A place-based approach to conservation management using public participation GIS (PPGIS)
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The New Zealand Department of Conservation (DOC) is an early adopter of a place-based approach to implementing regional Conservation Management Strategies (CMS). As a new approach, there are few signposts for guidance. The present DOC process relies on a top-down, deductive approach using expert judgement by agency staff. In this study, we examine an alternative approach that uses inductive, public participation GIS (PPGIS) methods to delineate places of significant conservation value. We compare and evaluate the agency’s deductive approach with places identified as significant using PPGIS. We discuss the results and present a proposed hierarchy of places framework for use in future place-based conservation management.

Keywords: place; conservation; place-based management; participatory GIS; PPGIS

1. Introduction
The concept of place-based conservation management is integral to the practical implementation of ecosystem management (Olsen et al. 2011), which is inherently spatial and place-based (Lackey 1998, McLeod et al. 2005). In the absence of politically and administratively feasible methods for implementing ecosystem management, place-based management is a strategy for translating ecosystem management into operational management practice (Young et al. 2010). Place-based management calls for the integration of the “full suite of human activities occurring in spatially demarcated areas” while accounting for biophysical, socio-economic and jurisdictional considerations (Young et al. 2010, p. 22).

While a practical focus on ‘place’ rather than ‘ecosystems’ appears intellectually seductive, it still requires the demarcation of places that are comprehensible to both users and managers alike, a major challenge. The boundaries of ecosystems are imprecise while the precision of administrative boundaries often bear little relationship to the biophysical realm or the human conceptions of place. If place-based conservation management is to take root, methods must be developed to identify places that integrate the geography of place with the human perception of place.

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In this paper, we confront the vexing question for place-based management. What is a place? The New Zealand Department of Conservation (DOC) has adopted a place-based approach to regional conservation planning. They are now challenged with the practical reality of how to identify places. Admittedly, place is a highly subjective concept and currently the DOC have no formal criteria for identifying places. Already they are finding the lack of any definitional guidance is problematic for those within and external to the agency. Without guidelines or heuristics, the critical first step of identifying places will likely result in ad hoc and non-replicable methods across regions, leading to internal agency ambiguity and externally contestable outcomes. Our challenge was to provide DOC with an alternative methodology that offers an objective, replicable and defensible process for place identification that integrates top-down, agency processes with inductive methods that use public participation GIS (PPGIS).

Science, in practice, involves both deductive and inductive reasoning processes (Babbie 2008). Deduction begins with an expected pattern that is tested against observations whereas induction begins with observations and seeks to discover the pattern within them. In this paper we consider the current DOC place-based approach to be deductive because managers are basing their expectations on theoretical knowledge and experience, whereas we consider the use of PPGIS to be inductive because generalisations are the result of specific data or observations provided by participants. There are advantages and disadvantages to each approach, and this paper highlights the value of incorporating both methods. Such integration utilises the wisdom of management, but examines expectations against specific observations from the public. The result is a place-based classification system for conservation planning with the capacity to validate expectations against observations.

1.1. What is place?
A simplistic view of place is a geographic location. However, places are more than location: they are individually and socially constructed spaces embedded with contextual meanings. Tuan (1977) contended that space becomes place through the transforming powers of meaning, value and familiarity. People assign meanings to places and derive meanings in their lives from them (Davenport and Anderson 2005). Sense of place is the amalgamation of knowledge, values, emotions and actions associated with a place (Jorgensen and Stedman 2001). Place attachment is the extent to which an individual values or identifies with a particular natural setting (Williams and Roggenbuck 1989). Place attachment is influenced by socio-demographic characteristics, activity involvement, experience preferences and landscape types (Williams et al. 1992, Bricker and Kerstetter 2000, Davenport and Anderson 2005, Brown and Raymond 2007). The concepts of place and place attachment have been explored through multiple disciplines, including geography, sociology, psychology, natural resource management and even public health (Frumkin 2003).

