, develop specific conservation objectives, explore alternative scenarios using visual outputs such as maps, and work towards mutually agreeable decisions. Also, data sharing networks among universities, governments, and community organizations, such as the NFA, could greatly enhance local capacity to acquire the geospatial information necessary for effective decision support (Chap. 12). Such policies would reduce the data procurement efforts needed and allow for more concentration on community engagement. Finally, effective participatory technical systems for community-based decision support must be developed in ways that meet the needs of participants without being so complex as to create barriers to their use. 'Creating decision-support tools, information, and knowledge that integrate community objectives and reflect community capacities are critical elements in both the development and on-going application stages. As such, considerable attention should be given to whether or not GIS technology is appropriate and sustainable as part of a decision-support tool in a community-based, public-participatory context' (Anderson et al. 2009).

11.3.2 A Wildlands Network Design for the Greater Northern Appalachians

As part of its work on the design and implementation of a continental-scale network of protected area, the Wildlands Network initiated a conservation planning process in the Greater Northern Appalachians (GNA) of Eastern Canada and the U.S. Accordingly, we (Reining et al. 2006) conducted a map-based methodology designed to systematically identify a network of areas of high conservation priority within the Northern Appalachian/Acadian and St. Lawrence/Champlain Valley ecoregions. We used a three-track approach (Noss 2003) intended to (1) represent environmental variation across these ecoregions, (2) protect special elements such as occurrences of rare species or communities and other sites with high ecological value, and (3) conserve sufficient habitat to support viable populations of focal species (Lambeck 1997; Miller et al. 1999; Noss and Cooperrider 1994; Noss et al. 1999).

To establish the location and extent of the network design elements, we used three major sources of information: (1) the results of site selection analyses; (2) The Nature Conservancy's (TNC) and Nature Conservancy of Canada's (NCC) Tier 1 matrix forest blocks in the Northern Appalachian/Acadian ecoregion (Anderson et al. 2006); and (3) input from experts from within environmental non-governmental organizations, government wildlife agencies, and academia (Beazley et al. 2010). The site selection analyses were based on MARXAN-generated solutions for representation of ecological land units, special elements, and source and threatened source habitat for three focal species (Canada lynx [*Lynx canadensis*], American marten [*Martes pennanti*], and wolf [*Canis lupus* or *lycaon*]). These were overlaid with Tier 1 and Tier 2 matrix forest blocks identified by TNC/NCC, and assessed and refined through expert input. To obtain expert input, we conducted a series of day-long workshops in Nova Scotia, New Brunswick, Québec, Vermont, New York, and Maine from January through May 2006. Some experts were also consulted by telephone (Reining et al. 2006).

The intent of the expert consultation was twofold: (1) to integrate expert systems (e.g., MARXAN) with expert judgment, and (2) to move from decision support (e.g., outputs of MARXAN) to decision making (e.g., proposed network design) (Beazley et al. 2010). Twelve different scenarios were run in MARXAN, defined by four different target levels (low, medium, high-low, and high) and three different values for a boundary length modifier variable, which influences the degree of fragmentation allowed in a solution (Chap. 14). MARXAN generates many kinds of outputs, including best runs and summed runs for each scenario. The best run is a near-optimal network solution that meets the goals with the least amount of land area. The summed run shows the number of times a planning unit was selected over several separate runs based on a given scenario. The more often a planning unit is selected, the more important it is to meeting the goals for that scenario. In addition, summed-summed runs show how often planning units are selected across separate runs and different planning scenarios. Those areas that are selected repeatedly across scenarios can be interpreted as having a high ecological irreplaceability (Chap. 14). Those selected infrequently are considered more 'replaceable' – that is, their relative conservation importance is lower than areas selected more frequently because their contribution to achieving conservation goals can more easily be replaced by other locations.

These outputs from the MARXAN analyses provide useful information to support decisions about the extent and the elements of a network design. However, since several potential solutions are equally valid, additional steps need to be taken to incorporate expert and local knowledge and other data that have not been captured by the site selection algorithm in order to make defensible decisions regarding the network design. Consequently, the best-run, summed-run, and summed-summed-run outputs were combined with the TNC/NCC Tier 1 matrix blocks and we consulted with experts to establish the location and extent of network design elements.

