The information planners need to conserve nature in their jurisdictions

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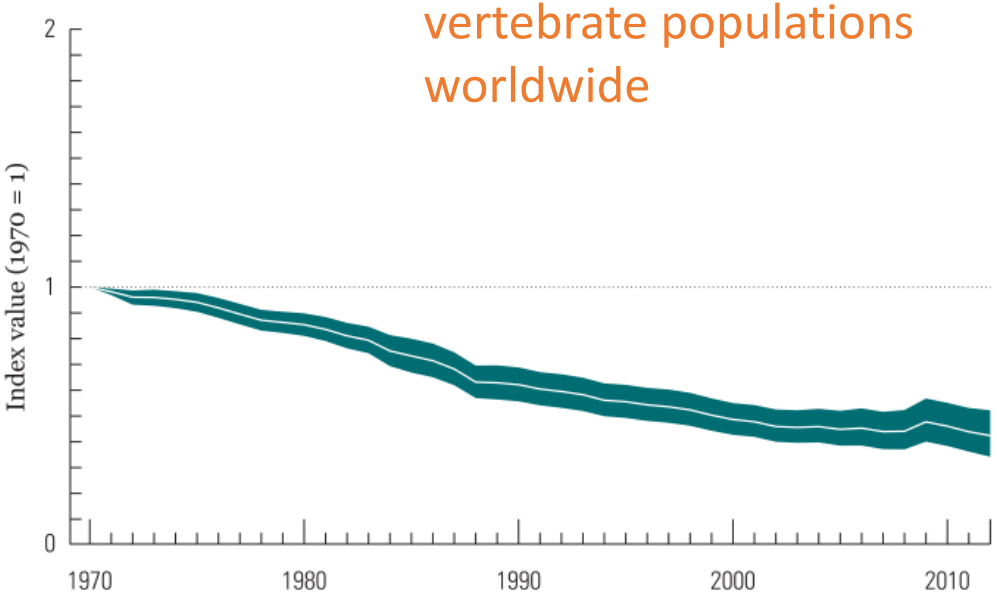
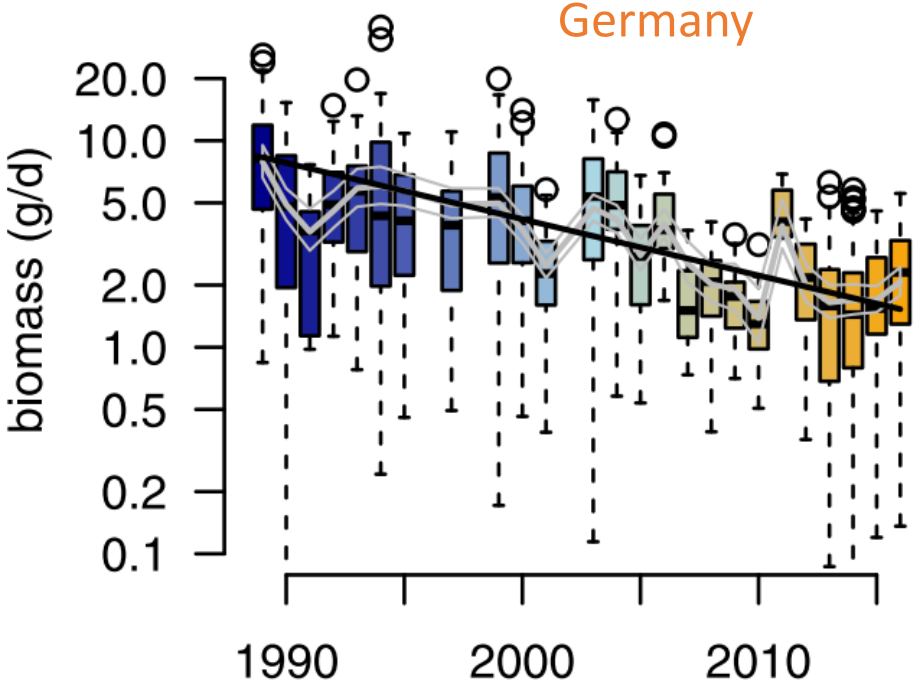
Biodiversity Loss

58% average decline in vertebrate populations worldwide



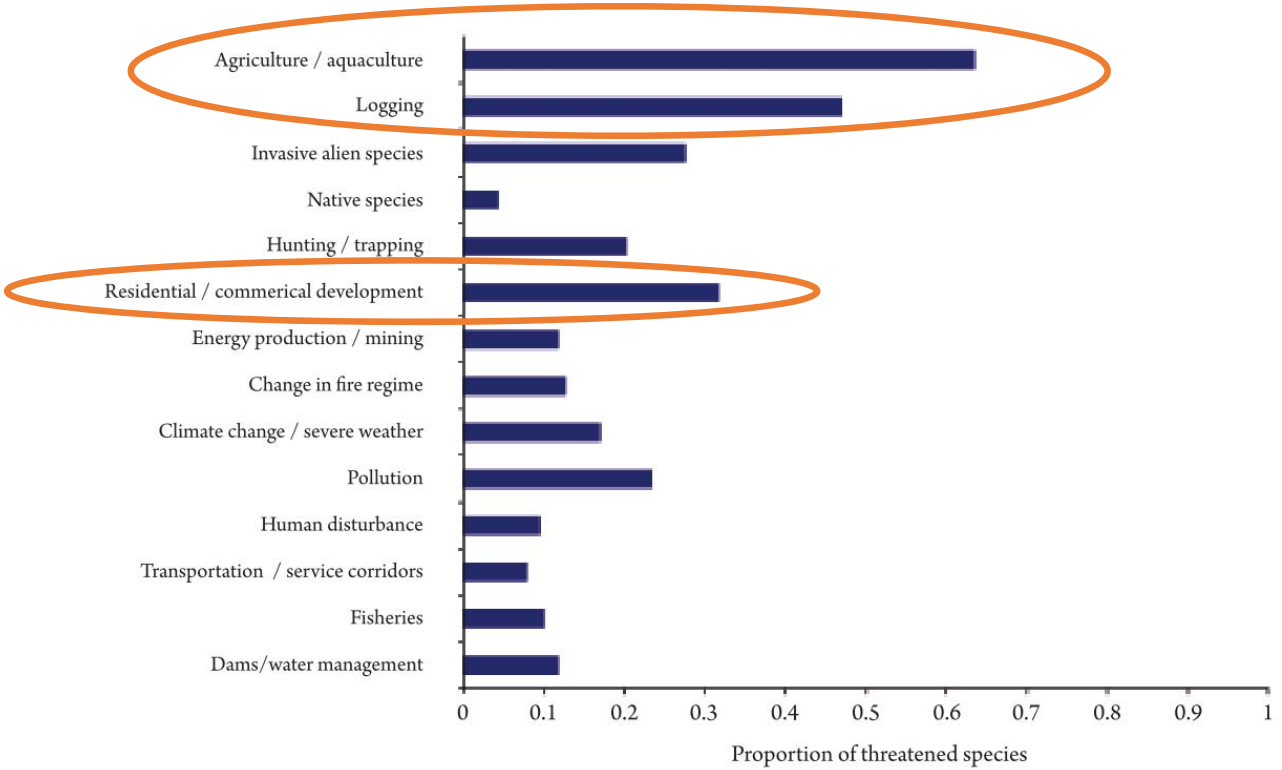
WWF Living Planet Report 2016

78% decline in insect biomass in protected areas in Germany



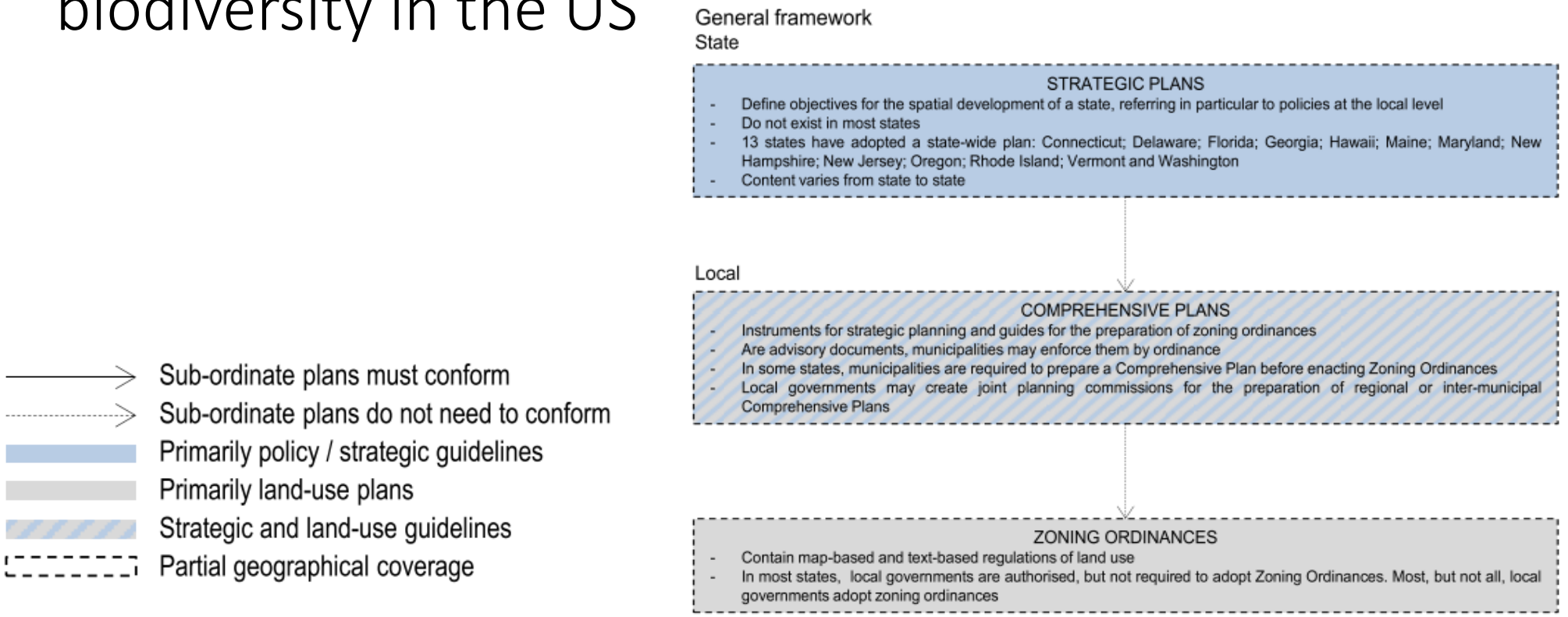
Hallmann et al. 2017. 2017. PLoS ONE 12(10): e0185809.