The geography of place and the human dimensions of place are tacitly combined, for better or worse, in the process of map development: locations and meanings become fused graphically through place symbolisation. Maps are fertile ground for contestation and potential conflict because they represent conceptions of place that may or may not be widely shared. If place-based conservation management is to gain traction, the fundamental starting point of identifying places needs to be logically
sound and intellectually defensible. So whose conception and maps of places should be used in place-based conservation management?

1.2. The people’s places

Public participation geographic information systems (PPGIS), or alternatively, participatory GIS (PGIS), are methods that seek to democratise spatial information and technology, often through mapping at local levels of social organisation to produce knowledge of place. The formal definition of PPGIS remains nebulous (Tulloch 2007), with use of the term ‘PPGIS’ emerging in the US and developed-country contexts, while the term participatory GIS or ‘PGIS’ emerged from participatory planning approaches in rural areas of developing countries, the result of a spontaneous merger of Participatory Learning and Action (PLA) methods with geographic information technologies (Rambaldi et al. 2006).


When PPGIS methods use sufficiently large random sampling of residents in a region, a collective spatial ‘truth’ about places in the region emerges through inductive analysis of the data. If points are used to identify spatial attributes, a common practice in PPGIS, higher densities of mapped attributes reflect spatial agreement among participants about where particular place attributes are located. The ubiquitous place boundary problem is resolved indirectly through the selection of heuristic density thresholds that determine the size and shapes of the place polygons in the study region. Coherent, collectively perceived places are generated through PPGIS despite the high degree of variability and potential error in individual knowledge or perceptions.

The people’s demarcation of places stands in contrast to a top-down approach to place identification. A conservation agency that initiates place-based management is likely to produce its own initial maps of places for conservation planning based on experience, understanding of biophysical significance, visitor use patterns and
history of management issues in the area. While the importance of such agency knowledge should not be underestimated, the inherent subjective nature of such place identification provides a potential point of challenge for conservation stakeholders based on the coherence of the supporting logic and rationale to identify places.

1.3. The place-based challenge

The New Zealand Department of Conservation (DOC) recently adopted a place-based approach to conservation planning. Under the Conservation Act of 1987 (the ‘Act’), the agency is required to develop 10-year strategic plans called Conservation Management Strategies (CMS). The purpose of a conservation management strategy is to implement general policies and establish objectives for the integrated management of natural and historic resources, recreation and tourism. These strategies are developed at a regional scale for each ‘conservancy’ or regional administrative unit in New Zealand. In the Act, there is no statutory requirement for the agency to use a place-based management approach to conservation. Indeed, the first generation of CMS planning documents under the Act lacked formal place designations.

Following the first generation of CMS plans, the agency adopted ‘place’ as an integrating concept for CMS planning. The DOC developed its first CMS using the ‘place’ concept for Stewart Island/Rakiura National Park which was provisionally approved in February 2011. The CMS identified five places by partitioning the island into irregular shaped ‘jigsaw’ puzzle pieces. Although considerable agency knowledge was undoubtedly applied to the creation of the five places, the publicly accessible CMS document contains no supporting rationale for the initial identification and demarcation of place boundaries. The CMS provides a simple two-level hierarchy of places by identifying and labelling places within the five larger places as ‘special places’. In the agency document that summarised public comments on the draft CMS (Department of Conservation 2009), place boundaries were a focal point for comment. For example, the document describes that “some opposition was directed at the proposed boundaries and constituency of the places” (p. 26), including five comments in opposition to the proposed boundaries of ‘Southern Place’ (p. 28).

