

PRIORITIZING PROPOSED WILDERNESS AREAS FOR WILDERNESS DESIGNATION

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Abstract:

The National Wilderness Preservation System protects especially pristine public lands that have been designated by Congress as wilderness. But wilderness areas are designated without consideration of existing protected areas or conservation needs. This study uses a Geographic Information System to rank the ecological urgency of proposed wilderness areas (n=631) so that future wilderness designations can be better informed by science. Results indicate that most proposed wilderness areas are in ecosystems that are already well-protected. But a few proposals would add substantial area to currently underrepresented ecosystems. The highest-ranking proposals are Beaver Creek Wilderness Study Area (a Bureau of Land Management unit in Colorado) and Assateague Island National Seashore Recommended Wilderness (a National Park Service unit in Maryland) because they are each located in virtually unprotected regions of the United States.

The data acquisition process for this study uncovered management problems within the federal agencies such as a fear of the public and overall lack of interagency collaboration. A review of the lessons learned highlights ways to improve systematic conservation planning at the federal level. Data standardization within and between agencies is a necessary step toward improved communication. Furthermore, federal land management agencies need to increase the quality and quantity of publicly available data regarding protected areas. Decision-making in the federal agencies has been extremely localized, but a new initiative in the Department of Interior seeks to change that by implementing broad-scale and science-based Landscape Conservation Cooperatives (LCCs). The new LCCs may be the appropriate arena for employing the systematic wilderness stewardship principles outlined here.

Introduction:

The Wilderness Act of 1964 (P.L. 88-577) established the National Wilderness Preservation System to protect exceptionally pristine federally-managed lands. The Act also directed the Forest Service, Fish and Wildlife Service, and National Park Service to review the wilderness potential across their lands and make recommendations for wilderness designations to Congress. Later, the Federal Land Policy and Management act of 1976 (P.L. 94-579) directed the Bureau of Land Management to conduct a similar review and recommendation process. These and subsequent federal reviews resulted in hundreds of recommended land parcels, many of which were eventually designated as Wilderness Areas. However, most of the recommendations remain today in conservation limbo as proposed wilderness areas, waiting for further action from Congress. Many proposals have sat in Congress for over 30 years without action.

The concern over stagnant wilderness proposals

Wilderness proposals present a political and ecological problem. Until Congress decides whether to designate the proposed area as wilderness, the agency must maintain the wild character of the land and manage the area *as if it were* wilderness. Thus, activities that may degrade wilderness qualities are typically banned in proposed wilderness areas. This can lead to anger and resentment among affected user groups. For example, the International Mountain Biking Association has fought against agency management plans that prohibit biking in proposed wilderness areas (Erb 2009).

Furthermore, rare species living in proposed wilderness areas do not have permanent protection. The proposed status affords only temporary protection, making long-term habitat

conservation plans uncertain. Big Hatchet Mountains Wilderness Study Area, a proposal managed by the BLM in southwestern New Mexico, is an example of this uncertainty. Its location near the intersection of the Chihuahuan and Sonoran Deserts and its mountainous terrain provide a broad variety of ecological niches. Consequently, the region is rich in animal and plant species, including desert bighorn sheep, golden eagles, several species of rattlesnakes, and endangered pincushion cacti (Julyan 1998). But until a decision is made regarding the management status of the Hatchets, biologists cannot know whether the habitats of these species can be included in long-term conservation planning. If the area were designated as wilderness, then the unique habitats would be protected in perpetuity. But if the area were released to development, then the habitats would be at risk for degradation and conservationists would need to look elsewhere to create habitat preserves for these species. In order for effective land use planning, Congress must decide the fate of proposed wilderness areas.

Finally, the requirement that federal agencies manage proposed wilderness areas as wilderness until a decision is made by Congress burdens the limited funds and staffing in some field offices. Consider, for example, that the BLM administers nearly three times as many Wilderness Study Areas as it does Wilderness Areas. If Congress would decide on the management status of the BLM's WSAs (and it is likely that many would be released for sale or development), then government staff could better focus their conservation efforts on only the permanently designated units. Resolution is needed so that federal agencies can write resource management plans for these parcels, allowing for long-term responsible use of America's public lands.