Through such consultations, we overlaid the matrix blocks with the results of the site selection analyses and used them to refine the preferred scenarios. In addition

to refinements made to the network design based on TNC's matrix forest blocks, we also made refinements on the basis of expert input received during the workshops and telephone calls with local experts in each state or province. In those meetings, the results of the site selection analysis were presented and then the meeting facilitators sought to achieve the following six goals:

1. Determine the preferred scenario, or combination of scenarios, for the state or province based on local conservation knowledge.
2. Determine overlap with known areas of conservation value.
3. Identify areas of known conservation value that were not captured.
4. Discuss deficiencies in the analysis.
5. Delineate potential boundary revisions that could readdress these deficiencies.
6. Discuss how this study should be communicated to other audiences.

The meeting process unfolded quite differently in each state and province, as described in Reining et al. (2006) and Beazley et al. (2010), but all helped to refine the final network design and ensure greater accuracy and relevance in the local context. In all Canadian provinces (Nova Scotia, New Brunswick, and Québec), experts chose to emphasize a combination of scenarios that set medium, high-low, and high goals and the lowest degree of allowable fragmentation. Experts there also recommended higher goals in areas with greater extent of natural cover or wildness, and lower goal scenarios in areas with more human development (e.g., agricultural regions). In Québec, experts explicitly divided the region into three sections and chose different scenarios for each. In contrast, experts in New Brunswick recommended a 5-km buffer around key network elements, such as linkages, to provide flexibility both in ensuring that a portion of the area will always be managed in support of the larger network and in determining how and where resources such as timber will be managed within the area.

Conversely, in the U.S. (Maine, Vermont, and New Hampshire), experts chose scenarios that allowed for moderate fragmentation. Similar to experts in Canada, however, those in the U.S., particularly in Maine, recommended different approaches or changes to the scenario outputs in regions that are more developed (e.g., Downeast Maine) versus those that are more wild (e.g., Northern Maine). The expert input also served to incorporate important linkage areas for focal species that do not necessarily emerge from site selection analyses, thus capturing additional information that would have been missing without expert engagement.

As a consequence of subregional differences in the selection of scenarios and outputs and the inclusion of other features introduced by the experts, the resulting network incorporates subregional goals. This result may thus be more consistent with those of other studies (e.g., Carroll et al. 2003) in which subregional goals were explicitly set. We recommend that future site selection analyses at ecoregional scales stratify the study area into smaller subregions and establish goals for those regions, while perhaps trying to maintain overall goals for the entire ecoregion. This should avoid the concentration of network elements within discrete areas of the ecoregion and result in a more distributive network.

11.3.3 Delineating Conservation Planning Areas in the Northern Appalachian/Acadian Ecoregion

Beginning in 2004, as part of a consortium of scientists from throughout the Northern Appalachian/Acadian ecoregion, we (Trombulak et al. 2008) began collaborating on a systematic conservation plan that transcends Canadian-U.S. political boundaries and encapsulates a range of subregions, including the Acadian Forest, the Northern Appalachian Mountains, and the Adirondack Mountains (Chap. 1). Our overarching goal, developed under the umbrella of Two Countries, One Forest (2C1Forest), was to produce a scientifically valid conservation plan for the Northern Appalachian/Acadian ecoregion. Our approach incorporated a three-track strategy – ecological representation, habitat for focal species, and rare species – to assess site-specific ecological irreplaceability (Chap. 14). We also assessed current (Woolmer et al. 2008) and future (Baldwin et al. 2007) forecasts of threats from human activity (Chap. 13) to incorporate site-specific vulnerability and urgency of threat. These we combined to assess conservation priorities, based on both irreplaceability and threat (Trombulak et al. 2008).

To make it easier to understand and visualize how areas that are threatened or important for achieving regional conservation goals are distributed across the landscape, we first sought to subdivide the ecoregion into a set of conservation planning areas, modeled on the approach used by Noss et al. (2002).

In brief, current technologies for remote sensing and GIS allow for spatial resolutions far greater than what is usable for conservation planning at the scale of the ecoregion. For example, our threats analysis for the Northern Appalachian/Acadian ecoregion was based on 90-m resolution, which results in over 43 million separate planning units, and our irreplaceability analysis was based on 10-km^2 hexagonal resolution, resulting in over 63,000 planning units. Clearly, these are too numerous to be the basis for identifying on-the-ground conservation priorities or for graphing variation in threat or importance at an ecoregional scale.