On what basis, and at what geographic scale, should places be identified in a CMS? Top-down, geographic demarcation of places through regional partitioning, as applied to Steward Island/Rakiura, is one approach. As observed, however, places and place boundaries may be contested by some participants in the planning process. In the absence of supporting rationale for place identification and demarcation in the CMS, outsiders will speculate how places decisions were made, potentially leading to distrust in agency motives. If administrative feasibility or expediency was the guiding principle behind the identification and demarcation of CMS places, one wonders whether the agency’s explicit acknowledgment of this rationale would have quieted or fuelled disagreement over places. How important is it to get the initial places right? In DOC’s information sheet for CMS planning, the agency states:

There is no hard and fast rule about which places should be in a CMS. That is up to the community, tangata whenua [Maori term for community], the Department of Conservation (DOC) and Conservation Board to decide. It is most likely that DOC will have an initial attempt at identifying those important places in your community and then ask for your feedback and direction. The entire conservancy may be divided into
places (and fitted together like a jigsaw), or places may be identified by their special, unique or complex management—not every part of the conservancy needs to be in a place. (Department of Conservation 2011)

This statement makes it clear that the agency wants to involve the public but also highlights the need for a more defensible, inclusive method that can assist managers striving towards a place-based approach.

There is an alternative to the top-down, agency identification of places based on geographic partitioning. What if places were identified based on the presence and abundance of conservation resources for which the agency has legal responsibility? The Conservation Act identifies four specific resources that comprise DOC’s raison d’être – natural heritage, recreation, history/culture and business/tourism opportunities. Logically, if CMS places could be identified based on the concentration of values associated with the four resources in a conservancy, there would be a direct nexus between the CMS places and the management policies that support these resources.

1.4. The research context

In 2011, DOC initiated the CMS planning process for the next two conservancies that will implement place-based conservation strategies – the Southland and Otago Conservancies located on the south island of New Zealand. These relatively large, heterogeneous regions provided an opportunity for the agency to trial the use of PPGIS for conservation management. In 2011, DOC collaborated with university researchers to implement PPGIS systems for both regions as part of the agency’s public consultation process. The PPGIS method, described below, collected place information from residents and visitors in the two regions.

The purpose of this paper is to compare and contrast the DOC’s initial place identification in the two regions with places generated through inductive analysis of PPGIS data to evaluate the utility of PPGIS for place-based management. Similar to the first place-based CMS for Stewart Island/Rakiura NP, the agency drafted initial places for both regions without the benefit of PPGIS data. The agency’s approach for identifying the initial places differed in each region thus providing interesting contrasts with the PPGIS data. In our analysis, we overlay the bottom-up, inductive places generated from PPGIS data with the agency’s initial top-down, deductive identification of places. We then quantify and describe the distribution of PPGIS resource attributes under both the inductive and deductive approaches to place identification. Following the results, we reflect on PPGIS as a replicable and objective solution for place identification and demarcation. We close with a proposed hierarchical structure for places that uses both inductive and inductive processes to identify and organise places within a conservancy for place-based management.

2. Methods

2.1. Study location

The two regions in this study are the Otago and Southland Conservancies on the south island of New Zealand. The Southland region covers more than 3.1 million ha, has over 3400 km of coastline, and includes New Zealand’s largest national park, Fiordland National Park. Southland is one of New Zealand’s most sparsely
populated regions (approximately 94,200 in 2010) with an economy based on tourism, agriculture, fishing, forestry and energy resources.

The Otago region covers approximately 3.2 million ha with an estimated population of 207,400 in 2010. Major centres of population include Dunedin, Oamaru and the tourist centers of Queenstown and Wanaka. In the west of the region, high alpine mountains and glacial lakes dominate the landscape, including Mt. Aspiring National Park. Tussock grasslands dominate the dry lands of the central region, while the hill country of the Catlins is located in the region’s southeast. Key economic sectors include tourism, education, agriculture and manufacturing.

