Overlapping Values

Intersection of High Conservation Values, Question 19

Is there a significant overlap of values (ecological and/or cultural) that individually did not meet HCV thresholds, but collectively constitute HCVs?

Background

The analyses conducted throughout a High Conservation Value Forest assessment process are focussed on identifying values that are independently critical or outstanding. This approach to assessing the landscape is susceptible to overlooking areas in which there is a confluence of several values, which considered in isolation do not represent a significant contribution, but when looked at collectively meet the criterion of being critical or outstanding. This is the intent of Question 19 – to locate those areas of significant concentration of a given type of value or areas which contain the overlap of multiple values.

Data Sources

The data inputs to the analyses for Question 19 should include all values considered for each of the preceeding 18 quesitons. This list should include all values assessed: those which were confirmed as HCVs; those which were found to be possible, potential or marginal; and those which were ruled out, but still present on the landscape (e.g. species at risk present or potentially present in the landscape but not in sufficient concentration). It is recommended that extra attention be given to delimiting and mapping all potential and marginal HCVs while they are being investigated in their respective focal Question, so as to facilitate their inclusion in the Question 19 analysis.

The inclusion of previously confirmed HCVFs in this analysis is intented to highlight opportunities to extend HCVF zones to capture neighbouring areas of concentration which may not have seemed relevent without their adjacency to "core" HCVF areas, or to potentially adjust their management strategies to accommodate the maintenance of secondary, overlapping values (e.g. an HCVF zone identified to mitigate a steep slope's erosion potential, could be modified very slightly to also be beneficial to a rare talus community which may not have qualified for HCVF status on its own).

If the results of a protected areas gap analysis are availabe, these can be used to help guide the selection of areas, but does not necessarily need to be included in the analysis as a value in and of itself.

Interpreting the Precautionary Principle

Several existing reports have declined to report on overlapping values due to problems with data quality and the potential difficulty in interpreting the analytical results they would produce.

In particular, an assumption made by virtually all analytical methods discussed below is that there is even sampling or coverage or data aross the area of investigation. With the exception of remotely sensed imagery, all data sources suffer this problem to some degree.

Values will often be based largely on "point" occurrence data. These type of data are inherently biased towards transportation corridors, populated places and other access points. This problem of "white holes" in the data can be particularly pronounced in boreal landscapes.

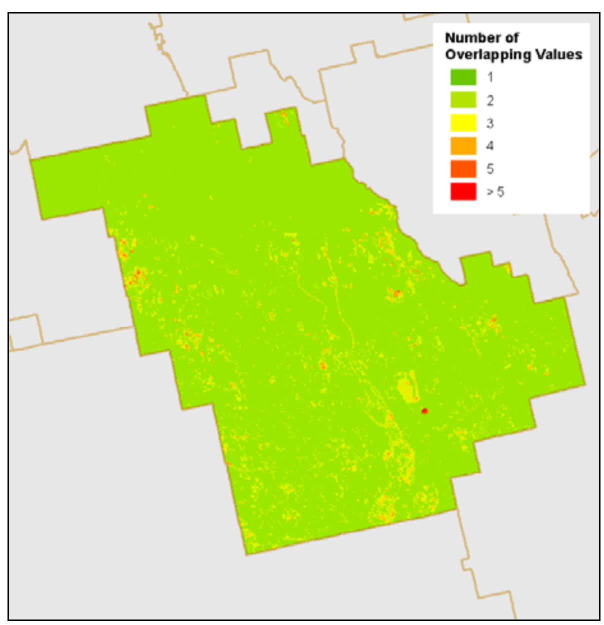
We must acknowledge the shortcomings of the information available, but analyses of overlapping values should not be forgone because of these limitations.

Additionally, it should be remembered that HCVF analyses are iterative processes, and the coincidences of gaps in the data can identify areas for future survey effort.

Additional Guidance

Many methodologies have been used to summarize the conservation values present on a landscape and

Figure 19.1 Additive, unweighted overlay of all HCV values using a 150 m resolution grid. Areas of high value overlap tend to be restricted to regions spanning only a few pixels, and are not conducive to identifying HCVF zones.



allocate areas to conservation or special management zones.

