

Does wildlife information influence public acceptability of development?

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Maximum public acceptability of development in Vermont was slightly more than 32 households/km² and clustered housing patterns were strongly favored over sprawled development. Acceptability was influenced by views on some common species, including bear and fisher, involvement in two forms of recreation, including birding and hunting, as well as demographic factors.

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<http://www.nsrcforest.org>

Project Summary

- ❖ Increasing development like roads and houses will alter the future landscape of Vermont. Development provides important resources for people and society, but also results in consequences for wildlife and opportunities for recreation. Managing development requires information on the public's acceptability of development and how acceptability is shaped by information on various consequences.
- ❖ In this study, we examined three questions: 1) What is the public's acceptability of development in terms of amount and spatial pattern of housing? 2) Does wildlife information influence public acceptability of development and 3) Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?
- ❖ We sent a visual preference survey to 9,000 households in Vermont that asked questions about development, wildlife, recreation, and demographics. We assessed acceptability of amount of development using social-norm curves and used parametric significance tests and mixed-effects models to examine the influence of wildlife, recreation, and demographic factors.
- ❖ The survey response rate was 44%. The maximum acceptable amount of development was slightly more than 32 households/km² and not meaningfully influenced by the broader consequences of development on seven common wildlife species. The public demonstrated a strong preference for clustered development over sprawled development, which became unacceptable at 20 households per km². Maximum acceptability of development was significantly influenced by views on some species, including bear, fisher, raccoon, and coyote, but not by others such as deer, fox, and bobcat. Similarly, those involved in two common forms of outdoor recreation, birding and hunting, were significantly less accepting of development relative to those not involved in these forms of recreation. Maximum amount of development was also affected by four demographic factors, including town density, whether a respondent was born in Vermont, whether a respondent was a homeowner, and year a respondent was born.
- ❖ The results provide a baseline measure of the public's acceptability of development, which can be used to guide decision-making about amount and pattern of development, wildlife management, and efforts to promote recreation in the state.