As a consequence, 2C1Forest sought to aggregate planning units together into a smaller number of conservation planning areas. Each conservation planning area would ideally represent a collection of contiguous planning units with similar measured levels of irreplaceability and have boundaries based upon easily understood geographic or cultural features (e.g., rivers, ridgelines, or major highways). We did not have any predetermined target number of conservation planning areas, although we thought that between 100 and 200 of these areas might provide an optimal balance between fine-scale resolution of regional variation and a manageable number of planning areas.

In January 2007, 2C1Forest identified an initial set of 76 conservation planning areas that encompassed the entire ecoregion, based on similarities in importance scores and other biophysical characteristics such as rivers, ridgelines, and major highways (Fig. 11.1). We then set out to validate and measure resonance of the boundaries of the proposed conservation planning areas with conservation experts throughout the ecoregion, solicit feedback, and integrate this knowledge into a refined

set of conservation planning areas. The use of experts as opposed to local residents and stakeholders was deliberate and beneficial for many reasons (Hmelo-Silver and Pfeffer 2004). If there can only be a few meetings, and the task requires a base level of knowledge, experts are usually ready to perform such tasks with less preparation and explanation. Additionally, if experts have a long tenure in a region, they are

Step 1: Conservation Planning Areas (CPAs)
Based on MARXAN Outputs
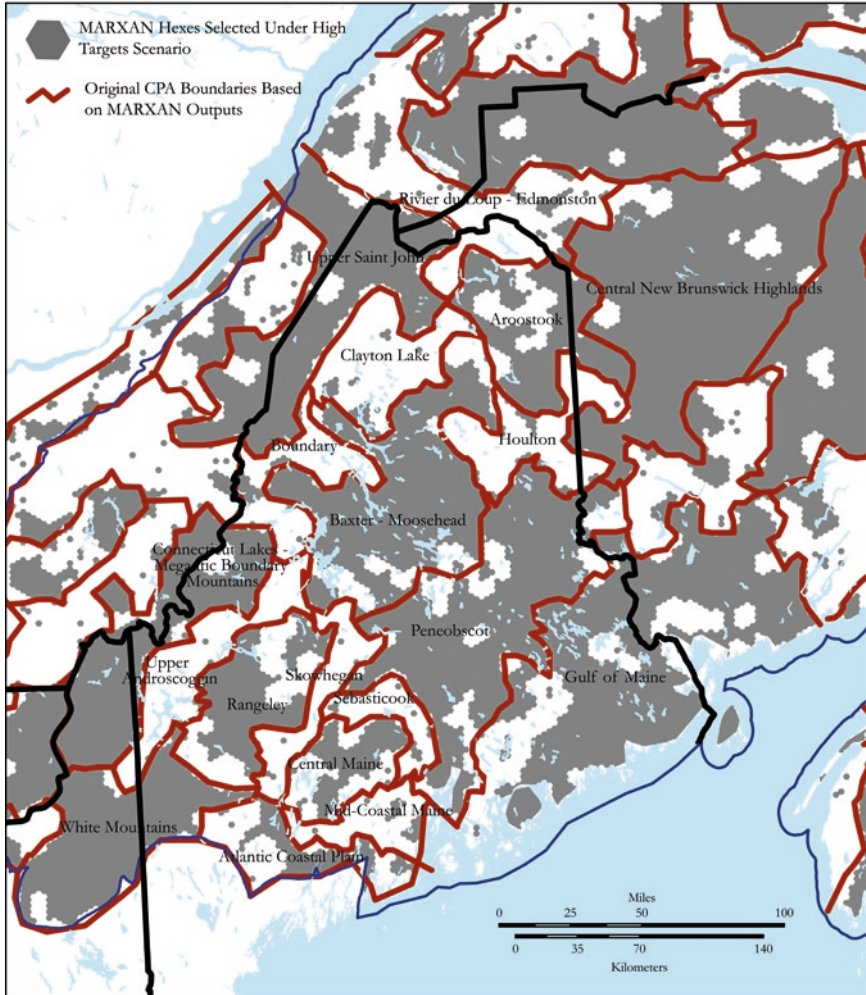
Fig. 11.1 Map composition showing evolution of conservation planning units in Maine. Step 1: initial set of conservation planning areas delineated by 2C1Forest. Step 2: revised set of conservation planning areas based on irreplaceability values and geographic or cultural features. Step 3: final set of conservation planning areas after review by experts