Resolving the management uncertainties

Geospatial analysis is an essential tool in resource planning. Landscape statistics can be calculated for vast areas in a relatively short time, allowing development of a science-based decision support system. For example, GIS analysis of the world's ecosystems and protected areas can identify where conservation efforts are succeeding and where conservation needs remain (e.g., Jenkins and Joppa 2009). Similarly, more focused analysis of the National Wilderness Preservation System may identify conservation needs in the United States (e.g., Loomis and Echohawk 1999). Such assessments can be used by a variety of parties: by federal agencies to adjust funding and/or staffing levels; by conservation advocates to focus lobbying efforts; and by Congress to prioritize environmentally-related bills.

This study evaluates the current state of ecosystem protection in the United States. Taking a landscape-level approach with geospatial analysis, I identified underrepresented ecosystems in the current system of protected areas. This highlights the locations of the most vital proposed wilderness areas, which has the potential to assist decision-makers in prioritizing current proposals for responsible administrative and legislative actions. This analysis updates earlier findings: the last NWPS-wide GIS analysis was performed ten years ago and more than one hundred new units have since been designated. In particular, the Omnibus Public Land Management Act of 2009 (P.L. 111-11) designated 52 new Wilderness Areas. This analysis also goes further than previous studies by examining the conservation potential of *proposed* wilderness areas, and it shows that some proposals would contribute more to the NWPS than others due to features such as ecological uniqueness. The proposals vary widely in biodiversity, recreational opportunities, size, shape, and number of inholdings. This analysis considers some

of these features in the prioritization, providing fresh insight for environmental advocacy groups and the federal land management agencies.

Methods:

I integrated GIS data from several government agencies to create a national-level map of existing protected areas and proposed wilderness areas. I used a biocentric prioritization that ranks proposals higher if they are located in currently underrepresented ecosystems.

Data collection

The boundaries of proposed wilderness areas were obtained from the Bureau of Land Management, National Park Service, and Forest Service. None of the agencies maintain a national-level dataset of such proposals. Instead, I downloaded as many individual boundary files as I could find on websites of the agencies' state and regional offices; then I contacted resource managers and information specialists at the remaining offices to piece together datasets of the proposals. Finally, using ArcGIS 9.3, I re-projected all of the boundary files to USA Contiguous Albers Equal Area Conic NAD 1983 projection, and I merged them into one national dataset of wilderness proposals.¹ Due to the dearth of agency data from Alaska, Hawaii, and the U.S. territories, the analysis extent was limited to the 48 contiguous states. This dataset of proposed wilderness areas was combined with additional third-party GIS information to provide options for the prioritization of their designation.

¹ The final dataset, however, is incomplete. Some FS, BLM, and NPS offices have not mapped the proposed areas yet, and they were therefore unable to provide GIS boundary files. Data requests sent to the national and regional offices of the Fish and Wildlife Service were rejected due to fears of public outcry over the proposed boundaries, and therefore the analysis is lacking all FWS data. The total number of FWS wilderness proposals is unknown.

Prioritization: Ecosystem representation and landscape statistics

First I calculated the percent of each ecosystem currently protected. Ecosystem boundaries were defined by Bailey's hierarchical classification of ecoregions (1995). In that scheme, natural systems of the United States are first classified as *domains* defined by climate. Domains are split into *divisions* defined by vegetation type; divisions are split into *provinces* defined by major plant communities; and provinces are split into *sections* defined by landform. In the analysis extent of the 48 contiguous states there are 163 sections, and these comprise the base map of ecosystems (Fig. 1).

The Protected Areas Database for the United States identifies federal, state, local, and non-governmental protected areas (USGS 2009). I used this dataset to calculate the percent of each ecoregional section that is currently protected. Only areas with strong protections were included in this calculation. The Protected Areas Database includes information on the strength of protections, as defined by the World Conservation Union (formerly, the IUCN.) There are six IUCN Protected Area categories (Table 1). Categories I through III were used to calculate the area of each ecoregion that is currently protected. Categories IV through VI, due to their human intervention, were considered weak protections and were excluded from the calculation.

I identified underrepresented ecosystems by using a goal of 10% protection within each ecosystem. This is the conservation goal agreed upon by the world's governments in the Convention on Biological Diversity (2004). Ecoregional sections with less than 10% protection were marked as needing further conservation.