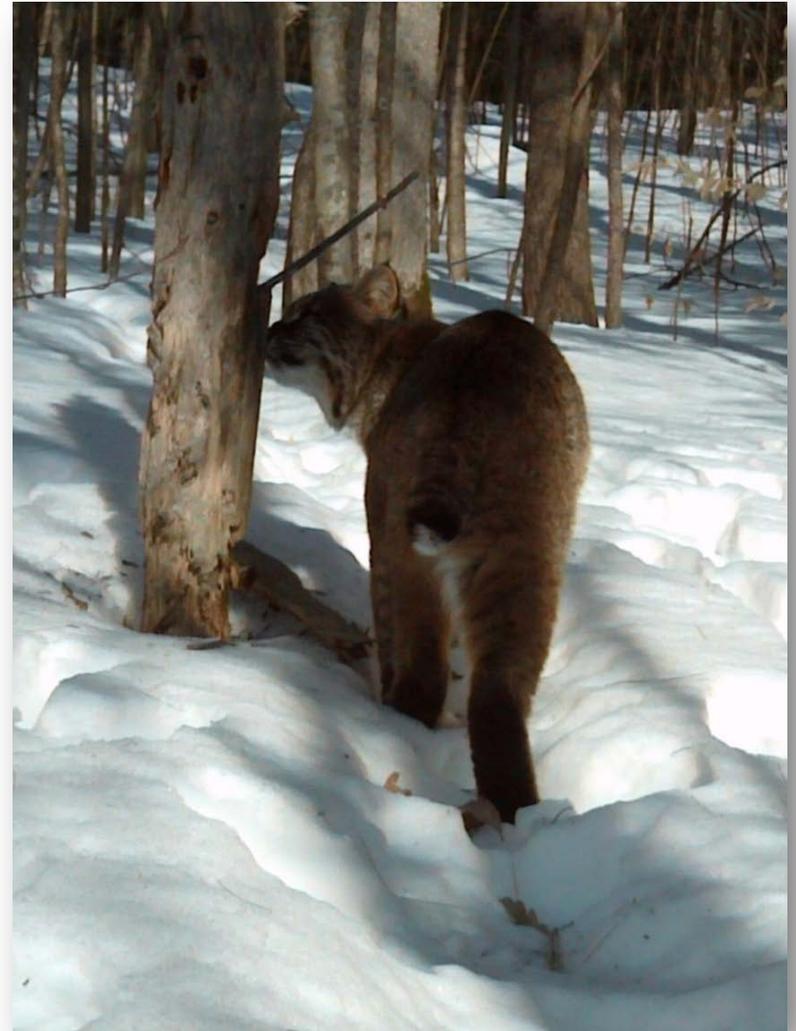
Background and Justification

- ❖ Projected increases in human population growth are expected to increase forest loss and fragmentation into the next century.
- ❖ Populations of Vermont, New Hampshire, and Massachusetts are predicted to grow 17%, 33%, and 10%, respectively, between 2000 and 2030, collectively adding 1.2 million people¹.
- ❖ In addition to adding more people to the landscape, each person is taking up more space. Currently, residential housing accounts for 87% of land use change in MA even in areas where population growth is roughly flat².
- ❖ In Vermont, the rate of land conversion to development is 260 times faster than population growth³.



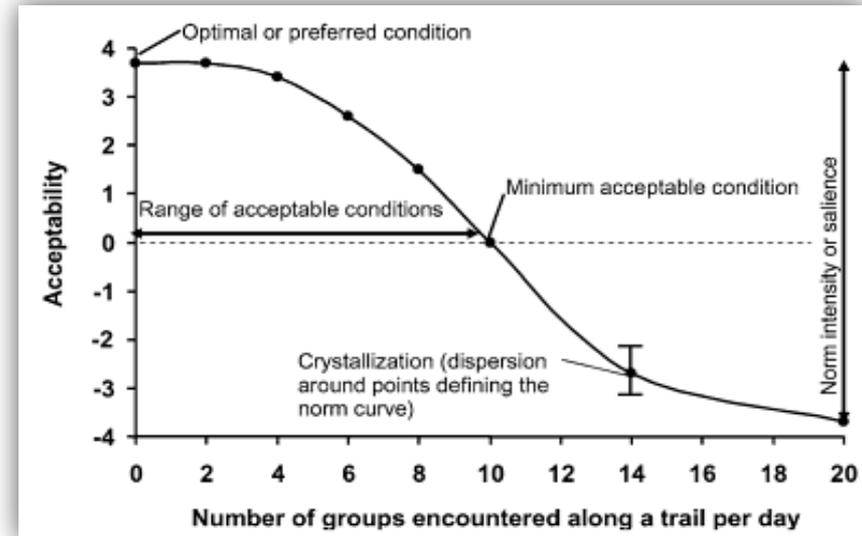
Background and Justification

- ❖ Increasing development like roads and houses will alter the future landscape of Vermont.
- ❖ Development provides important resources for people and society, but also results in consequences for wildlife and opportunities for recreation.
- ❖ Managing development requires information on the public's acceptability of development and how acceptability is shaped by information on various consequences.
- ❖ For example, if you were presented with information on how deer would decline due to a certain amount of development, would you be more or less accepting of that development? Would your level of acceptability be changed by your involvement in recreational activities, like hunting?



Background and Justification

- ❖ Predicting future land use change is extremely challenging, especially in Vermont, where development is driven at the town level.
- ❖ One way to gauge the potential for future development is through visual preference surveys that ask respondents to identify their acceptability for different levels of development⁴.
- ❖ These surveys can serve as a basis for understanding how much landscape change is acceptable and also how that change will affect wildlife populations.
- ❖ We addressed three questions: 1) What is the public's acceptability of development in terms of amount and spatial pattern of housing? 2) Does wildlife information influence public acceptability of development? and 3) Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?