Step 2: Conservation Planning Areas
Based on Geographical Features

CPA Boundaries Based on Roads, Watersheds,
Town, and County Lines

Rivier du Loup - Edmonston

Upper Saint John

Central New Brunswick Highlands

Aroostook

Clayton Lake

Boundary

Houlton

Baxter - Moosehead

Connecticut Lakes -
Megantic Boundary
Mountains

Peneobscot

Upper
Androscoggin

Skowhegan

Gulf of Maine

Rangeley

Sebasticook

Central Maine

Mid-Coastal Maine

White Mountains

Atlantic Coastal Plain

Miles
0   25   50   100

0   35   70   140
Kilometers

Fig. 11.1 (continued)

often sensitive to issues and needs of stakeholders not represented in meetings.
Accordingly, we arranged for a series of meetings and workshops with experts from
non-governmental organizations, government agencies, and academia, as well as
unaffiliated local experts engaged in conservation activities across the ecoregion.

Going into this exercise, we were aware that expert judgment is frequently
included in conservation planning and is often presented without a clear method-
ological framework. As a consequence, we developed methods to investigate the

Step 3: Conservation Planning Areas
Based on 3 Rounds of Expert Review

CPA Boundaries after 3 Rounds of
Expert Review in Maine

Mid St. John

Fish River

Upper St. John   St. John Valley

Allagash   Aroostock

West Branch Penobscot   Baxter

Mettawamkeag

Boundary
Mountains   Moosehead
                  Lake

                  Piscataquis
                  Foothills   Down East Lakes

Connecticut -   Maine
Rangely Lakes   High   Upper Kennebec   Lower
                   Peaks   Penobscot

                                                Down East Rivers

                   Lower
                   Kennebec   Down East - Acadian Coast

White Mountains -
Mahoosucs   Lower
                   Androscoggin

                   Mid Coastal Maine

Miles
0   25   50   100
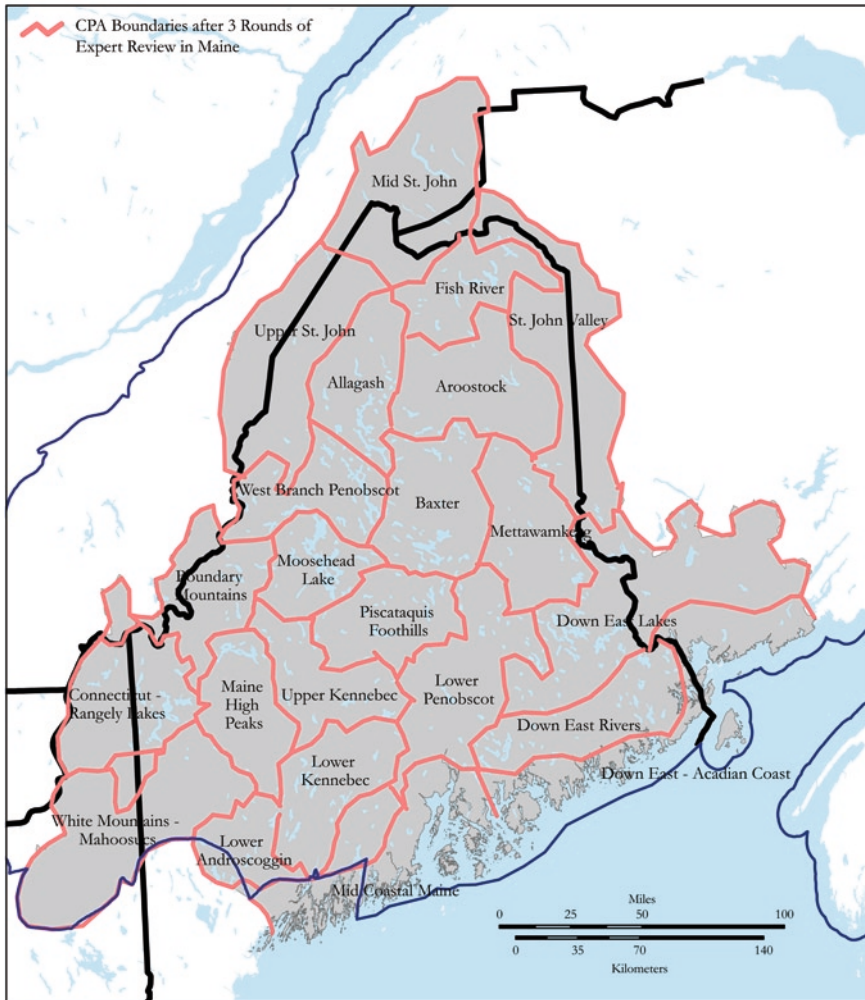
0   35   70   140
Kilometers