Overlay Analyses

Overlays are typically performed as raster-based analyses in which map layers representing each value under consideration are algebraically summed to produce a final surface illustrating the direct spatial intersection of the values. The inputs layers can be weighted to put more importance on values determined to have more significance in the analysis at hand. For example, a layer representing occurences of a G1 ranked species at risk might receive a heavier weighting than an S2 species.

While this method will illustrate the direct areas of overlap, these areas will be dependent on the resolution of the grids (pixel size) of data used and may not represent the zone required to actually address the management of the values identified. Figure 19.1 illustrates an additive, unweighted overlay of hypothetical values on the Spanish Forest. It should be noted that areas of high overlap in this type of assessment are restricted to regions comprised of only a few pixels. This is largely driven by clustered species at risk occurrence data.

Neighbourhood and Density Analyses

Neighbourhood and density analyses summarize multiple layers of data by calculating the number or denisty of values present in a search window of a user-defined size. Theoretically, the size of this search window should be of a scale appropriate to the values being addressed, avoiding the problem of identifying "pixels" of high value, noted above.

The difficulty in implementing neighbourhood and density approaches is the large diversity of values which are simultaneously being addressed. These values are potentially at greatly different scales, both with repect to the spatial extent of the value being measured (e.g. greater than 500,000 ha large landscape level forests, versus species at risk element occurences on the order of tens or hundreds of hectares), and the accuracy with which it has been recorded (e.g. digital elevation models at 30 or 90 metres resolution, forest resource inventory information at 1:10,000 scale, national level datasets at 1:1,000,000 scale). Additionally, the varied topologies of the input data (i.e. points, lines, polygons) can create computational difficulties in assessing a neighbourhood density.

Optimization algorithms

Optimization algorithms are used to find the most efficient solution to achieve a stated set of goals given a stated set of constraints (Williams *et al* 2004). In the context of conservation planning, this usually entails starting with raster-based layers of conservation values (as in an overlay analysis), and selecting the cells which most fully achieve the stated conservation objectives, usually constrained to either the smallest possible area, or allocated based on a cost function. For example, an optimization may have a goal of capturing 30% of the potential habitat for a suite of species in the smallest possible area, or capturing the maximal amount of potential habitat for a suite of species in 5,000 ha.

Some of the more common algorithms used for conservation planning are listed below.

- CPLAN (http://www.ozemail.com.au/~cplan)
- MARXAN (http://www.ecology.uq.edu.au/marxan.htm)
- SITES (http://www.biogeog.ucsb.edu/projects/tnc/overview.html)

While these techniques are powerful tools to summarize information and prioritize lands for conservation planning, at their core, their applicability to HCVF assessments is not as clearly defined. Optimization routines are dependent on setting goals and articulating the constraints under which the goals must be achieved. The intent of HCVF assessments in general, and Question 19 in particular, is to identify those areas which are critical or outstanding, without constraint. That is, if 80% of a forest is found to be of high value, then 80% of the forest should be identified as HCVF. There is no need to balance or optimize the selection of HCVF areas against a set of constraints. More important is the objective setting of thresholds

Table 19.1 Proposed thematic groups of HCV values and thresholds for the number of occurrences which would constitute an HCVF zone under Question 19.

Theme	Inputs	Threshold and Rationale	
Biodiversity	Q1, Q2, Q3, Q4, Q5	≥ 5	High threshold set to avoid bias of clustered sampling of species data
Protected Areas	Q6	≥ 2	Potential provision of connectivity between occurrences
Intact Forest	Q7, Q10	≥ 2	Potential provision of connectivity between occurrences
Ecosystems	Q8, Q9, Q11	≥ 3	Areas of high beta diversity
Basic Services of Nature	Q12, Q13, Q14, Q15	≥ 2	Precautionary approach to the maintenance of ecosystem services
Social Values	Q16, Q17	≥ 3	Areas of multiple use or culturally significant for several reasons
Diversity of Values	Presence or absence of each of the above listed themes	≥ 5	Presence of a substantial diversity of values, recognizing that several values will likely be spatially auto-correlated (e.g. protected areas, intact forests and biodiversity)

against which to assess the values under investigation. If a particular value does not meet the threshold, then there is no need to identify areas as HCVF just to satisfy a quota.