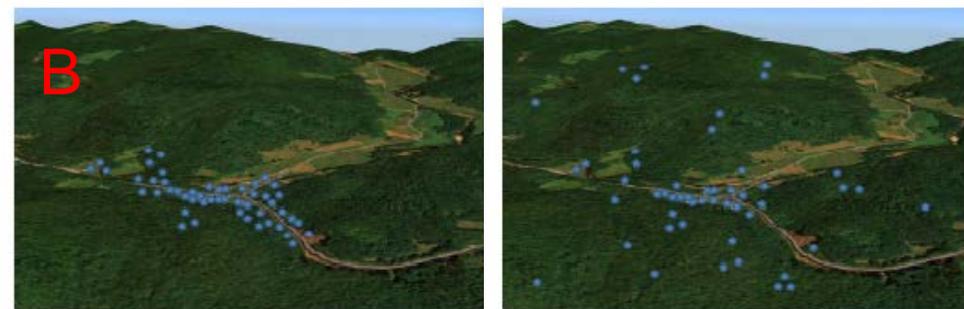
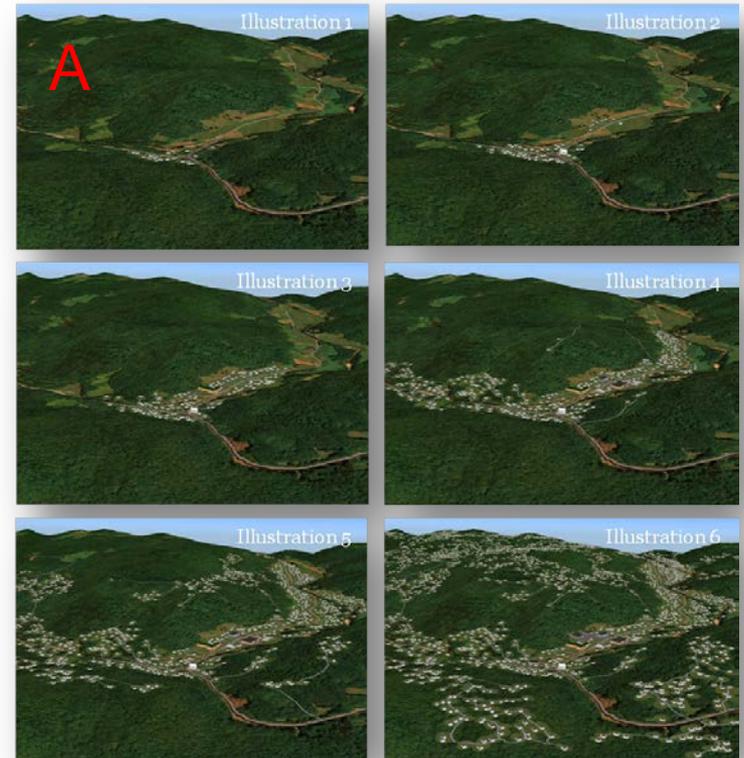


Determining acceptability – this is a hypothetical example of results from a study that assessed the minimum acceptable condition for number of groups encountered along a hiking trail per day⁴. Respondents were given a visual preference survey that included a series of images showing a trail with increasing numbers of groups. For example, image 1 had no other hikers, whereas image 11 had 20 groups of hikers. Respondents were asked to rate each image on a scale from -4 (completely unacceptable) to +4 (completely acceptable). The plot above shows mean responses (as dots) and the maximum acceptable condition was the point at which the curve crosses zero or the x-axis (here, it would be 10). This curve is referred to as a *social norm curve* and it can be useful in identifying public acceptability. In our study, we used social norm curves to estimate the maximum acceptability of development and the influences of various factors on responses, such as wildlife information.

Methods

1) *What is the public's acceptability of development?*

- ❖ We sent a visual preference survey to 9,000 households in Vermont. The survey included six illustrations (A) of a town showing increasing amounts of development and respondents were asked to rate each illustration on a scale of -4 (completely unacceptable) to +4 (completely acceptable). We estimated the maximum acceptable development by building a social norm curve from results⁵.
- ❖ We also asked respondents to rate four pairs of images showing different patterns of development (B). Each pair included the same number of houses in a clustered (left) and sprawled pattern (right). Pairs showed increasing development.