2.2. **PPGIS data collection**

PPGIS websites for each of the regions were developed after consultation and pilot testing with DOC staff. The website design consisted of an initial screen where the participant entered an access code, followed by an informed consent screen, followed by the Google Maps screen where participants placed markers on the map, followed by a final screen with text-based survey items to identify respondent characteristics (see Figure 1; the websites can be viewed at: www.landscapemap2.org/nzdoc or www.landscapemap2.org/otago). PPGIS data collection consisted of two parts: (a) spatial attribute mapping using a custom Google Maps application; and (b) general survey questions assessing participants’ familiarity with conservation areas in the regions and selected socio-demographic information. The mapping activity consisted of participant selection of markers representing different spatial attributes located in three panels on the left of the map screen and then dragging and dropping the markers onto the appropriate map location in the conservancy.

The spatial attributes to be identified by participants included 30 landscape values, park experiences and development preference markers. The list of markers and their associated definitions were identical for the two regions. Of relevance to this study were spatial attributes directly related to the four resources identified in the Conservation Act of 1987, for which DOC must implement conservation management strategies and detailed objectives: natural heritage, recreation, historic and tourism. The PPGIS attributes and their operational definitions are shown in Table 1.

Respondents could optionally annotate each marker after placement. Mapping precision was enforced by only allowing marker placement if the participant had zoomed to level 12 in Google Maps (approximate map scale of 100 000:1). Participants could optionally toggle on/off data layers for recreational huts, tracks and user-contributed photos of the region and toggle alternative base map views: ‘Map’, ‘Terrain’, ‘Satellite’, ‘Hybrid’ and 3-D ‘Earth’.

PPGIS participants were recruited in early 2011 using three approaches: a random mail sample of households in the Southland and Otago regions, by visitor contact at selected conservation areas, and by advertising in local newspapers. The source of participants was tracked through the assignment of unique access codes for the website. Randomly selected households (n = 750 for Southland, n = 1000 for Otago) were contacted by mail and invited to participate in the study. A follow-up reminder was sent approximately two weeks after the first invitation. For individuals contacted at conservation areas, an email address was collected and a personal reminder to participate in the study was sent after about two weeks. For individuals
Figure 1. The Google Maps interface for public participation GIS (PPGIS) in Southland, New Zealand. Markers located in the three panels on left (values, experiences and development preferences) are dragged and dropped by participants onto a map after zooming into location.
<table>
<thead>
<tr>
<th>Natural heritage resources</th>
<th>Historical resources</th>
<th>Recreation resources</th>
<th>Tourism resources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Scenic/aesthetic</strong> – these areas are valuable because they contain attractive scenery including sights, smells and sounds.</td>
<td><strong>Historical/cultural</strong> – these areas are valuable because they represent history, NZ identity or provide places where people can continue to pass down memories, wisdom, traditions OR a way of life.</td>
<td><strong>Recreation (non-facility based)</strong> – these areas are valuable because they provide dispersed recreation opportunities where users are relatively self-reliant, i.e. tramping (trekking/backpacking), climbing, hunting/fishing or adventure activities.</td>
<td><strong>Tourism development</strong> – this area is acceptable for building tourism accommodation and services.</td>
</tr>
<tr>
<td><strong>Ecological/life sustaining</strong> – these areas are valuable because they help produce, preserve and renew air, soil and water.</td>
<td><strong>NZ identity/heritage</strong> – I experienced a connection with the past or my NZ identity</td>
<td><strong>Recreation (facility based)</strong> – these areas are valuable because they provide recreation activities through the provision of managed tracks, huts, campsites and other facilities.</td>
<td><strong>Economic</strong> – these areas are valuable because they provide income and employment opportunities through industries like tourism, natural resources or other commercial activity.</td>
</tr>
<tr>
<td><strong>Native wildlife</strong> – these are valuable because they provide areas for indigenous (native) wildlife to live and/or opportunities for humans to observe.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Native vegetation</strong> – these areas are valuable because they sustain areas of indigenous (native) plants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Marine value</strong> – these areas are valuable because they support marine life.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wilderness</strong> – these areas are valuable because they are wild, uninhabited or relatively untouched by human activity.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
that learned of the study from friends, relatives or the media, a dynamic access code was allocated on the website.