Land cover and land use change is a major cause of biodiversity loss



Baillie et al. 2010. Evolution lost: status and trends of the world's vertebrates. Zoological Society of London; Brummitt et al. 2015. PLoS ONE 10: e0135152; Collen et al. 2012. Spineless: status and trends of the world's invertebrates. Zoological Society of London; Joppa et al. 2016. Science 352: 416-418.

Municipal and county-scale planning can potentially play a major role in the conservation of biodiversity in the US



Land-use planning systems in the OECD: country fact sheets, 2017

Municipal and county-scale planning can potentially play a major role in the conservation of biodiversity in the US

- Canopy-conscious zoning, tree ordinance clauses, and growth management strategies such as conservation subdivisions significantly increased canopy cover in counties within the Atlanta metropolitan statistical area

Table 3
Tree canopy preservation model parameter estimates.

Variable	*B*	Standard Error	*z* score	Sig.
Constant	−0.1866	0.0371	−5.03	0.000
Tree ordinance	0.0037	0.0165	0.23	0.821
Management	−0.0565	0.0091	−6.2	0.000
% Δ population	0.0218	0.0136	1.61	0.108
Communicate	−0.0025	0.0021	−1.19	0.233
% Δ impervious surface	−1.5633	0.3883	−4.03	0.000
Quality growth examples	0.0058	0.0016	3.6	0.000
Inhibitors	0.0115	0.0026	4.34	0.000
Landuse	0.1200	0.0328	3.66	0.000
Ordinance clauses	0.0103	0.0028	3.74	0.000
Zoning	0.0026	0.0009	2.93	0.003
Tree board	−0.0089	0.0128	−0.7	0.486
Degree of regulation	−0.0137	0.0101	−1.36	0.175
Cobb/Clayton dummy	0.0864	0.0212	4.08	0.000
R^2 = .8015				

Hill et al. 2010. Land Use Policy 27: 407-414.

To realize this potential, planners need useable ecological information

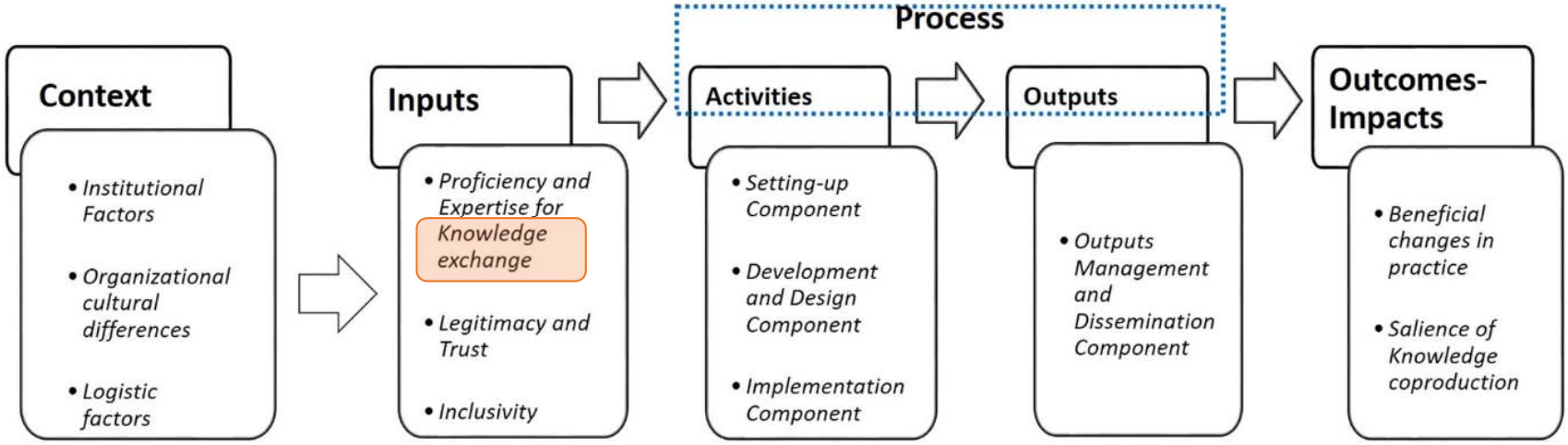
Table 1
A selection of ecological principles, guidelines or recommendations for land use planning. Checkmarks indicate that one or more items in each source requires species-specific information, is not prescriptive, does not consider socioeconomic constraints, or the presentation of items is not sequential. N/A = not applicable.

Source	Species-specific information required	Not prescriptive	Number of items	Not sequential	Does not consider socioeconomic constraints
Soulé (1991)	√	√	5	√	√
Dramstad, Olson, and Forman (1996)	√	√	55	√	√
Duerksen et al. (1997)	√	√	19	√	√
Bennett (1999)	√	√	5	√	√
Dale et al. (2000)	√	√	8	√	√
Zipperer, Wu, Pouyat, and Pickett (2000)		√	6	√	√
Forman (2002)	√	√	7	√	√
Pulliam and Johnson (2002)		√	4	√	√
Environmental Law Institute (2003)	√	√	16	√	√
Environment Canada (2004)	√	√	18	√	√
Li, Wang, Paulussen, and Liu (2005)	√	√	21	√	√
Fischer, Lindenmayer, and Manning (2006)	√		10	√	√
Lindenmayer et al. (2006)	√	√	31	√	√
Colding (2007)			1	N/A	√
Noss (2007)	√	√	7	√	√
Forman (2008)	√	√	121	√	√
Lindenmayer et al. (2008)	√	√	13	√	
Opdam and Steingröver (2008)	√	√	10	√	√
Lovell and Johnston (2009)	√	√	6		√
Stagoll, Manning, Knight, Fischer, and Lindenmayer (2010)	√	√	16	√	√
Sayer et al. (2013)	√	√	10	√	
The present framework			5		

Gagné et al. 2015. Landscape and Urban Planning 136: 13-27.

A more effective approach

- **Knowledge co-production** seeks to produce "usable, or actionable, science through collaboration between scientists and those who use science to make policy and management decisions”



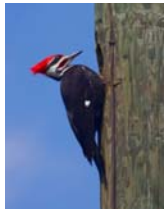
Meadow et al. 2015. Weather, Climate, and Society 7: 179-191; Djenontin & Meadow 2018. Environmental Management 61: 885-903.

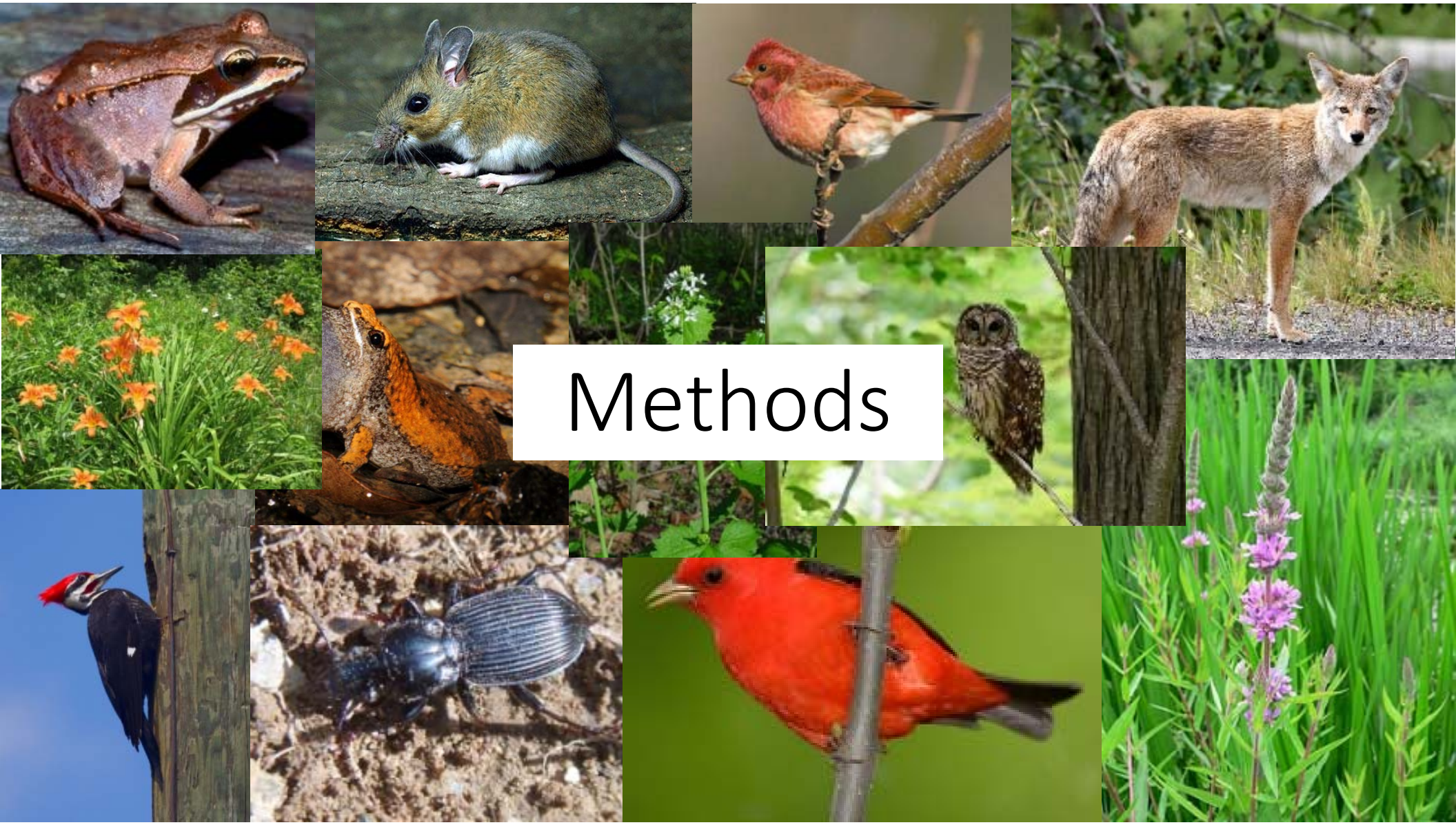
Our research objective

- Facilitate the sharing of knowledge between ecologists and planners on a large scale by soliciting feedback from planners about the content and format of information that they need to most effectively conserve biodiversity in their jurisdictions