Methods

2) *Does wildlife information influence public acceptability of development?*

- ❖ We divided our surveys into two groups: 1) *control*, which presented illustrations just with development, and 2) *wildlife*, which presented each illustration with a legend that included information on the presence or absence of seven common species. Social norm curves were built for each, then compared.
- ❖ Occupancy models⁶ were used to estimate presence and absence in each illustration along with input from experts. An occupancy model is a mathematical expression that predicts probability of occupancy at a given site. We built models from camera trap data⁷, then applied models on a pixel by pixel basis to each illustration to estimate presence/absence.



	Illustration Number					
	1	2	3	4	5	6
Black Bear	√	√	√			
Fisher	√	√	√	√		
Raccoon			√	√	√	√
Deer	√	√	√	√		
Bob cat	√	√	√	√		
Coyote	√	√	√	√	√	
Fox			√	√	√	√

Methods

3) *Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?*

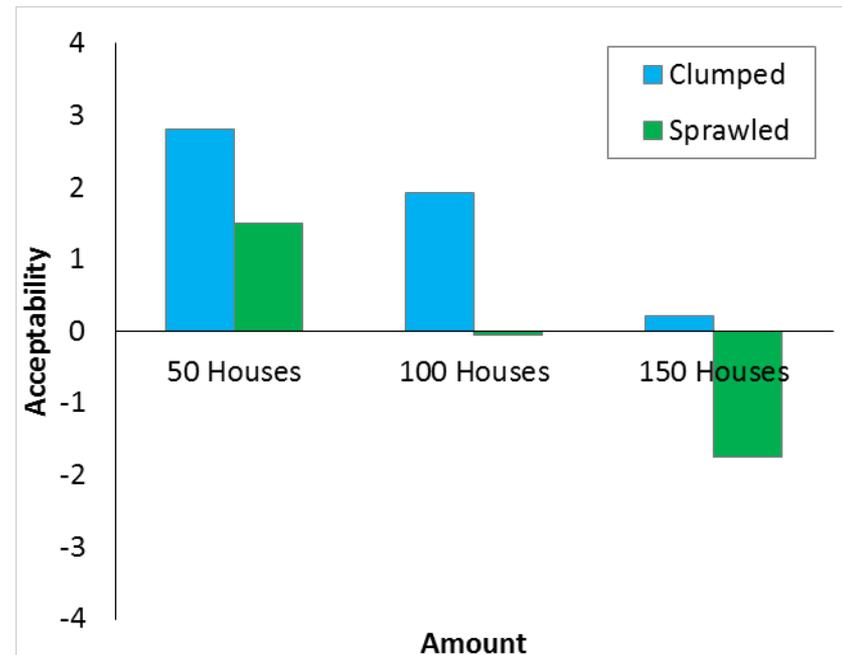
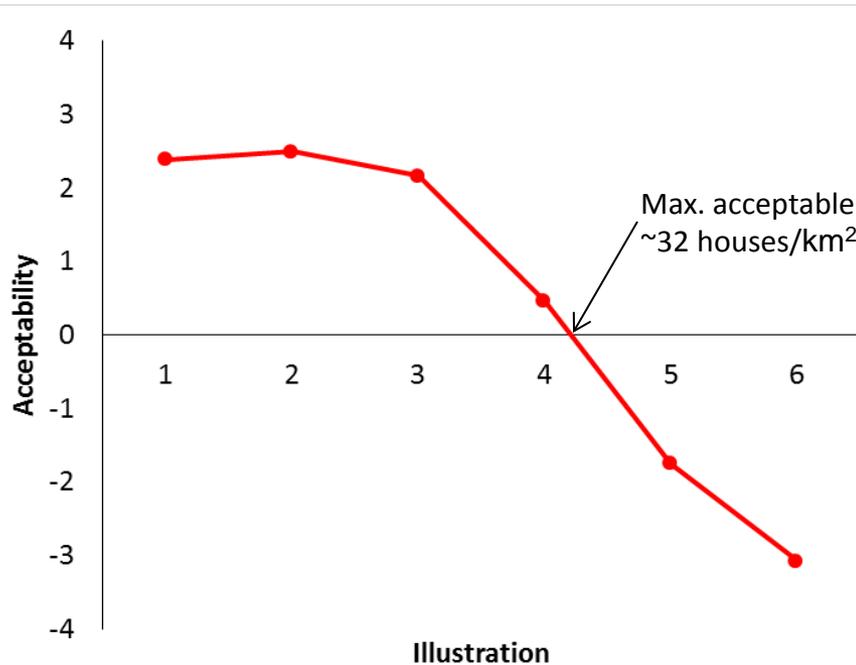
- ❖ We included a questionnaire that asked respondents about wildlife, recreation, and demographics. Respondents were asked to rate acceptability of each wildlife species living in or near their town using the -4 to +4 scale. They were also asked which forms of common recreation they engaged in, including birding, hiking, hunting, fishing, ATV-ing, farming, snowmobiling, camping and none. Lastly, respondents were asked for the following demographic information: year born, whether born in Vermont, whether Vermont was primary residence, and whether a homeowner. Analysis involved building a social norm curve of development acceptability for each respondent, using a cubic function to describe the curves mathematically and estimate maximum acceptability, then using mixed models and model selection techniques to evaluate (model) the influence of wildlife, recreation, and demographics on maximum acceptability⁸.