Fig. 11.1 (continued)

use of expert judgment as a conservation planning tool in a systematic transparent manner while conducting our expert engagement processes. We documented in detail four planning meetings in Maine and Québec, using the services of a professional notetaker during three of these meetings, allowing us to concentrate on facilitating the meetings and workshops. Verification of planning unit boundaries was conducted in real time with maps. Reasons for suggested changes, motivations, and the thoughts and feelings presented were documented for later analysis.

Using qualitative methodology, we subsequently analyzed the text from four meetings, in which 28 conservation planning experts participated.

Experts from natural resource agencies, conservation organizations, and academia were invited to these meetings. Attendees were given an overview presentation of the scientific work of 2C1Forest and the approach the consortium was taking toward conservation planning in the ecoregion. The concept of conservation planning units was introduced, together with the draft maps of conservation planning areas that had been developed by the group in January 2007. Large format paper maps of Maine and Québec, and surrounding states and provinces, were provided. GIS capacity was also available at each meeting. Workshop participants were asked to review, in plenary, the boundaries of each conservation planning area, the ecological and cultural features contained therein, and names that had been assigned to the conservation planning area. We asked the group to propose changes that they thought were needed to the boundaries and names.

Themes emerged from these meetings and workshops that transcend the particular case of the Northern Appalachian/Acadian ecoregion and relate to overall issues of including expert judgment in conservation planning. Experts tended to converge on a set of recommendations, suggesting that a 'consensus atmosphere' may lead a group of experts to the same conclusion. We also found that the expert recommendations that emerge from any particular meeting related strongly to the missions and goals of the organizations represented at the meeting. For example, in Maine, the set of conservation planning areas agreed upon by the experts blended boundaries based on scientific rationales as well as local knowledge and local needs, such as area-specific initiatives or campaigns (Fig. 11.1).

We experienced challenges in coming to consensus in the meeting held in Québec, due primarily to two factors. First, communication challenges emerged from language-related differences between primarily English-speaking facilitators and primarily French-speaking or bilingual experts. Second, among the experts in Québec, understanding of the ecoregional planning process was more limited than in Maine, possibly because several of the experts in Maine had previously been engaged as experts in the Wildlands Network Design process (Sect. 11.3.2). The difficulties experienced in the Québec meeting changed our approach to delineating conservation planning areas to one that avoided the use of expert engagement and instead used pre-defined spatial units, such as watersheds and biophysical regions. Although the solicitation of further diverse expert opinion was abandoned, the planning process benefited from a more thorough understanding of the local and regional conservation landscape.

11.4   Discussion

Several issues emerge from our consideration of these examples of conservation initiatives that attempted to integrate expert judgment with other methods and sources of data. One key issue is the importance of early involvement by experts

to increase legitimacy and promote buy-in to both the process and its results. Experts (and by extension, stakeholders and local residents as well) should be engaged in defining the problems and objectives, delineating planning units, setting goals and targets, selecting preferred scenarios and solutions, and other key aspects of decision making associated with large-scale conservation initiatives. This engagement in fundamental decisions and rule-setting creates enthusiasm for the process and its implementation, without which a plan is unlikely to be realized on the ground.

If the notion that legitimacy and buy-in from a broad base is accepted as being important for successful implementation of a conservation plan, then the question arises as to who should be involved. Are experts alone enough, or should the process include a cross-section of experts, stakeholders, and local residents? Each of these groups has relevant and potentially non-overlapping interests, knowledge, and perspectives. Stakeholder and local views warrant integration as well, but require separate or different processes than those designed for experts because of the different levels and types of information needed to facilitate informed participation by these groups. However, many of the same points made with respect to expert involvement may well apply to these other groups, such as early engagement and the importance of gaining their buy-in and support for the process and its outcome.