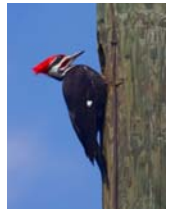
Methods

Study area and identification of potential respondents

- Ten states in the southeastern US: Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia.
- Random selection of counties and municipalities, stratified by state population size in 2016 and the proportions of jurisdictions in each state that were counties or municipalities
- 1,163 potential respondents





Survey instrument

- 31 questions
  - The importance of nature conservation
  - The drivers of nature conservation
  - How nature conservation is implemented
  - The information that planners need to more effectively implement nature conservation
  - The socio-demographic status of respondents
- **Nature:** all non-human animals, plants, and other organisms, as well as the environments upon which they depend for food, water, and shelter
- **Nature conservation:** the protection, preservation, or restoration of nature

Survey instrument and protocol

- Four telephone interviews in June, 2017
  - Two urban municipalities in South Carolina
  - One rural municipality in West Virginia
  - One rural county in Virginia

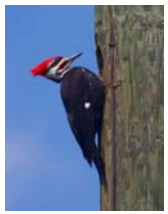
- Survey distributed by email beginning June 27 and closed on July 27, 2017
  - Chance to win one of ten $50 Amazon gift cards
  - University of North Carolina at Charlotte Institutional Review Board approval (Study #17-0256)

Jurisdiction context

- Jurisdiction population density in 2016 (US Census Bureau)
- Jurisdiction population change between 2010 and 2016 (US Census Bureau)
- The proportion of jurisdictions in protected areas (USGS Protected Areas Database of the United States)
- The proportion of jurisdictions encompassed by natural land cover (USGS National Land Cover Database)





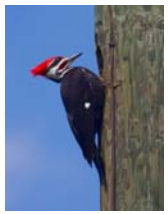



Analyses

- Summarized responses to open-ended questions by assigning them to content categories
- General linear models and redundancy analyses to test for the effect of jurisdiction context on planner responses

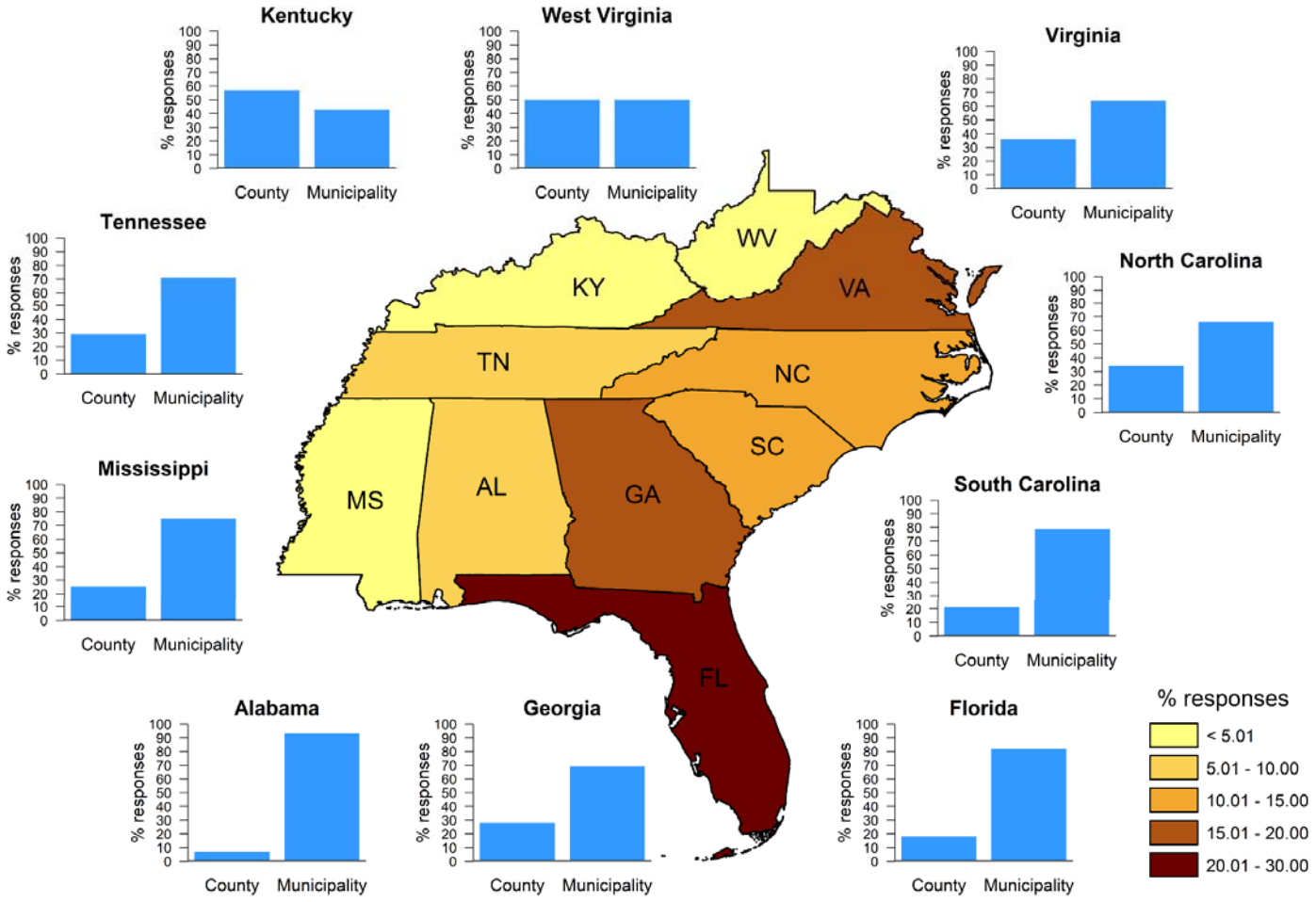




Results

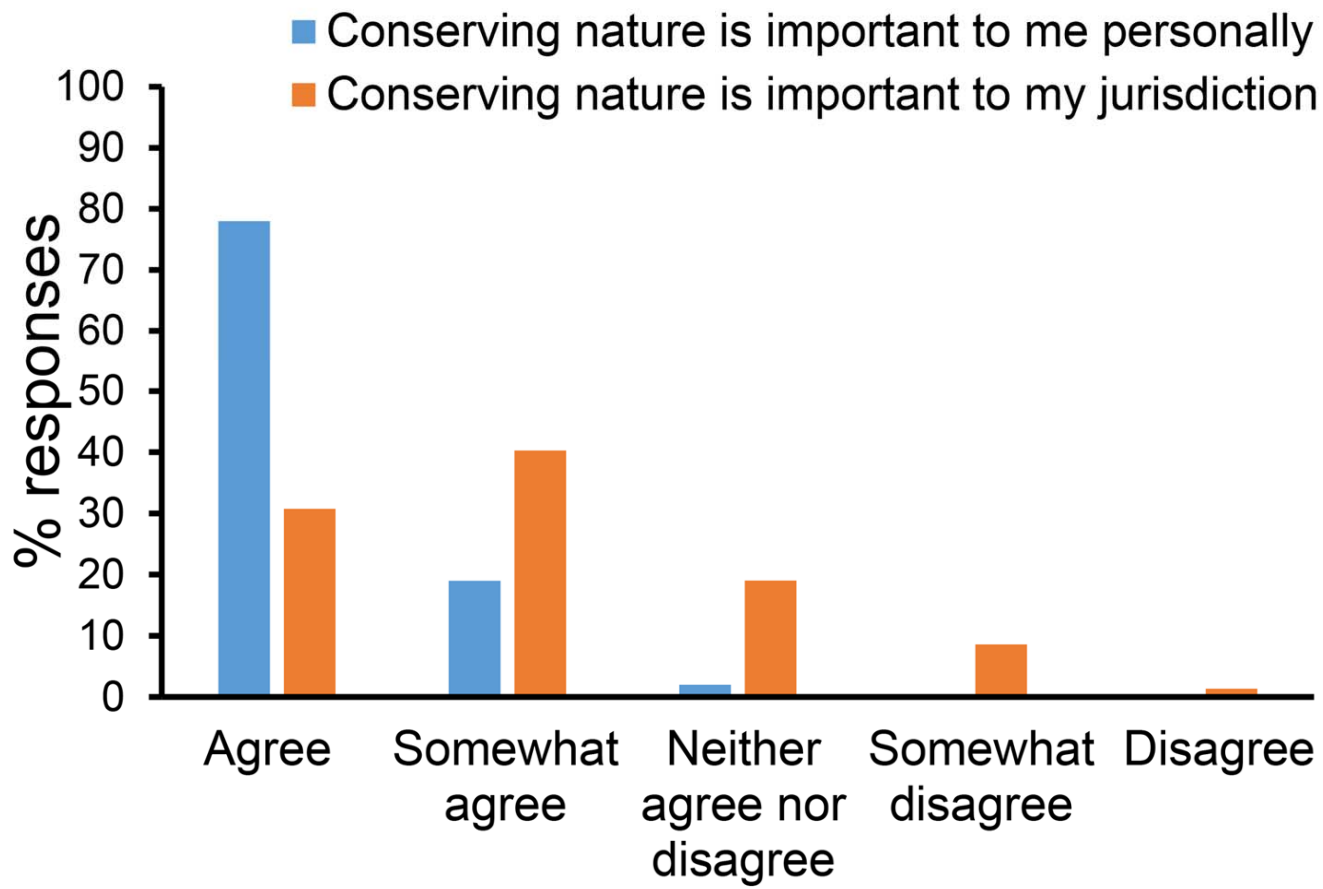
233 responses (20% response rate)