2.3. Data analysis methods

A total of 14,370 spatial attributes were identified by PPGIS participants (n = 698) in the two regions. The spatial data were cleaned by eliminating markers placed outside the two study regions and by filtering markers unrelated to the four resources in this study (natural heritage, recreation, history, tourism), leaving 3826 (Southland) and 6296 (Otago) markers available for analysis.

2.3.1. Generating CMS places

To generate places from the point data, we created standardised ‘hotspots’ representing higher densities or clusters of points for each of the four resources using a 1000 m grid cell size and 10000 m search radius. Kernel density mapping is a technique that fits a smoothly curved surface (grid) over each point producing a circular area (kernel) of a certain bandwidth (or search radius). The resulting highest densities of grid cells are commonly referred to as ‘hotspots’. Because the number of points influences the kernel density calculations, we standardised kernel densities for each of the four resources by subtracting the mean grid density and dividing by the grid standard deviation. By convention (see Alessa et al. 2008, Brown and Pullar 2011), we classified standardised kernel densities with values in the upper one-third of the distribution as hotspots, or in this case, CMS places. Hotspots are usually colour-coded to show increasing point density.

The selection of the key parameters (grid cell size, search radius, standardised kernel density cutoff) required heuristic judgement. We chose 1000 m for the grid cell size based on the assumed precision of marker placement and the total area of the region. The search radius was a judgement about the distance at which these PPGIS attributes might be presumed to cluster. Empirical research (Nielsen-Pincus 2011) suggests that landscape values similar to the PPGIS attributes mapped in this research tend to cluster between 3 and 6 km. The selection of a smaller search radius reduces the area of the hotspots while selecting a larger search radius increases the area of the hotspots. Selecting the search radius usually involves trials to determine the optimal size of the hotspots relative to the whole region. As a heuristic, we wanted approximately one-third of the region to be identified as hotspots (CMS places) and selected a search radius of 10 km to generate somewhat larger areas.

Using standardised scores based on kernel densities with the same threshold for hotspot identification has the effect of generating similar aggregate areas for each resource, despite large differences in the number of points mapped per resource. Over multiple data studies, the upper one-third of standardised kernel density threshold has yielded the most consistent, interpretable results. This threshold identifies the highest densities of clustered points as hotspots while avoiding hotspots based on isolated points or smaller numbers of clustered points. For PPGIS with fewer points for analysis, it may be necessary to adjust the standardised density threshold higher to avoid hotspots being created or influenced by single points. We required a minimum of three points for the creation of a hotspot.

Once the hotspots were generated for each of the four resources individually, the grid cells were converted to polygons and merged into a single regional CMS places
map. The sequencing of the analysis is important. If the hotspots had been generated from the aggregated resource points rather than generated from each individual resource first, the results would be different as the large number of points associated with natural heritage and recreation would dominate the results. Given that the Conservation Act does not rank the four resources preferentially, the generation of hotspots should be sequenced to avoid biasing the results toward more frequently mapped place attributes.

2.3.2. Comparing inductive PPGIS places to deductive DOC places

To compare the results of inductive PPGIS places and the draft DOC places, we examined a number of descriptive variables for both regions: the number of places identified, the spatial area contained by places, the minimum and maximum place size and the mean place size. To visually compare the results, the two methods for generating places were overlaid on the same map.

2.3.3. Describing and organising PPGIS places

The CMS places contain many physical geographic features. To better understand the number and type of geographic features located within the CMS places, we intersected the places with the New Zealand gazette of place names (2008). We also tabulated the number of resource points that fell within each hotspot. These tabulations allowed identification of the dominant resource and named geographic features located within the PPGIS generated places. Using Southland as an example, we describe a hierarchy of places for place-based management based on both deductive and inductive analysis.