Beyond the question of engaging experts are the issues of defining expertise and distinguishing experts from other participants (Tynjälä 1999). Some experts are particularly good at integrating information across fields, and others have detailed knowledge in a specialized or localized field. Both forms of expertise are important (Doswald et al. 2007). Many factors come into play in ecoregional conservation planning. Who then is considered an expert, in which fields, and who is a stakeholder or interested party? If each of these groups are to be involved in the process, then it can be a complex task to determine who makes the decisions and on what grounds, whose expertise or interest or knowledge counts, and who is to be invited to participate. For example, how do the traditional ecological knowledges of indigenous First Nations become incorporated into the planning process and how is it weighted relative that of other local people who have lived in and worked with the land and water for many generations? Such questions need to be addressed explicitly and transparently.

If one wants to include experts (or other stakeholders and local residents) that do not have technological or conceptual familiarity with GIS-based or expert systems or tools, then the issue of technological capacity needs to be addressed. If the experts, stakeholders, or residents are not familiar with these tools, then the efficacy of participatory GIS applications is limited. GIS-based mapping tools can integrate a wealth of relevant information and generate several alternative scenarios relatively quickly, but as demonstrated by the Nova Forest Alliance example, participatory GIS methods that aim to provide tools for use by experts and stakeholders will not work unless the intended users understand how to integrate these tools into their decision making on an on-going basis.

A tension also exists between the accuracy of expert judgment regarding conservation values and features and the results of empirical and expert literature-based models.

As Clevenger et al. (2002) note, the widespread availability of geographic information systems allows for a 'more explicitly reasoned environmental decision-making process based on qualitative or expert-judgment data in multi-criteria evaluations.' But expert-judgment data are not guaranteed to be as accurate as data derived by more empirical means, as Clevenger et al. (2002) found when they compared three spatially explicit habitat models for back bear (*Ursus americanus)*, one based on empirical data, one based on a review of the literature on black bear habitat requirements, and one based solely on expert judgment. The expert literature-model provided results that were a good approximation of those obtained by the empirical model, and both performed much better than the expert-judgment model.

Empirical data may not always be available, however, and are often time-consuming and expensive to produce. Doswald et al. (2007), in studies of lynx in Switzerland, found that 'expert knowledge, and especially local knowledge, can be employed to create a good habitat suitability model.' The researchers concluded that 'this has implications for conservation and science because it shows not only that expert knowledge may be used when no other data exist, but also that local 'ground workers' should be employed more often in the development of habitat suitability models or conservation plans.'

Yet, even when empirical data exist, expert judgment can lead to information not available through other scientific methods. Experts in a local area are more likely to understand cultural and political barriers to conservation, which may mitigate or avoid conflict inherent in conservation planning (Dorussen et al. 2005; Hmelo-Silver and Pfeffer 2004). In contrast, stakeholders, while more focused on specific elements of a system, as opposed to integrated information, can shed light on 'hotspots of value' in a given landscape, which may help guide planning and communication in conservation planning (Brown et al. 2004; Raymond and Brown 2006).

The issue of scale is important when integrating expert judgment. Local experts tend to think locally and have detailed knowledge and deep concern about localized areas, whereas ecoregional planners tend to think at larger spatial scales. This difference in perspective was illustrated in both the Wildlands Network Design exercise in the Greater Northern Appalachians (Sect. 11.3.2) and 2C1Forest's efforts to delineate conservation planning units for the ecoregion (Sect. 11.3.3). In both cases, local experts defined locally-relevant approaches for their provinces or states, or for subregions within them. In the Wildlands Network Design, local experts selected a mix of solutions so as to combine those that they thought were better tailored to natural versus culturally transformed subregions and that delineated areas that were more consistent with those previously defined as locally important. While such inputs may inject an important aspect of subregional stratification in ecoregional conservation planning, they may also detract from the systematic character of the planning exercise. Subregional or post-expert-integration analyses may serve to determine the influence of input by local experts on the degree to which a conservation plan achieves ecoregional goals.

In 2C1Forest's attempts to delineate consistent conservation planning areas for the Northern Appalachian/Acadian ecoregion, local experts sought consensus, with

mixed success, around planning area that best matched pre-existing or emerging ecological classifications in their own state or province. This points to at least two issues important to conservation planners when engaging and integrating expert input. First, it is unlikely that ecoregional consensus will be reached through separate expert processes conducted in separate subregions (such as provinces and states). The degree to which incorporating conservation planning areas delineated on different bases would affect the results is unknown. Thus, it would be useful to (1) create processes that combine experts from various subregions to attempt to define a consistent ecoregion-wide conservation planning area scheme and/or (2) conduct analyses to determine the effects of using subregionally-defined conservation planning areas that differ across an ecoregion.