Our respondents

- Directors of planning departments, senior planners, or junior planners (90%)
- Members of American Institute of Certified Planners (40%)
- LEED accredited or LEED green associates (4%)
- White (89%), non-Latino (94%), male (60%)
- Master's or equivalent degree (70%)
- Medians of 45-54 years, $60,000-$69,000 annual income, and "middle of the road" political ideology

Importance of nature conservation



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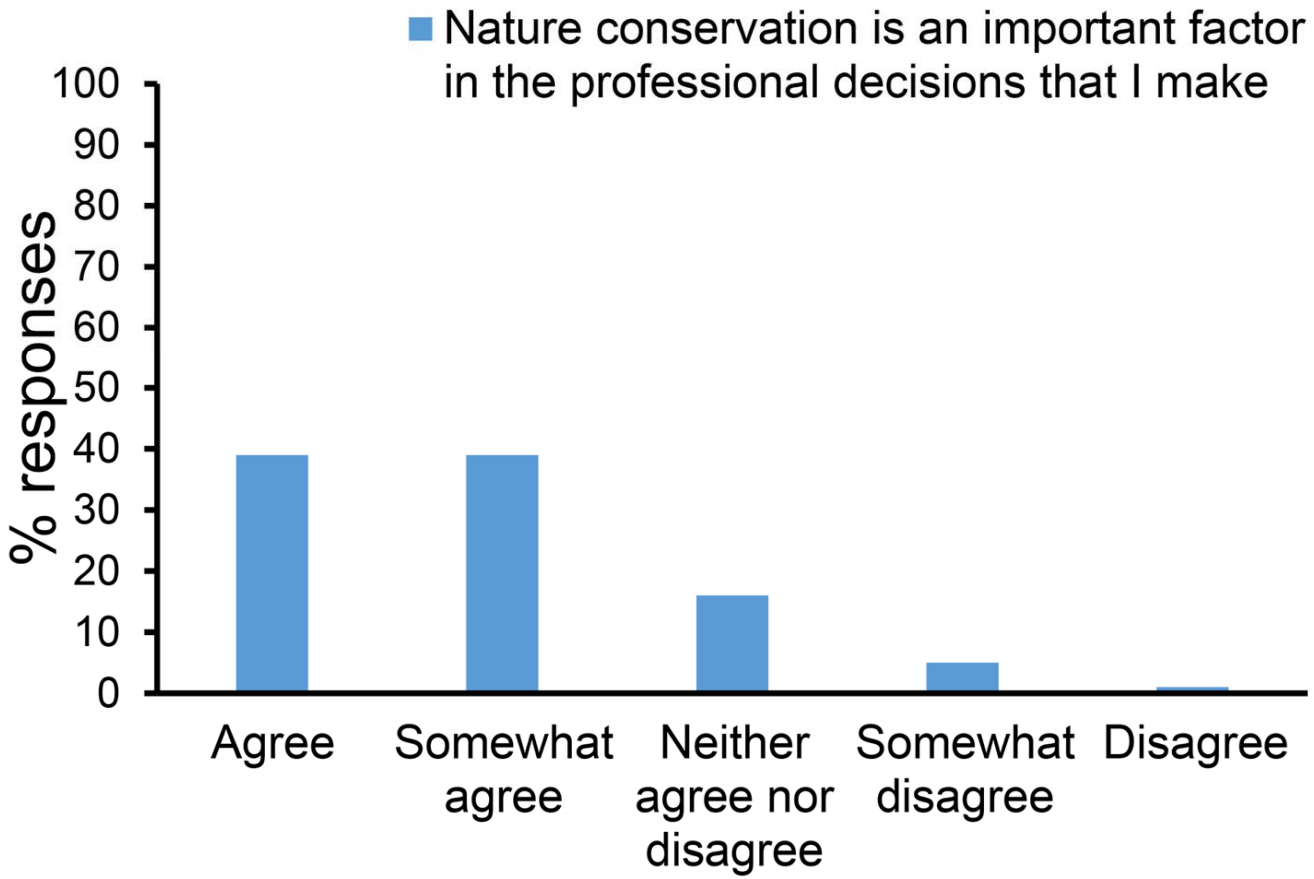
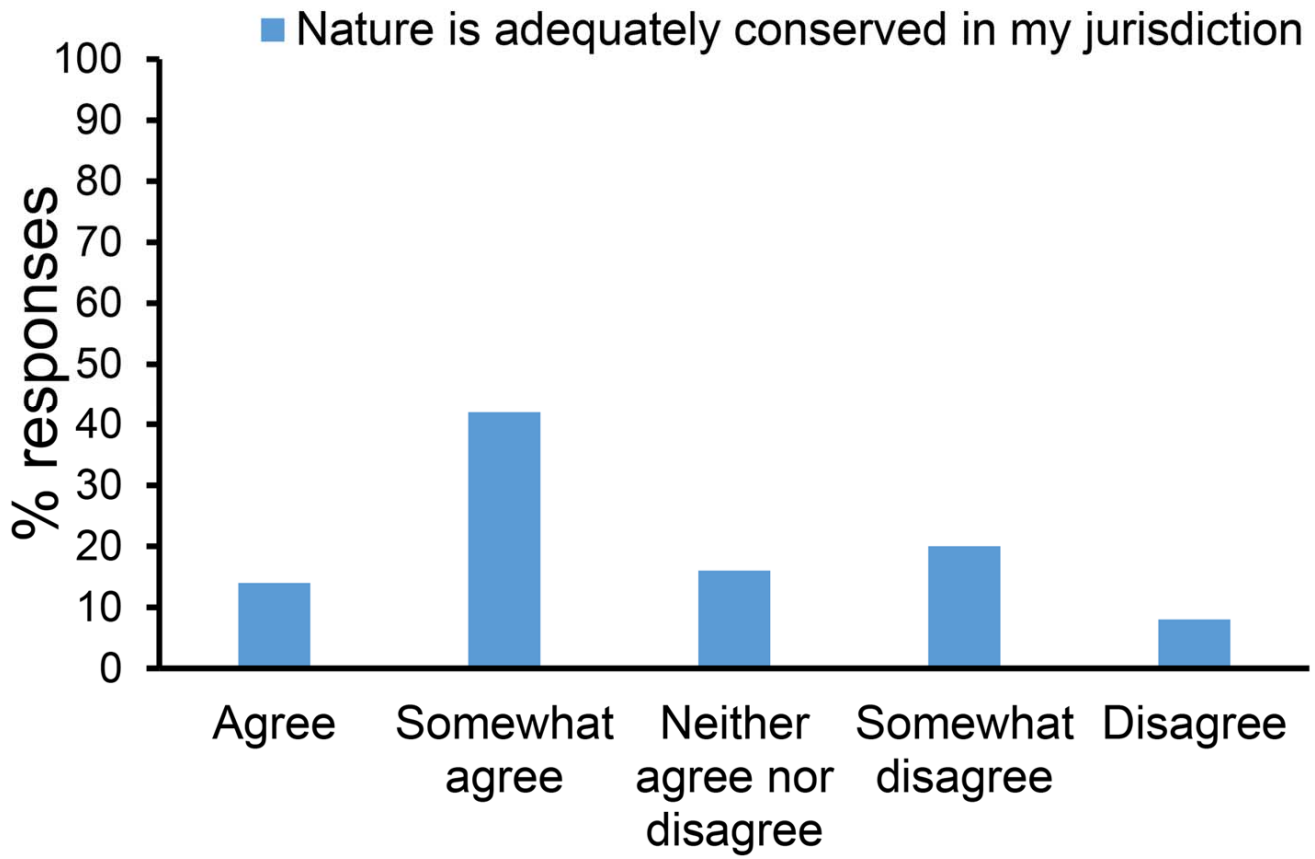
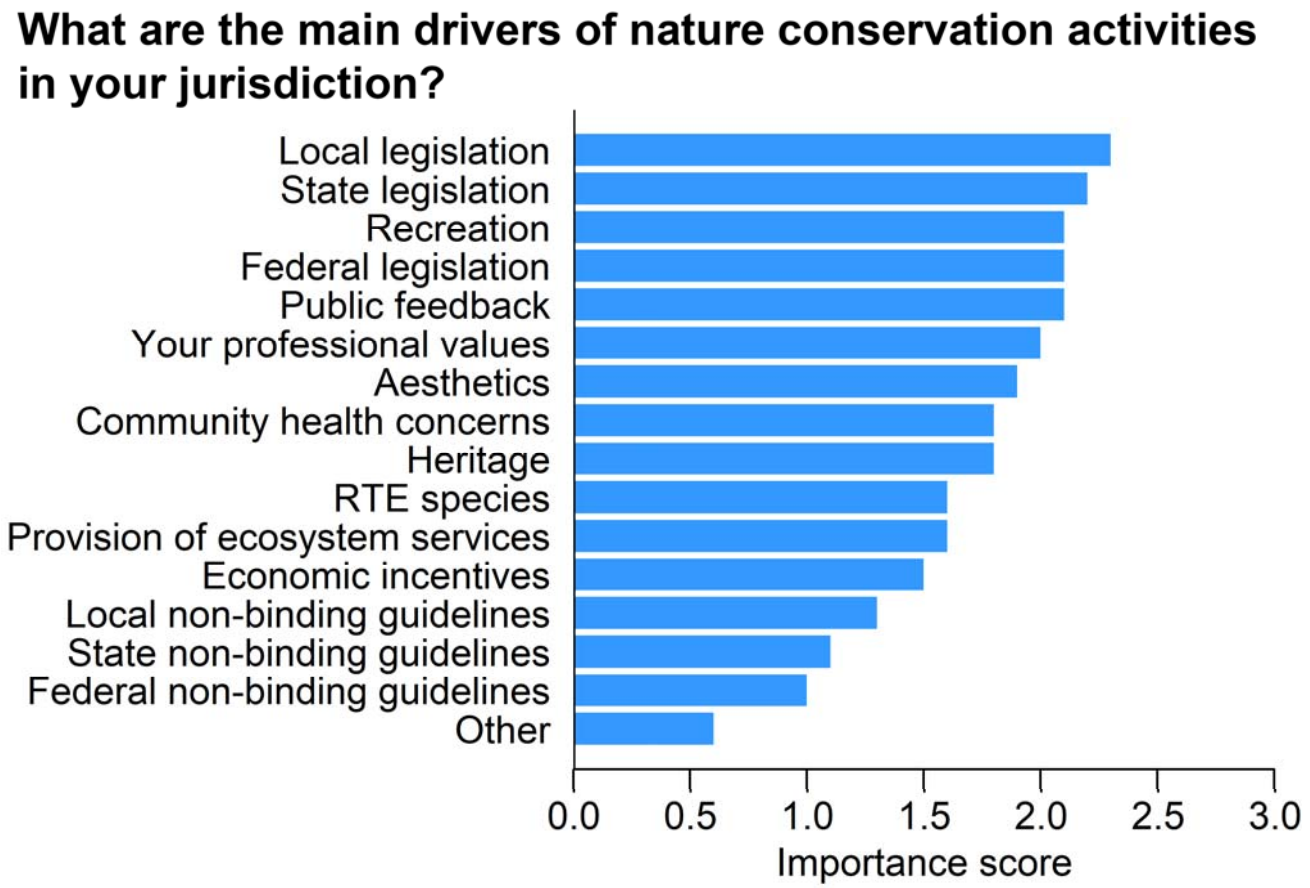