3. Results

The PPGIS-generated hotspots (places) for each of the four resources for Southland are shown in Figure 2. Natural heritage places dominate in the western reaches of the region (Fiordland National Park) and the south coast. Recreation places follow a similar distribution pattern as natural heritage places. Both historic and tourism locations show spatial dispersion throughout the region, with higher densities of historic places on the south coast and higher densities of tourism in Milford and Doubtful Sounds on the west coast.

The quantitative descriptors of PPGIS places were consistent for both Southland and Otago (see Tables 2 and 3). In both regions, the number of historical hotspots was greatest, and the number of tourism hotspots the lowest. The mean areal size of hotspots was smallest for tourism and largest for recreation in both regions. One difference between regions was that hotspot analysis generated fewer PPGIS places for Southland places ($n = 20$) than Otago ($n = 25$). This appears to be the result of several distinct resource hotspots in Fiordland National Park in Southland joining during the spatial merge, thus creating fewer PPGIS places. We note that DOC also identified fewer places in Southland than Otago in its internal process.

The PPGIS-generated places were overlaid with draft DOC places, shown in Figure 3. The DOC strategy for initial place designation in the Southland region allocated the entire region to places that fit together like puzzle pieces. The resulting names for places with this strategy were generalised, producing names such as
Table 2. A comparison of deductive (agency) and inductive (PPGIS) places in Otago region in New Zealand.

<table>
<thead>
<tr>
<th></th>
<th>Otago (agency)</th>
<th>Otago (PPGIS)</th>
<th>Natural Heritage</th>
<th>Recreation</th>
<th>History</th>
<th>Tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of places</td>
<td>23</td>
<td>25</td>
<td>22</td>
<td>19</td>
<td>30</td>
<td>14</td>
</tr>
<tr>
<td>Area of places (sq km)</td>
<td>18,274</td>
<td>12,998</td>
<td>8585</td>
<td>9296</td>
<td>5855</td>
<td>2453</td>
</tr>
<tr>
<td>Minimum place size (sq km)</td>
<td>3</td>
<td>4</td>
<td>46</td>
<td>14</td>
<td>4</td>
<td>47</td>
</tr>
<tr>
<td>Maximum place size (sq km)</td>
<td>2151</td>
<td>3283</td>
<td>1520</td>
<td>1705</td>
<td>595</td>
<td>610</td>
</tr>
<tr>
<td>Mean place size (sq km)</td>
<td>795</td>
<td>520</td>
<td>390</td>
<td>489</td>
<td>195</td>
<td>175</td>
</tr>
<tr>
<td>Number of points</td>
<td>N/A</td>
<td>6296</td>
<td>3315</td>
<td>2373</td>
<td>403</td>
<td>205</td>
</tr>
</tbody>
</table>

Figure 2. The location of standardised PPGIS ‘hotspots’ in the Southland region of New Zealand for: (a) natural heritage; (b) recreation; (c) history; and (d) tourism values. Point densities are colour coded from lower (yellow) to higher (purple). When spatially joined, these hotspots become the basis for designating Conservation Management Strategy (CMS) places.
An obvious limitation of this approach is the lack of specificity in place identification and the inability to discriminate between relatively high resource value places and lower value places. In contrast, the PPGIS approach to place identification relies on the clustering or concentration of resource values. This approach results in the identification of more places with the ability to describe the relative intensity of specific resource values for each of the places. A benefit of the DOC partitioning approach is that the entire region is allocated to places that can be described in the CMS document – there are no lands, including private lands, not covered by conservation strategies in the CMS. A benefit of the PPGIS approach is that places can be identified by the relative strength and mix of resource values located within the region.

In contrast to Southland, the Otago place designation approach by DOC does not include the entire area. In some instances, places comprise the area within the boundaries of conservation units, while in other instances they follow generalised polygons. In the mountainous, western reaches of the region, the initial DOC place designation missed places that are identified using the PPGIS approach. In the eastern half of the region, the DOC approach included more PPGIS places, although there are two PPGIS places that have no spatial overlap with the DOC places.