The second issue is ensuring that key concepts are clearly understood. In the 2C1Forest exercise, the concept and analytical purpose of conservation planning areas were not well understood by many of the experts participating in the meetings and workshops. The interplay and distinctions in roles between planning areas and ecological classifications is subtle and perhaps not adequately understood even among some experts. Further, using ecological classes as conservation planning areas would have implications for assessments of ecological irreplaceability that incorporate representation as a conservation goal, since every planning unit/ecological class would need to be represented. The analytical effect is that the comparative component around representation values would essentially be eliminated from the assessment of irreplaceability of conservation planning areas. Thus, expert involvement in delineating conservation planning areas requires clear understanding and communication of sometimes subtle, fundamental concepts and methodologies and their analytical purposes.

Regardless of the need to systematically integrate expert input, we stress the importance of flexibility. Flexibility in approach to conservation planning initiatives is necessary given cultural diversity across broad ecoregions, diversity both in scales of perspective among experts and in types of experts. While every ecoregion may not include two official languages and two nations, cultural diversity will inevitably exist nonetheless. Even within one country with one language, significant cultural differences often exist within large landscapes. Often these differences derive from complex and interrelated factors such as long histories of diverse livelihoods and land and resource use, population densities, the degree of cultural transformation of the landscape, and the history of settlement and occupancy by different cultures, including First Nations. Across large ecoregions, it is inevitable that cultural, social, and economic diversity, as well as biogeographic diversity, will occur, and the processes for integrating expert input into ecoregional planning will need to respond accordingly.

Both consensus and conflict are part of decision making processes among experts. It has been demonstrated that groups may tend to come to a consensus-based decision irrespective of what experts might decide were they to provide their input outside of the group (Bojórquez-Tapia et al. 2003). Did this occur in the three processes examined here? We believe that in the 2C1Forest exercise, consensus was achieved from each individual meeting in Maine, consistent with the findings of

others (e.g., Bojórquez-Tapia et al. 2003) that experts tend to reach consensus on 'salient' issues. If a planning group does a good job of communicating to the experts the importance of their participation, then experts are more likely to engage in problem-solving directed toward the desired goal. In this scenario, the experts had a task that was likely to engage the 'consensus phenomenon,' as well as mitigate potential conflict over issues of 'turf.' However, the experts did not come to consensus in Québec, which may in part have been due to inadequate communication of the importance of their contribution to the overall planning initiative. As mentioned earlier, the experts in Maine had a clearer understanding of the ecoregional planning process based on a longer history of exposure in Maine to this perspective on conservation planning (Baldwin et al. 2007; Beazley et al. 2010; Reining et al. 2006). The participants in Québec may have benefited from additional preparatory materials and processes, including explicit assurances about the importance and value of their input.

Regardless, ecoregion-wide consensus was not reached and would be unlikely to be reached through separate independent meetings in various provinces and states, as consensus emerges within but not between such meeting groups. This reinforces the notion that some common meetings or cross-participation of experts among various groups across the ecoregion might be necessary for ecoregion-wide consensus to emerge, should this be determined to be necessary or desirable.

Ecoregional conservation planning is another example of a broader movement in resource management in which support is shifting to approaches that include multiple centers of interaction and away from those in which a single agency holds power (Conca 2005; Hajer and Wagenaar 2003; Plummer et al. 2005). In such contexts, integration of expert and other judgments is a fundamental component. In interactive approaches, questions arise around how much authority to make decisions should be devolved to each group (experts, conservation organizations, stakeholders, or local residents) and how such groups should coordinate or collaborate to make decisions. The potential for conflict is great, as various experts and stakeholders have different interests and will therefore support varying views and approaches. Conflict is an inevitable part of participatory and collaborative processes and should be embraced. Conflict resolution techniques are thus important to participatory processes, including those involving experts, particularly if experts represent a variety of fields or come at their task with localized versus integrative skills.