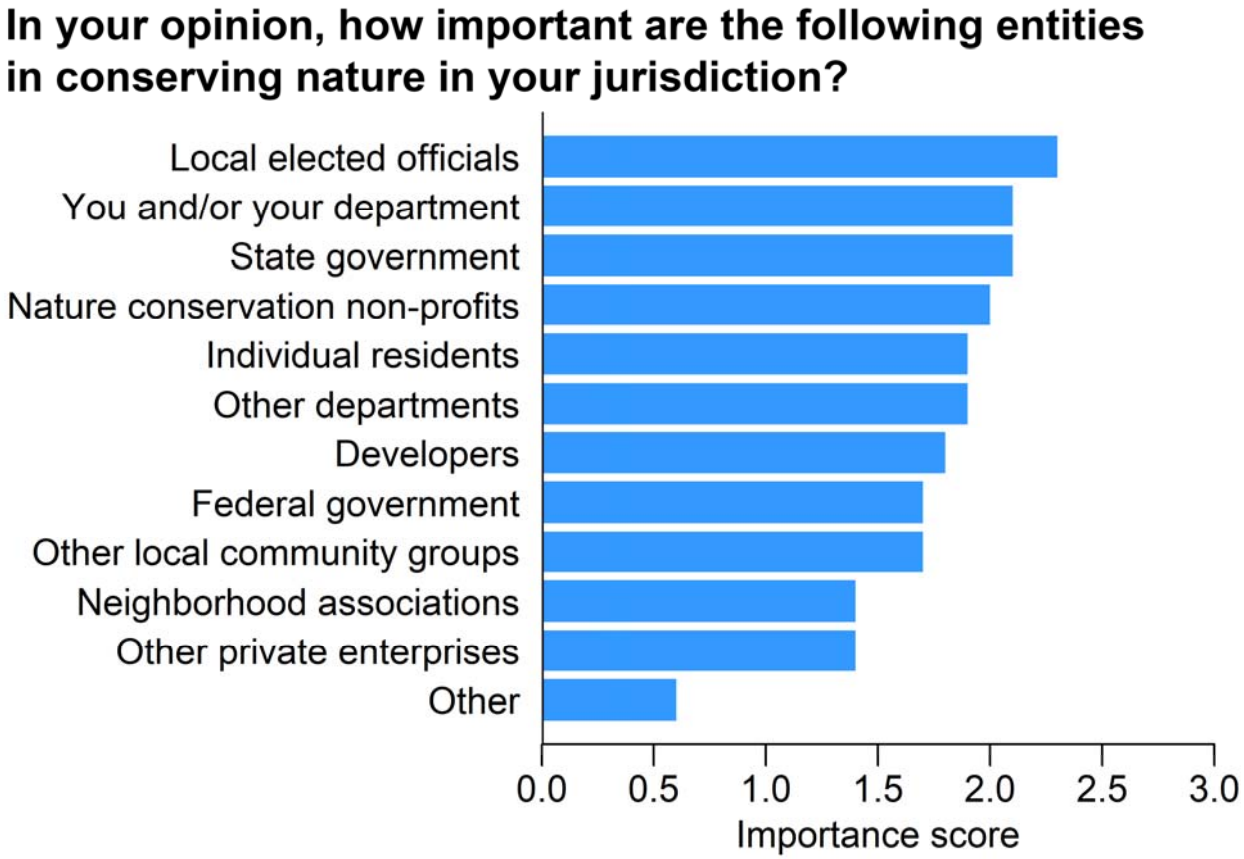
Importance of nature conservation



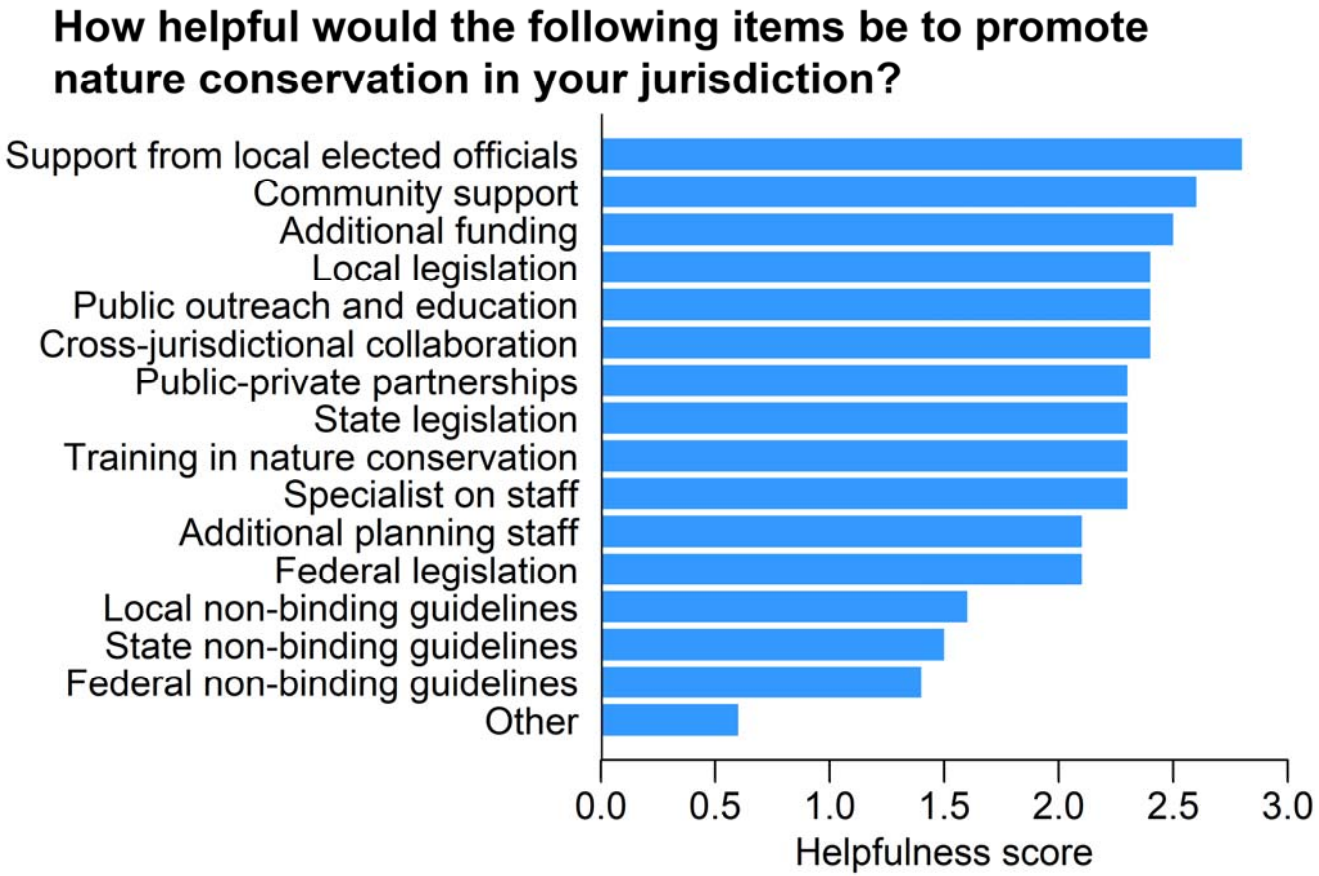
Drivers of nature conservation



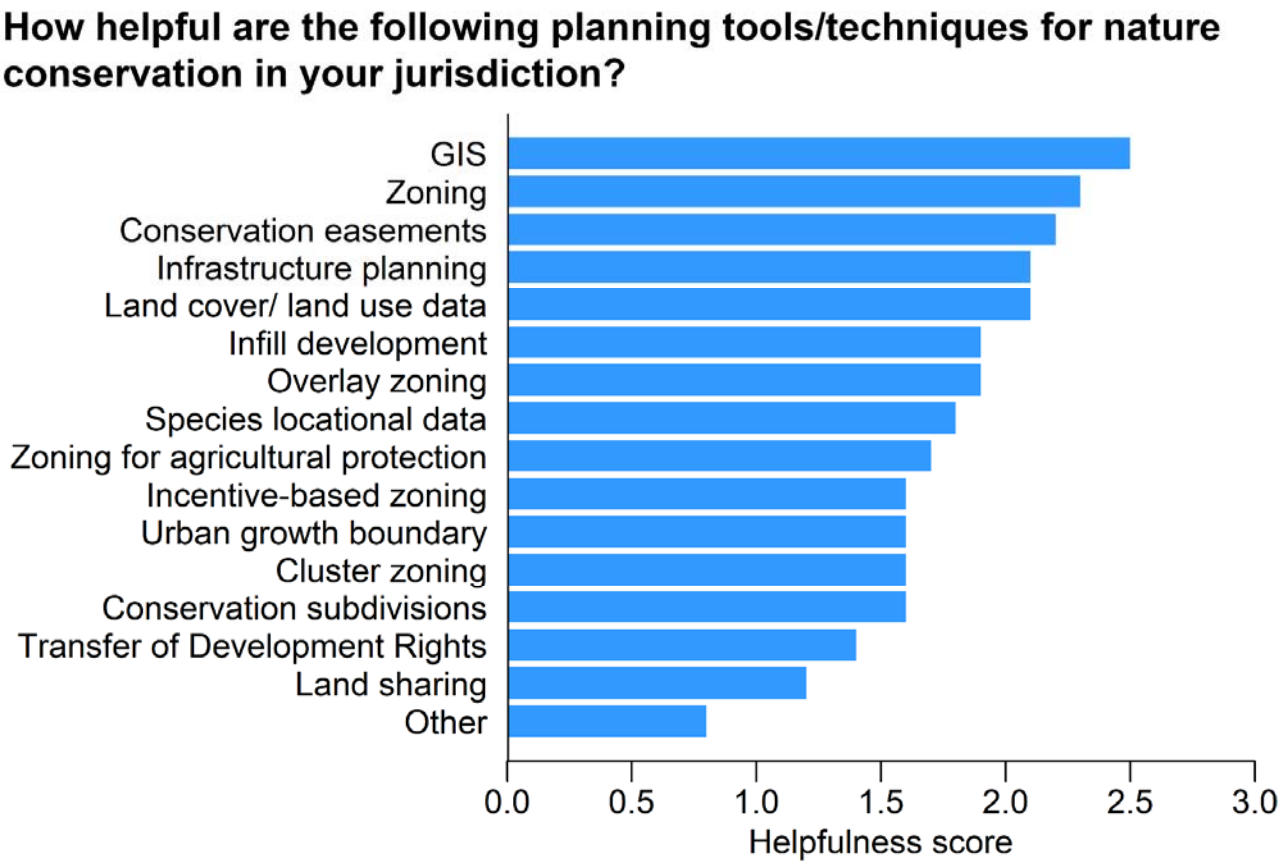
Drivers of nature conservation