Results

1) *What is the public's acceptability of development?*

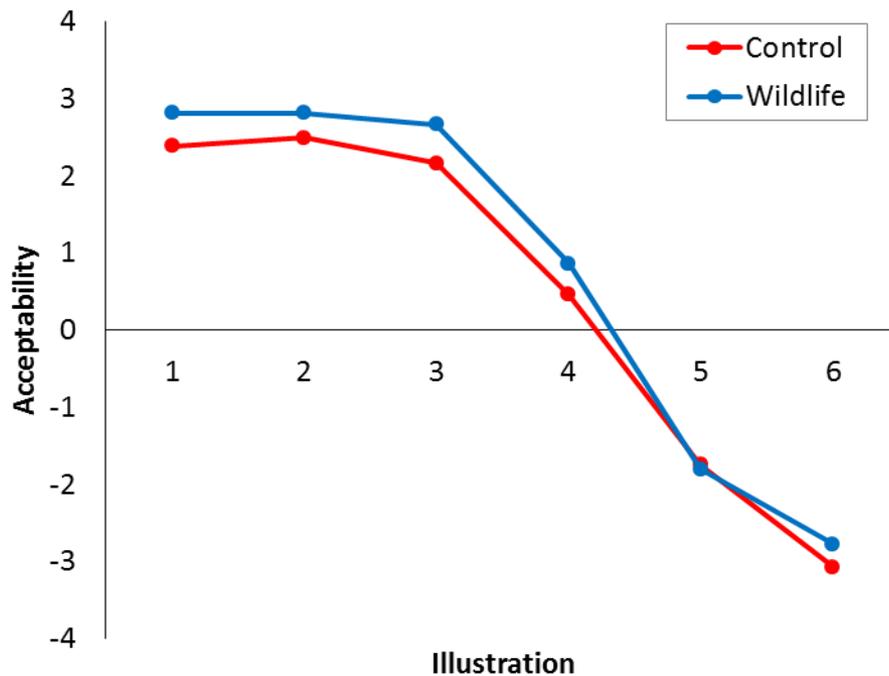
- ❖ Survey response rate was 44% (n=3,629; 724 undeliverable surveys).
- ❖ Maximum acceptable development was between illustrations 4 and 5, equating to slightly more than 32 houses/km².
- ❖ Clustered development was favored over dispersed development.
- ❖ Maximum acceptable development: clustered = 30 houses/km², dispersed = 20 houses/km².



Results

2) *Does wildlife information influence public acceptability of development?*

- ❖ Maximum acceptable development was between illustrations 4 and 5, equating to slightly more than 32 houses/km².
- ❖ No significant difference between control and wildlife groups.