Working through conflicting views, however, leads to creation of new knowledge, as participants confront the views of others and strive toward resolution. Lee (1994) suggested that 'political conflict can provide ways to recognize errors, completing and reinforcing the self-conscious learning of adaptive management.' Acknowledging and addressing conflicts can serve to generate new information, strengthen outcomes, and reinforce ownership by experts (Conca 2005). Conflict and its resolution are important components of ecoregional conservation planning. The tensions between consensus and conflict are key to legitimacy and consensus. Only when multiple views are considered and genuinely incorporated will a strong network of supporters emerge to enable implementation of the conservation plan.

11.5   Lessons Learned

The documented benefits of expert engagement in ecoregional planning include increased support and legitimacy for the process and its results, and increased buy-in to its implementation. Experts bring a source of data, tacit knowledge, and local context and perspectives to the conservation planning process, and often infuse ecoregional planning with subregional diversity reflective of the ecoregion. They can provide guidance in key aspects, such as setting goals and targets, and assessing and combining various scenarios and solutions generated by expert systems. Together, a group of experts can provide both ecoregional overviews and local perspectives. As conservation planning becomes decentralized and multi-centered interactions and initiatives are more broadly supported, the engagement of experts will become more important to successful conservation initiatives.

As important as these benefits and imperatives are, challenges inherent in integrating the views of a wide range of experts remain, both among the experts and with expert systems. The tensions and synergies between conflicting views and processes towards consensus require negotiation processes and skills. With these, potentially disruptive differences can be embraced and channelled into creative new solutions and new knowledge. Questions remain as to how much consensus is necessary or desirable, and how much divergence or diversity can be incorporated into conservation planning across areas as large as ecoregions. Tensions exist between the need for consistency across the ecoregion and the imperative of flexibility deriving from diversity.

Studies call for the incorporation of expert judgment to be more systematic, which we support. Close attention to methods of expert engagement, the results accruing from such engagement, and the implications of expert influence on ecoregional planning is important to better understand how to best engage experts and integrate their input with other ecoregional planning methodologies, data sources, and tools, such as GIS-based expert systems. Various fundamental planning components that experts may influence, such as planning units, goals, targets, scenario development, and selection of solutions, should be analysed and compared to understand the implications of such decisions, such as their sensitivity to subregional variation. Opportunities to use nested hierarchies or hybridized approaches that combine high-level ecoregion-wide classifications and rules with localized subregional ones (e.g., MARXAN with Zones [http://www.uq.edu.au/marxan/]) should be explored and tested for their effectiveness. Such approaches could allow for systematic applications of consistent protocols across ecoregions, as well as accommodate diverse subregions. In the meantime, subsequent analyses of expert-driven results should determine the extent to which they retain spatial cohesion and achieve conservation goals at the ecoregional scale.

However, the examples described here of integrating expert judgment into systematic ecoregional conservation planning highlight several important lessons. First, engagement of experts should not be simply about gaining after-the-fact opinions or approval. To maximize the extent of buy-in by experts, many of whom would be

responsible for ultimately implementing any resulting conservation plan, they need to be legitimately involved in the creation of methodology and results. Second, experts need to be distinguished in the planning process from stakeholders and local residents. While precise definitions of these different groups of participants are elusive and are likely to vary from one region to another, a transparent methodology for assessing and weighting each group's input is important. Finally, the methods used for engaging expert participation need to match the experts' technological capabilities and conceptual understandings. Planners should not assume that all participants have the same level of experience with methodologies or computer-based decision-support tools. While a lack of familiarity with such methodologies should not disqualify an expert from participation, it does highlight the importance of advanced preparation and planning on the part of those facilitating the process. In other words, simply inviting a group of experts to show up at a meeting and expecting significant results to emerge is unlikely to be successful.

Beyond these more technical issues are those related to the social sciences of expert engagement. How might we take what we have learned here to lead to more efficient and successful participatory conservation initiatives in the future? Are there ways to harness the consensus atmosphere in an expert meeting to help lead to more resilient conservation strategies? We have seen that local experts can drive results to match local priorities, and large-scale planning efforts thus risk becoming less spatially coherent if separate meetings are held strictly within subregions. Are there ways to build consensus across broad ecoregions, or is subregional consensus adequate, or alternatively, desirable? These questions can only be answered if the social and qualitative forms of data to build this understanding are tracked. Taken together with scientific measures of successful conservation, a more integrated picture of expert engagement will begin to emerge that will help conservation planners globally.

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