Returning to the Southland example, the frequency of place recognition by PPGIS participants can be operationalised by the number of resource points comprising the PPGIS places. The resulting map is shown in Figure 4a. The dominant resource value for each PPGIS place is shown in Figure 4b. Not surprisingly, Fiordland National Park and the south coast are the most recognised for having all four resource values. While most PPGIS places contain a mix of resource values, the map shows that some places are dominated by particular resource values. For example, the region contains some places dominated by tourism values (Te Anau Downs) and history (Nightcaps). The PPGIS approach allows this distinctive place character to be identified.

A potentially useful final step in the PPGIS process for place identification is to intersect the places with named geographic places appearing in a gazetter. The New Zealand Geographic Board publishes the New Zealand Gazetteer of Official Geographic Names. The gazetteer provides information on the official names, the gazette or statutory reference, the type of feature or place (e.g. town, river) and the extent of the feature (LINZ 2012). This provides a potential proxy for landscape

<table>
<thead>
<tr>
<th></th>
<th>Southland (agency)</th>
<th>Southland (PPGIS)</th>
<th>Natural Heritage</th>
<th>Recreation</th>
<th>History</th>
<th>Tourism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of places</td>
<td>10</td>
<td>20</td>
<td>22</td>
<td>24</td>
<td>27</td>
<td>16</td>
</tr>
<tr>
<td>Area of places (sq km)</td>
<td>44,087</td>
<td>14,985</td>
<td>9251</td>
<td>11,107</td>
<td>6542</td>
<td>2536</td>
</tr>
<tr>
<td>Minimum place size (sq km)</td>
<td>719</td>
<td>12</td>
<td>33</td>
<td>5</td>
<td>14</td>
<td>46</td>
</tr>
<tr>
<td>Maximum place size (sq km)</td>
<td>21,995</td>
<td>6101</td>
<td>1598</td>
<td>3940</td>
<td>1578</td>
<td>413</td>
</tr>
<tr>
<td>Mean place size (sq km)</td>
<td>4409</td>
<td>749</td>
<td>420</td>
<td>463</td>
<td>242</td>
<td>158</td>
</tr>
<tr>
<td>Number of points</td>
<td>N/A</td>
<td>3646</td>
<td>2015</td>
<td>1178</td>
<td>290</td>
<td>163</td>
</tr>
</tbody>
</table>
Two approaches for designating places in Conservation Management Strategy (CMS) planning in New Zealand. In the Southland region (left), the whole region was divided into places. In the Otago region (right), designated places did not cover the entire region or all conservation areas. Blue areas are PPGIS mapped attributes that represent aggregate high densities of natural heritage, recreation, history, and tourism values.
heterogeneity. When this task was undertaken for the Southland region, most PPGIS places were dominated by streams, hills or historic areas, meaning this type of landscape was highly valued by respondents. The additional information provided by the gazetter, such as local names, is also beneficial in community consultation. For example, the gazetter shows the Catlins PPGIS place designation consists of the named geographic locations of Mokoreta and Redan. It is also useful to identify the names of public conservation lands located within each PPGIS place designation. Both of these steps can contribute to the development of a descriptive hierarchy of places, described below.

4. Discussion

The New Zealand DOC has adopted a place-based approach to develop and implement regional Conservation Management Strategies (CMS). The CMS planning process for the Southland and Otago conservancies are the first trials of PPGIS to inform the conservation planning process, and in particular, the identification of ‘places’ within the regions. In the absence of a PPGIS process, the agency would rely on a top-down, deductive approach to place identification within the conservancies, subject to modifications based on public consultations in open houses, community events or written submissions. The PPGIS approach provides significant spatial data from the public, early in the process, to inform the identification of places with resources for which the agency is statutorily required to manage.