Results

3) *Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?*

The following represent our top models by category that best explained the data. Each model predicts the maximum acceptability of development (MaxAcc) for a Vermonter.

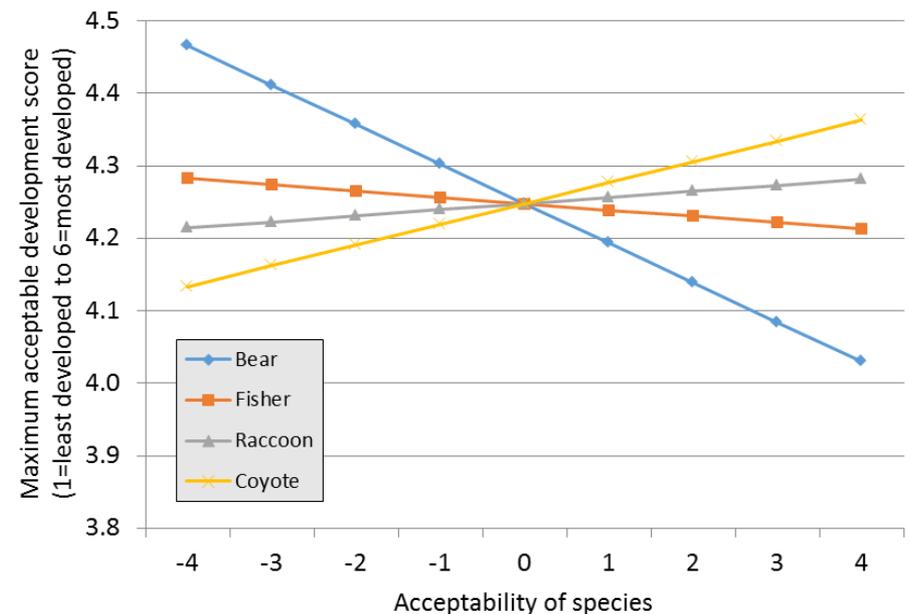
Wildlife

$$\text{MaxAcc} = \beta_{\text{intercept}} + \beta_{\text{Bear}} + \beta_{\text{Fisher}} + \beta_{\text{Raccoon}} + \beta_{\text{Coyote}}$$

Where

$\beta_{\text{Intercept}}$	= 4.248
β_{Bear}	= -0.055
β_{Fisher}	= -0.009
β_{Raccoon}	= 0.009
β_{Coyote}	= 0.029

Interpretation: a respondent's acceptability of four species (bear, fisher, raccoon, coyote, and not deer, bobcat, red fox) best described our data and predicted acceptability. Based on the effect sizes (β values), if one is more accepting of bear and fisher, then that person favors less development. Acceptability of coyote and raccoon had the opposite effect. *Take away* – views on some species matter, especially bear in gauging acceptability of development.



Results

3) *Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?*

Recreation

$$\text{MaxAcc} = \beta_{\text{intercept}} + \beta_{\text{Birding}} + \beta_{\text{Hunting}}$$