Overlay summarized by ecological units

Much in the same way that neighbourhood analyses summarize the values present within a defined window, we can use pre-existing ecologically defined units in the landscape (e.g. FRI stand polygons, ecosite polygons, etc.) to summarize the results of an overlay analysis. While this method may not accurately represent the scale of certain values being assessed, the use of pre-defined units nonetheless ties the summary of values to ecological communities and processes more than a pixel by pixel derivation of HCVF zones.

Thresholds for concentrations of individual values and for diversity of values

Summarizing values to ecological units is the first step in identifying critical or outstanding areas of overlapping values. To actually delimit HCVF zones for Question 19, thresholds need to be identified and applied to these summarized results.

We propose that a suite of thresholds should be used to identify outstanding areas, considering both the overlaps of numerous values which are thematically similar, and overlaps of different themes. Grouping all data inputs by HCV theme could result in the potential categories and thresholds listed in Table 19.1. In addition to thresholds for overlapping values within a given theme, we also propose threshold for areas that contain a diversity of themes.

Figures 19.2 and 19.3 illustrate the investigation of two of these proposed thresholds, the overlap of biodiversity values, and the diversity of values, respectively. The analyses summarized the overlay of all values by ecosite polygon. It can been seen that, while there are obvious spatial congruencies between these analyses and the unweighted overlay of Figure 19.1, these analyses are able to identify actual units in the landscape that can be considered for HCVF status.

SUMMARY OF RECOMMENDATIONS

- Analysis should incorporate all previously assessed values, both those which met the threshold of HCV and those that did not
- It is recommended that an additive overlay of all values be conducted, summarizing the values using ecological units, such as stand or ecosite polygons
- Multiple thresholds should be identified, both for overlaps of many thematically similar values, and for the diveristy of values present

LITERATURE CITED

Williams, J., C. ReVelle and S. Levin. 2004. Using mathematical optimization models to design nature reserves. Frontiers in Ecology and the Environment 2(2) : 98-105

Figure 19.2 Ecosite polygons shaded according to the number of biodiversity-theme values (as per Table 19.1) which they contain. Using the threshold proposed in Table 19.1, those polygons containing 5 or more values (shaded red) would be designated HCVF.

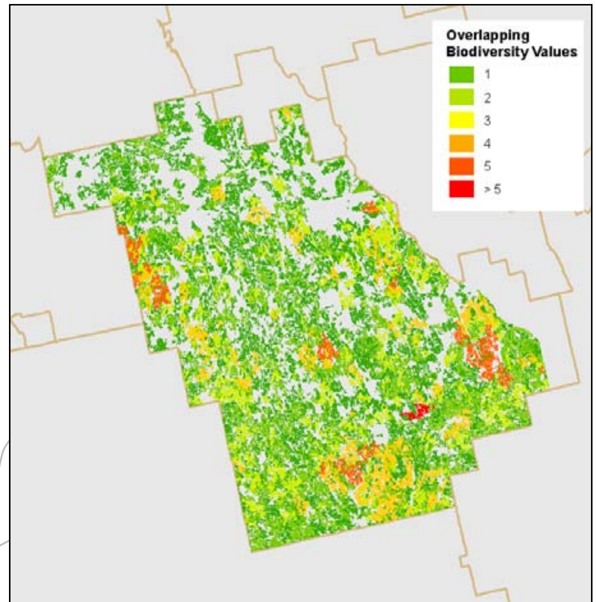
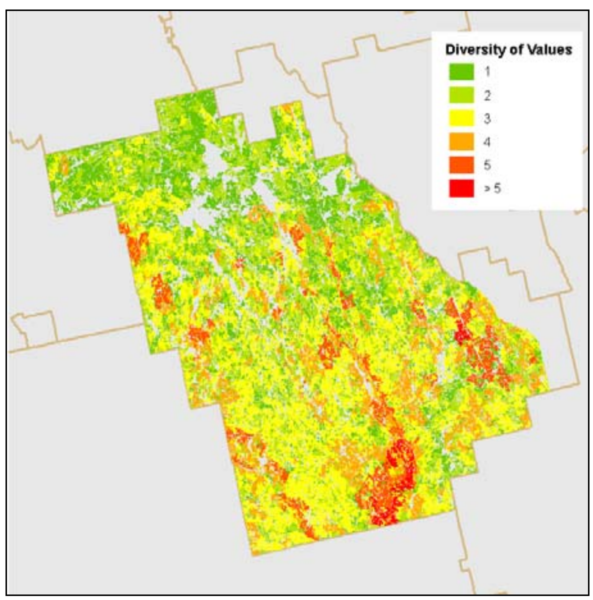