Drivers of nature conservation



How nature conservation is implemented



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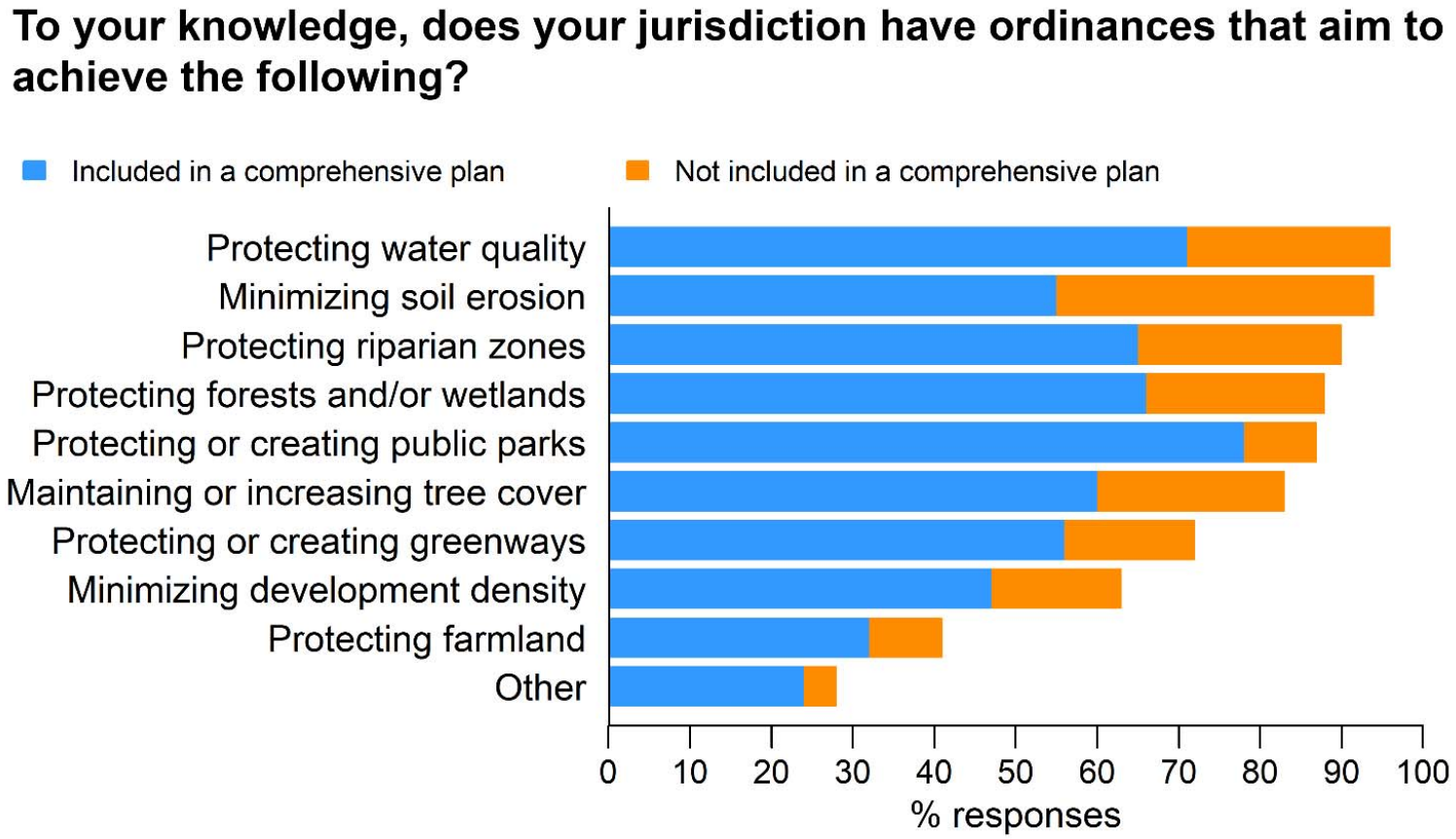
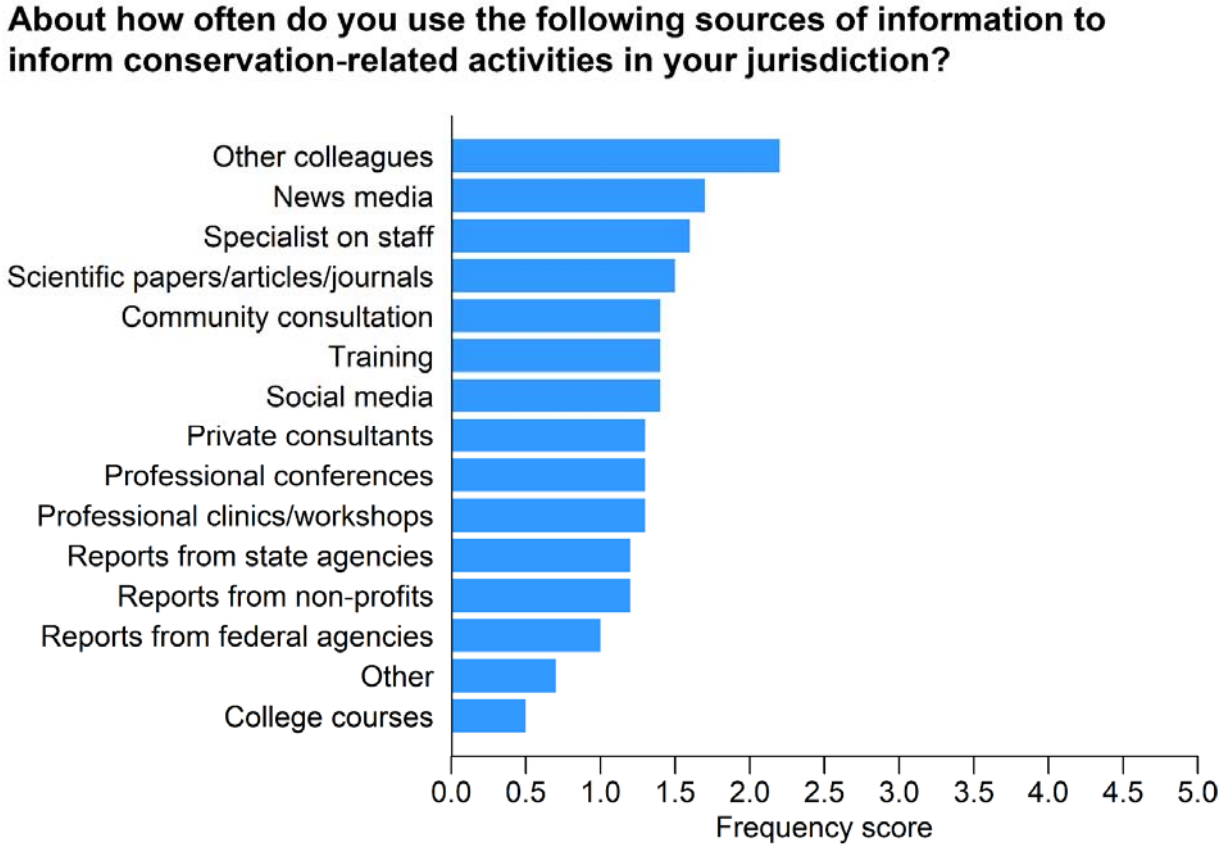