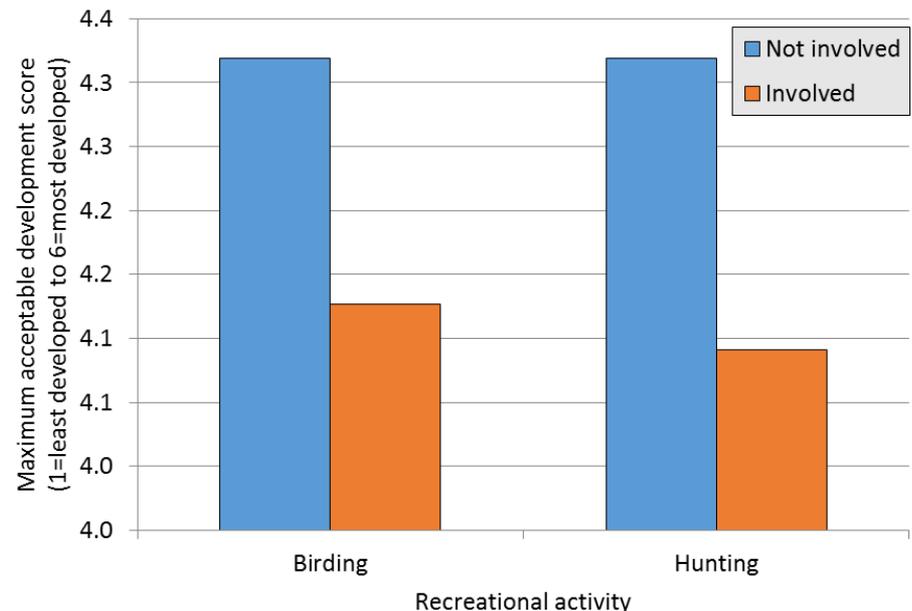
Where

$$\beta_{\text{Intercept}} = 4.319$$

$$\beta_{\text{Birding}} = -0.193$$

$$\beta_{\text{Hunting}} = -0.228$$

Interpretation: a respondent's involvement in two activities (birding and hunting, and not ATV-ing, camping, farming, fishing, hiking, or snowmobiling) best described our data and predicted acceptability. Based on the effect sizes (β values), if one is actively involved in birding and hunting, then that person favors less development. *Take away* – involvement in these two particular activities have the greatest impact on acceptability of development.



Results

3) *Is the maximum amount of acceptable development influenced by views about wildlife, involvement in recreation, and demographic factors?*

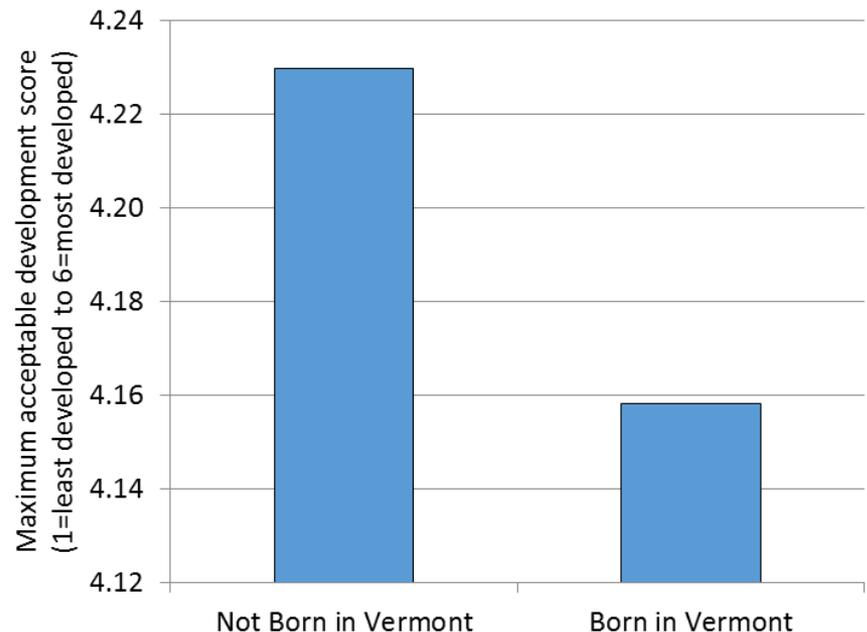
Demography

$$\text{MaxAcc} = \beta_{\text{intercept}} + \beta_{\text{Pop}} + \beta_{\text{VT born}} + \beta_{\text{Year born}} + \beta_{\text{Own house}}$$

Where

$\beta_{\text{Intercept}}$	= -18.000
β_{Pop}	= 0.005
$\beta_{\text{VT born}}$	= -0.094
$\beta_{\text{Year born}}$	= 0.011
$\beta_{\text{Own house}}$	= 0.067

Interpretation: four characteristics (town population size, VT born, year born, own house, and not whether VT is primary residence) best described our data and predicted acceptability. Being born in Vermont had the strongest effect (β value) and was negative, indicating that those born in the state were less accepting of development than non-native Vermonters. Other variables showed the opposite. Those living in larger towns, those that were born more recently, and those that own their own home were more accepting of development. *Take away* – some demographic characteristics predict acceptability of development, which may help with policy and land use planning.