Place identification for conservation planning may be normatively viewed as an approach that combines both top-down, deductive and bottom-up, inductive processes (see Figure 5). Planners and resource professionals within DOC develop an initial set of sub-regions for a CMS conservancy. These sub-regions can cover the entire planning region (as in Southland) or selected areas within the planning region (as in Otago). The allocation of the entire planning conservancy to sub-regions, i.e. the jigsaw puzzle approach used in Southland, appears preferable to the Otago
approach, particularly if PPGIS data are available to identify the smaller, more resource-specific places within the conservancy. On the other hand, the inductive process begins with identifying the features, or place descriptors, that management needs public input about and which identify public interest in the area. In this case, DOC planners were interested examining place values, experiences and development preferences. These place descriptors form the first step in developing the PPGIS. The PPGIS, in turn, generates a community-driven classification of places that can be viewed in tandem with the sub-regions identified by management. The result is a nested hierarchy of places (Region -> Sub-region -> Places -> Place descriptors) that provides a useful framework for engaging in public consultation where individuals can view the maps to affirm the initial place selections or make suggestions for change. CMS place maps derived from PPGIS can also be put on the Internet for public comment, which was done for the Southland region (see Figure 6). The inductive and deductive approaches inform each other and highlight places and issues requiring additional focus.

The use of PPGIS for place identification and demarcation does not eliminate the need for subjective judgement, but place identification using PPGIS moves closer to some form of standard operating procedures (SOPs) for CMS planning that can be replicated in other regions. For example, heuristic parameters for the initial point search radius (e.g. 10 km), standardised kernel density thresholds (e.g. highest one-third), and a minimum point count for the creation of a place (e.g. 3), can provide a standard approach for place identification across conservancies. We would not advocate blind adherence to these parameters, but consistent treatment of spatial data does provide for meaningful cross-regional comparison.

Is there a heuristic rule for the number of places to be identified in a CMS? The CMS document should strike a balance between geographic coverage of places and place specificity for implementing management activities. The final number of CMS places is an important consideration because current and future values for each place must be identified in the CMS as well as objectives to guide future management for the next 10 years. The draft map for Southland contained 10 places. The PPGIS approach generated 20 places. In the Otago region, there was not much difference between the initial draft agency map and the PPGIS place map (23 vs. 25 places). Given the similarity in the number of PPGIS generated places in Southland and
Figure 6. A map viewer that displays the location of hotspots (places) within the Southland region. Visitors to the website can view and comment on the results.
Otago, the results suggest that between 20 and 25 places would be a reasonable heuristic.

In the hierarchy of places, the chosen nomenclature should assist both the agency and public in communication. We suggest the use of sub-regions to identify the top-down partitioning of the conservancy into the ‘jigsaw’ puzzle pieces while reserving the term ‘places’ for those areas identified through the PPGIS process. The sub-regions provide general location (e.g. Northwestern) within the conservancy while the places identify more specific place features (e.g. the Takitimu area).

Using PPGIS to better inform place identification and demarcation is a modest proposal for implementing effective place-based conservation management. Getting the places right is not likely to resolve fundamental differences in public opinion about the appropriate conservation policies to be implemented in places, but there is benefit that accrues from understanding broad public perceptions about the relative abundance of conservation resources and associated public values in specific locations. The four conservation resources for which DOC is legally entrusted are not necessarily compatible (e.g. tourism development may conflict with natural heritage). Where different resource places coincide, special management attention will be required to achieve conservation outcomes.

Future research should examine public receptivity to alternative conservancy place maps. It would be relatively easy to generate a series a place maps for a conservancy that represent a pure top-down approach, a pure-bottom-up approach and the integrated approach as suggested herein. Preferences could be determined through polling or focus groups as part of the public consultation process. The identification and demarcation of places can never be rendered into a deterministic formula but it does appear possible to advance the art of place-making through participatory GIS processes that integrate multiple human perceptions of place.

References