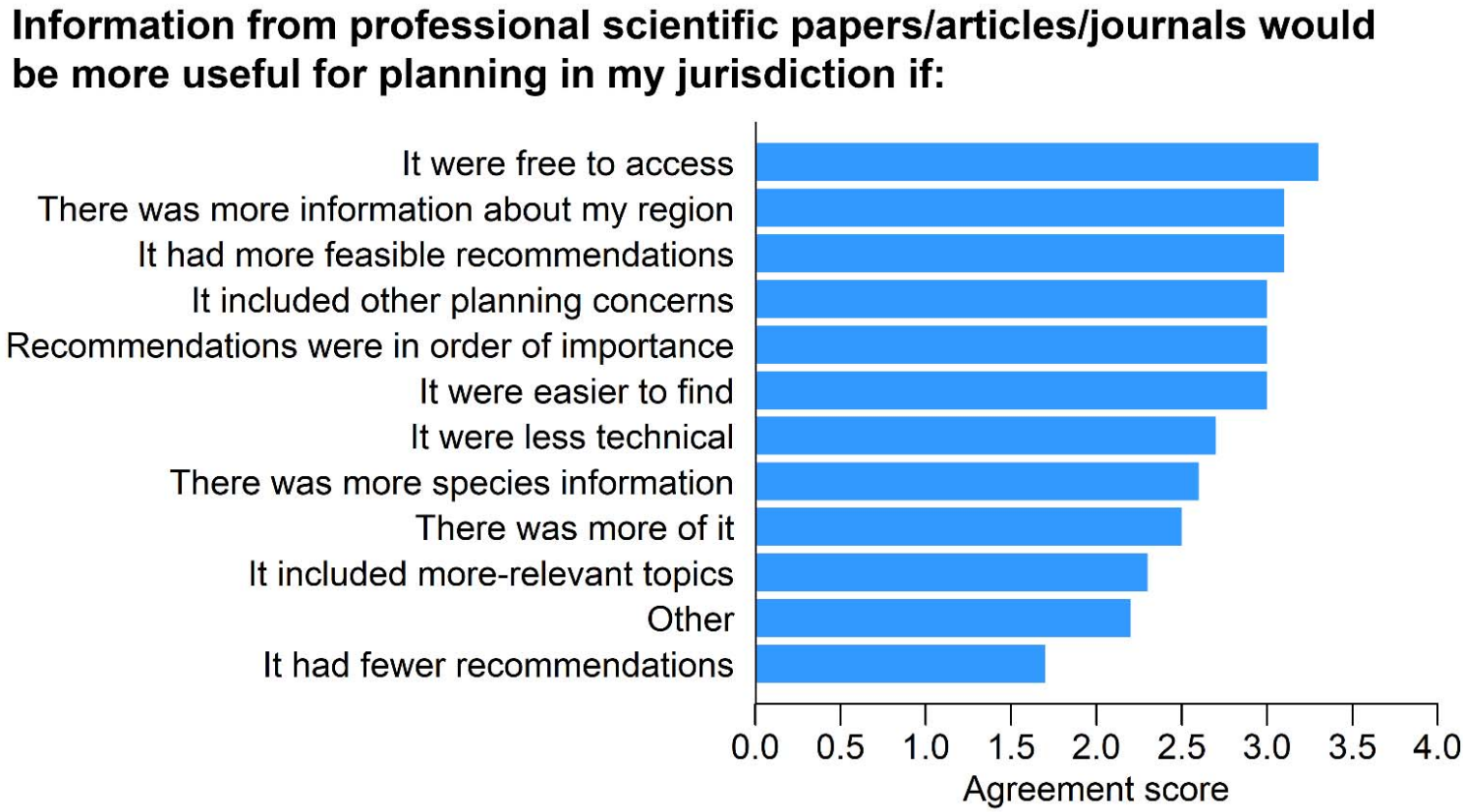
What are the most feasible ways to address important nature conservation concerns in your jurisdiction?

Category	Description	Response example	Percent of responses
New plans, policies, regulations	Changes to or new plans, codes, policies, or regulations at the local level	"Draft policies in the Comprehensive Plan and Land Development Regulations for conservation efforts"	43
More awareness	More awareness and/or education among the public and elected officials	"Education and access to issues facing the community"	34
Local elected official mandate	Mandate from local elected officials	"Local elected official support"	9
Need for more money	Need for more funding, revenue, or money	"Finding funding sources"	8
Higher-level mandates	Mandates from higher levels of government, including enforcement	"mandatory requirements from state and fed"	7
More cost/benefit information	More information specifically about the economic costs and benefits of nature conservation	"Show how it will save money"	6
More understanding	Better information about particular elements of nature conservation, such as areas or species to be conserved	"It may be helpful to know more about threatened and endangered species in our parks and how we can help them expand within our parks"	5

Information that planners need to more effectively implement nature conservation



Information that planners need to more effectively implement nature conservation

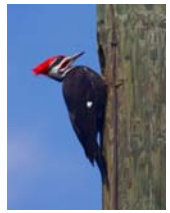


Information that planners need to more effectively implement nature conservation

- Common conservation activities (> 50%)
  - Minimizing soil erosion
  - Improving water quality
  - Maintaining or increasing habitat in the form of tree cover, public parks, forests, wetlands, and/or riparian areas





Information that planners need to more effectively implement nature conservation

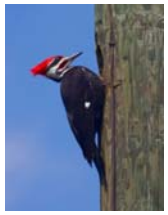
- Uncommon conservation activities (<30%)
  - Protection of old fields, pasture and/or farmland
  - Maintaining or increasing the provision of ecosystem services
  - Conserving rare, threatened, and/or endangered plants and/or animals
  - Maintaining or increasing habitat diversity
  - Minimizing the isolation of or distances among protected areas of forest, wetland, old fields, pasture, and/or farmland
  - Minimizing the use of pesticides and/or herbicides
  - Reducing mowing frequency or lawn area
  - Reducing wildlife roadkill

Information that planners need to more effectively implement nature conservation

- The relative proportion of planners who thought that individual conservation concerns were important generally matched the relative proportion who were working on similar conservation activities.
- Except
  - Loss of ecosystem services (87% considered important, 30% addressed professionally)
  - Pesticide and herbicide use (79% considered important, 12% addressed professionally)





Information that planners need to more effectively implement nature conservation

- In most cases, planners' conservation concerns matched the perceived concerns of residents of their jurisdictions
- Except
  - Pest or overabundant wildlife (13th most important to planners, 5th most important to residents)
  - Loss of ecosystem services (2nd, 7th)
  - Loss of plant and/or animal diversity (5th, 12th)
  - Loss of tree diversity (3rd, 11th)
  - Non-native plants and/or animals (4th, 10th)

Information that planners need to more effectively implement nature conservation

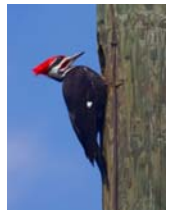
Category	Description	Response example	Question 1 (% responses)	Question 2 (% responses)
Seeking or enhancing best management practices	Seeks advice on how to implement a particular policy or practice, or how to improve implementation	"How best to connect fragmented habitat"	51	47
Convincing decision-makers and constituents	Seeks advice on how to convince elected officials, developers, other staff, voters, or constituents that an activity is worthwhile	"How can we either convince, incentivize, or force developers to eliminate the practice of clear-cutting/mass tree removal for site development?"	23	15
Efficiency challenges	Seeks advice on how best to distribute resources and conservation efforts across space.	"Higher density urban with less "green space" versus sprawl - which is really more environmentally friendly?"	11	9
Quantifying the value of an activity	Seeks advice on how to quantify the value, often in monetary terms, of a conservation activity	"what conservation activities have the greatest benefit to cost for a rural jurisdiction."	11	7
Understanding species/nature	Seeks information about a species or group of species.	"I would want to know what species are endangered and where they are in my jurisdiction."	7	5

Effects of context

- Median population density = 1,059 persons/mile^2 (min = 8; max = 15,299)
- Median population change (2010-2016) = 6% (min = -7; max = 84)
- Median proportion of land that was protected = 3% (min = 0; max = 66)
- Median proportion natural land = 41% (min = 0; max = 92)





Effects of context

- Planners agreed significantly more strongly that nature was adequately conserved in their jurisdiction if their jurisdiction experienced less population change

- Planners in jurisdictions with higher population densities
  - employed private consultants, attended professional conferences, and used social media more frequently
  - were working on maintaining or increasing tree cover and diversity and implementing green stormwater infrastructure, such as green roofs, permeable pavement, or bioswales

Effects of context

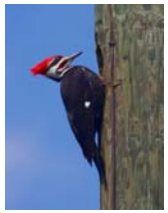
- Planners in jurisdictions that experienced less population change
  - agreed more strongly that scientific information would be more useful if it included recommendations listed in order of importance and there was more of it
- Planners in jurisdictions with more population change
  - were working on conserving rare, threatened, and/or endangered species and maintaining or increasing habitat diversity, but were not working on improving water quality
- Planners in jurisdictions with proportionally more protected area
  - used white papers or reports from federal agencies, state agencies, and nature conservation non-profits more frequently
  - agreed more strongly that scientific information would be more useful if it were less technical and included more-relevant topics
  - were working on protecting forests and/or wetlands, protecting rare habitat types, and managing pest or overabundant wildlife, but were not working on restoring streams

Effects of context

- Planners in jurisdictions with proportionally more natural land
  - were working on protecting old fields, pasture and/or farmland and minimizing the negative effects of recreational use on protected areas
- Planners in jurisdictions with proportionally less natural land
  - tended to seek information about a specific species or group of species