Implications and applications in the Northern Forest region

- ❖ Public acceptability of development is slightly more than 32 houses/km² in Vermont, which may reflect a broader pattern of acceptability in the Northern Forest. This level provides a benchmark for policy related to regulating development.
- ❖ Clustered housing patterns are favored over dispersed housing patterns. Clustered housing approached unacceptability at 30 houses/km², whereas sprawled housing became unacceptable at 20 houses/km². This provides a guide for development planning at the town, county, and state level.



Implications and applications in the Northern Forest region

- ❖ Information on the consequences of wildlife information (as presented in our survey) did not influence maximum acceptability of development. However, people's opinions about certain species influenced the results. Those that are more accepting of bears and fishers accepted less development. Bears especially had a strong effect size, and efforts to promote this species (and fisher) may be a tool to change public opinion about development.
- ❖ Involvement in recreational activities influenced the results. Those involved in birding and hunting were less accepting of development over other types of common recreational activities. Efforts to engage people in these two activities may also be a tool to influence public opinion on development.
- ❖ Four demographic factors influenced maximum acceptable development, including the population size of town, whether born in VT, year born, and whether a homeowner. Our model results provide effect sizes for each of these factors and can be used to predict levels of acceptability at multiple spatial scales for landscape planning.

Future directions

Three areas for future study that build from our project include:

- ❖ Examining whether type of information matters. We presented wildlife information as the presence/absence of species under different scenarios of development. Future studies could consider evaluating how other presentations of data (e.g., population size of species) influence development acceptability.
- ❖ Examining whether information can change opinions on development. Our results indicated that views on some species, like bear, and involvement in some recreational activities, like hunting and birding, influence acceptability of development. Future studies could assess whether promoting certain species and recreational activities among the public actually results in changes in acceptability.
- ❖ Examining whether acceptability changes over time due to Shifting Baseline Syndrome⁹. As the landscape develops, 'baseline' opinions on the state of the environment may change – in other words, what is perceived as 'normal' today in terms of species present, amount of forest, number of houses, etc. in a landscape may be very different from perceptions of normal in previous generations. This may have serious consequences for wildlife and recreation management and should be considered for future study.



List of products

Manuscripts in preparation (peer-reviewed)

Espenshade, J., J. Murdoch, T. Donovan, R. Manning, C. Bettigole, and J. Austin. *In prep.* Public acceptability of development in the Northern Forest of Vermont, USA – the influence of wildlife information, recreation involvement, and demographic characteristics. Target journal: *Society & Natural Resources*, anticipated submission: August 2015.

Espenshade, J., J. Murdoch, T. Donovan, and R. Manning. *In prep.* Does outdoor recreation influence acceptability of wildlife? Target journal: *Human Dimensions of Wildlife*, anticipated submission: August 2015.

Espenshade, J., J. Murdoch, T. Donovan, R. Manning, and B. Fisher. *In prep.* How perception of development influences views on landscape change. Target journal: *Society & Natural Resources*, anticipated submission: September 2015.

Graduate thesis

Espenshade, J. 2015. How wildlife information, recreation involvement, and demographic characteristics influence public acceptability of development. Master of Science thesis, University of Vermont, Burlington, Vermont.

Conference presentations

Espenshade, J., J. Murdoch, and R. Manning. 2016. Public acceptability of development in the Northern Forest of Vermont, USA – the influence of wildlife information, recreation involvement, and demographic characteristics. Human Dimensions of Fish and Wildlife 'Pathways Kenya' conference, Nanyuki, Kenya, January 10-13.

Espenshade, J. 2015. How wildlife information influences public acceptability of development. Student Research Conference, University of Vermont, Burlington, Vermont, March 23, 2015.