Figure 19.3 Ecosite polygons shaded according to the diversity of HCV themes (as per Table 19.1) which they contain. Using the threshold proposed in Table 19.1, those polygons containing 5 or more values (shaded red) would be designated HCVF.



Q19 – Overlapping Values

McCarthy, T., R. Arnup, J. Nieppola, B. Merchant, K. Taylor and W. Parton. 1994. Field guide to forest ecosystems of northeastern Ontario. NEST Field Guide FG-001.

Methodology

Figures 19.1, 19.2 and 19.3

Data Sources

- WWF-Canada. Designated Areas Database
- CCEA. Canadian Conservation Areas Database (CCAD)
- OMNR. Natural Resource Value layers
    - Regulated Provincial Parks layer
    - Regulated Conservation Reserves layer
    - Crown Game Reserves layer
    - Conservation Authority Lands layer
    - ANSI layer
    - Camps – Recreational layer
    - Deer Yards layer
    - Moose Aquatic Feeding Areas layer
    - Nesting Sites layer
    - Trails layer
    - Wildrice beds layer
- Ontario Natural History Information Centre (NHIC)
    - ANSI-ES Sites
    - ANSI-LS Sites
    - ANSI-LSC Sites
    - Life Sciences (ESA) Sites
    - International Biological Programme (IBP) Sites
    - All Tracked Species and Communities Element Occurrences (1km buffered points)
- Global Forest Watch Canada. Large Remaining Unfragmented Forest Areas (revised). 2001.
- SRTM 90 m Digital Elevation Model. Slope surface derived and reclassified as per the Question 14 guidance using ArcGIS Spatial Analyst 9.
- Forest Resource Inventory polygons.
    - Used in conjuction with tree species range maps from http://climchange.cr.usgs.gov/data/atlas/little to identify occurrences of range edge species.

Methodology

- *N.B.* All input HCVs used for the Spanish Forest are hypothetical and are based on a survey of HCVs identified in the region, but not on any existing HCVF assessment of the Spanish. These are meant for illustrative purposes of this example only.
- Forest Resource Inventory (FRI) polygons were processed using the Ontario Wildlife Habitat Analysis Model (OMNR 2002) software application. This tool allocates FRI polygons to Northeastern Forest Ecosystem Classification site types (as per McCarthy *et al* 1994) using stand attributes.
- Adjacent ecosite polygons were then merged to create polygons of contiguous ecosite type
- All values data was rasterized, using the slope grid as a base.
- These grids were map algebraically summed to produce the unweighted overlay map illustrated in Figure 19.1
- Each individual input data layer was categorized into one of the six themes identified in Table 19.1
- Using the zonal statistics functionality of ArcGIS Spatial Analyst, occurrences of values in each input theme was summarized by ecosite polygon
- Figure 19.2 illustrates the ecosite polygons shaded according to the number of occurrences of "Biodiversity" values (as per Table 19.1) found within it
- Figure 19.3 illustrates the ecosite polygons shaded according to the number of different themes (as per "Diversity" in Table 19.1) found within it