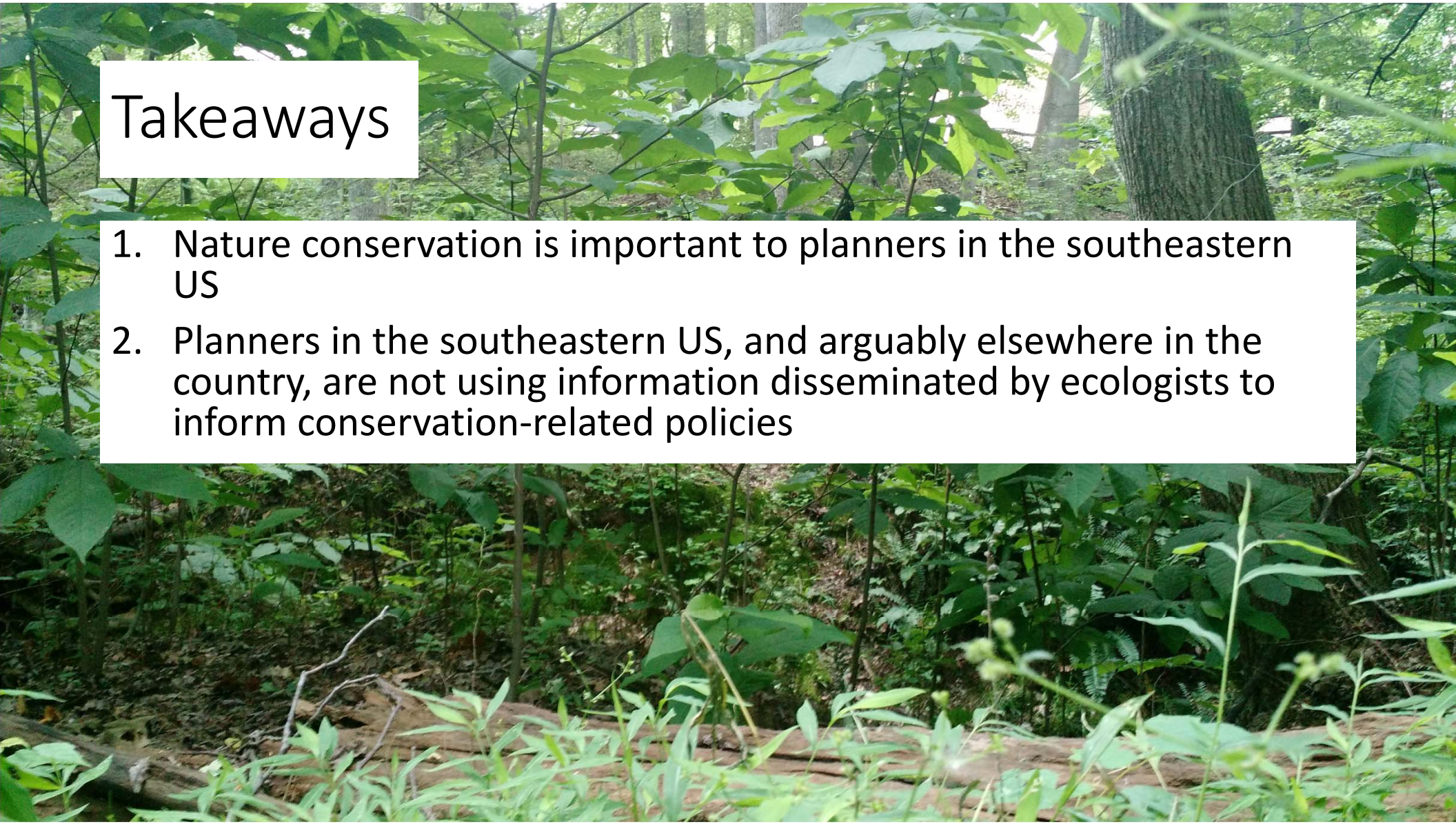




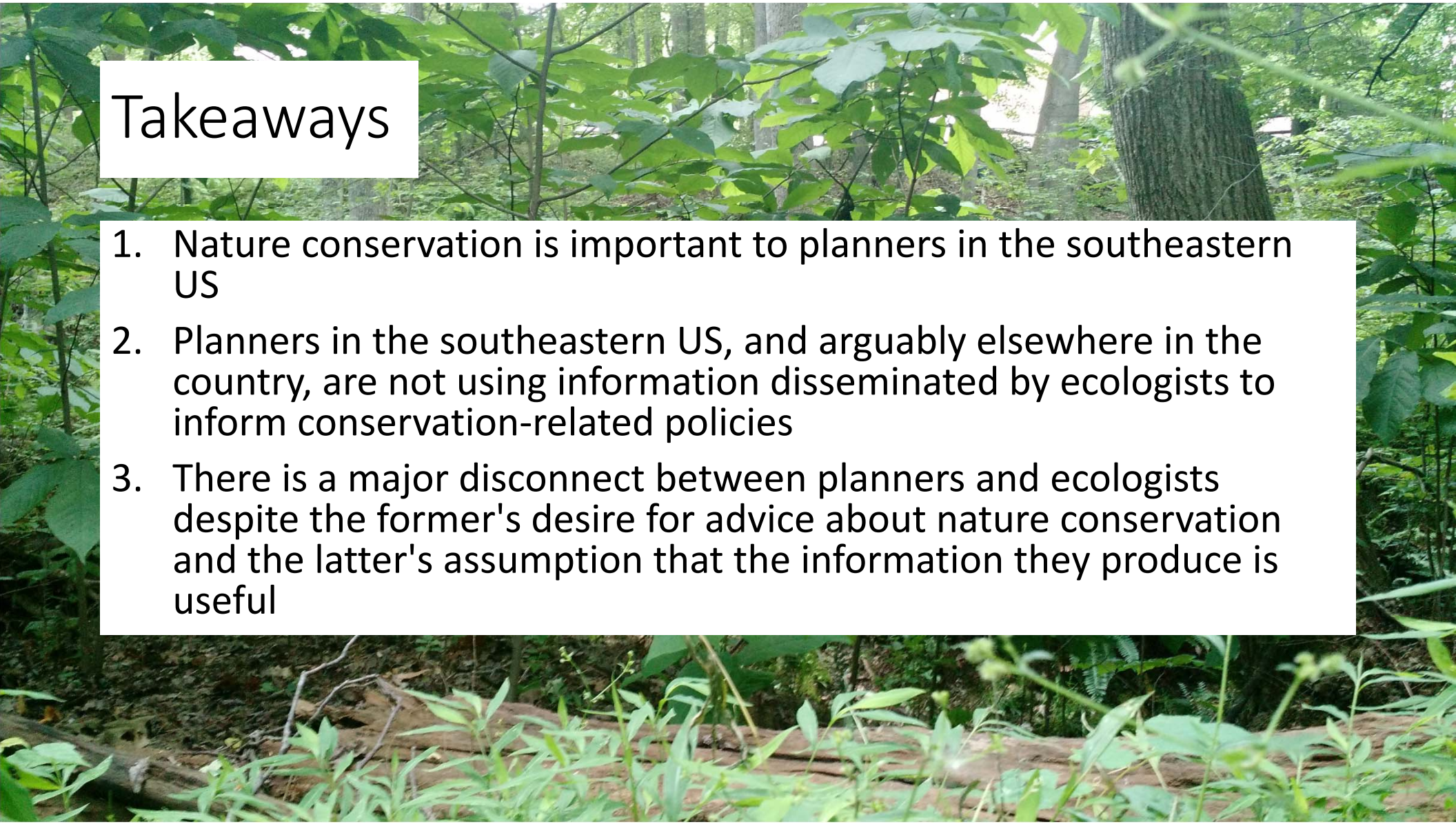
Takeaways

1. Nature conservation is important to planners in the southeastern US



Takeaways

1. Nature conservation is important to planners in the southeastern US
2. Planners in the southeastern US, and arguably elsewhere in the country, are not using information disseminated by ecologists to inform conservation-related policies



Takeaways

1. Nature conservation is important to planners in the southeastern US
2. Planners in the southeastern US, and arguably elsewhere in the country, are not using information disseminated by ecologists to inform conservation-related policies
3. There is a major disconnect between planners and ecologists despite the former's desire for advice about nature conservation and the latter's assumption that the information they produce is useful

Takeaways

4. A potential solution, supported by our results, is the use of translational ecology or knowledge co-production approaches

- **Translational ecology** occurs when ecologists, stakeholders, and decision-makers work together to “develop ecological research via joint consideration of the sociological, ecological, and political contexts of an environmental problem that ideally results in improved environment-related decision-making”
- **Knowledge co-production** seeks to produce "usable, or actionable, science through collaboration between scientists and those who use science to make policy and management decisions”

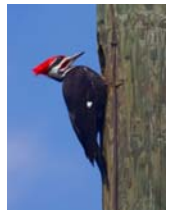
Enquist et al. 2017. Frontiers in Ecology and the Environment 15: 541–550; Meadow et al. 2015. Weather, Climate, and Society 7: 179-191

Collaborative research between planners and ecologists

- Need highlighted by effects of context
- Planner conservation activities and concerns are good starting points
  - E.g., best management practices





Collaborative research between planners and ecologists

- Stakeholders, such as the community and local elected officials, should also be included

Table 3 Kendall's Tau correlation between factors and (1) plan implementation and (2) open space protection

Factors	Subjective measures			
	Plan implementation		Open space protection	
	Kendall's Tau (n)	*P*	Kendall's Tau (n)	*P*
Plan quality	0.08 (21)	0.66	0.20 (23)	0.23
Plan implementation	–	–	0.73 (21)	0.0001***
Open space protection	0.73 (21)	0.0001***	–	–
Stakeholder participation in planning (total #)	0.33 (21)	0.08*	0.48 (21)	0.01**
Stakeholder participation in planning (breadth)	0.33 (21)	0.06*	0.31 (21)	0.12
Stakeholder participation in implementation (total #)	0.45 (21)	0.03**	0.40 (21)	0.05*
Stakeholder participation in implementation (breadth)	0.28 (21)	0.16	0.12 (21)	0.59
Public support for open space protection	0.01 (21)	0.97	0.21 (23)	0.29
Support of elected officials	0.42 (21)	0.03**	0.18 (23)	0.34
Collaboration with other conservation organizations	−0.11 (21)	0.58	0.08 (23)	0.69
Commitment to evaluating implementation progress	0.38 (20)	0.06*	0.22 (21)	0.27

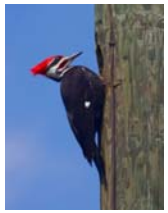
Steelman & Hess. 2009. Environmental Management 44: 93-104.

Summary

- State of planning for nature conservation in the southeastern US
- Evidence for need for collaborative research and points to start from
- Ultimate goal is usable and effective science that is needed to address the challenge of biodiversity loss





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