To prioritize proposed wilderness areas, I overlaid the national dataset of wilderness proposals on the map of current levels of ecosystem protection. Proposals lying within underrepresented ecosystems were deemed more critical than proposals in ecosystems with more

than 10% current protection. Finally, I calculated the total area of each wilderness proposal. Within a given ecoregion, larger parcels were ranked higher.²

Results:

Data collection results

I compiled data for 668 proposed wilderness areas: 576 administered by the BLM, 55 administered by the National Park Service, 29 administered by the Forest Service, and eight administered by the Fish and Wildlife Service. The agencies have remarkably different methods for surveying and proposing wilderness areas; they maintain wilderness data in different formats; and their manner in communicating with the public is strikingly different. Thus, a “wilderness proposal” does not mean the same thing across the four agencies. Because these factors greatly affected later analyses, the data collection results for each agency are described here.

Bureau of Land Management:

The Bureau of Land Management has the shortest history of wilderness preservation among the four federal land management agencies. In 1976, Congress directed the BLM to identify and inventory its public lands having wilderness characteristics and to study the areas for possible recommendation as wilderness. The resulting areas were named “Wilderness Study Areas,” a term that only the U.S. Forest Service also uses. Congress also required the BLM to manage Wilderness Study Areas (WSAs) “so as not to impair the suitability of such areas for preservation as wilderness” (P.L. 94-579 Section 603(c)). This requirement is meant to ensure that the wilderness values of WSAs are not degraded before Congress can decide whether to

² The resulting geographic information table can be sorted four ways: solely by total area of the proposal (ignoring current level of ecoregion protection); solely by current level of ecoregion protection (ignoring area); first by area and then by ecoregion protection; or first by ecoregion protection then by area. The fourth method was chosen for this study because it considers both variables, but is biocentric.

designate the lands as wilderness. However, one fact germane to this analysis is that the BLM does not always manage WSAs in the same fashion as wilderness. The agency allows some non-compatible uses in WSAs. For example, at St. Anthony Sand Dunes Wilderness Study Area, visitors are allowed to recreate with All-Terrain Vehicles (ATVs), Off-Highway Vehicles (OHVs), and Off-Road Vehicles (ORVs), despite the fact that the Wilderness Act prohibits motor vehicle use. In this way, some wilderness proposals administered by the BLM are different from the proposals of the other agencies.

The BLM's WSAs are part of the National Landscape Conservation System (NLCS), which includes other protected areas such as designated wilderness areas, national monuments, national conservation areas, outstanding natural areas, a forest reserve, wild and scenic rivers, and national historic and scenic trails. At the beginning of this study in 2009, the BLM did not have a national-level dataset of any of its protected area categories within the NLCS. Instead, datasets are maintained at the state level. The BLM has twelve "state offices," most of which are actually multi-state regions. For example, while all data for BLM-administered lands in Idaho are kept at the Idaho state office, data for Montana, North Dakota, and South Dakota are kept at the Montana "state office." The largest region is the Eastern States office, which covers the 31 states from Minnesota to Louisiana and eastward. The BLM does not administer any lands in Hawaii or the U.S. territories, so those regions do not have corresponding state offices. The BLM also has a National Operations Center in Denver, Colorado and a headquarters in Washington, DC, both of which are tasked with standardizing and maintaining national-level information pertinent to the BLM. At the beginning of this study, neither office had aggregated data from the states regarding the NLCS generally or WSAs specifically.

Most of the BLM state offices maintain both Intranet and Internet websites for the dissemination of data on public lands. (For Internet sites available to the public, see: <http://www.blm.gov/nstc/gis/GISsites.html>) However, the focus of the GIS data is typically land status records relating to the BLM's multiple-use mission: grazing, oil exploration, solar energy development, etc. Few state offices maintain GIS data sets for the units of the National Landscape Conservation System, and at the beginning of this study, all of those state-level data sets were between five and fifteen years old. Thus, I began my data collection with the BLM's websites, and then collaborated with BLM employees from the state and field offices to identify information gaps and complete the dataset for BLM WSAs. The resulting dataset is the most complete record of BLM WSAs ever. The BLM administers 576 Wilderness Study Areas in the eleven western states and Alaska, covering approximately 5,639,039 hectares.

National Park Service:

With the passage of the Wilderness Act in 1964, the National Park Service was one of the three original agencies directed by Congress to review roadless areas of 5,000 or more acres for possible inclusion in the National Wilderness Preservation System. The agency was given ten years to complete this review, but forty-six years later the review is incomplete. Additionally, for park units created since 1964, Congress typically included a requirement for wilderness review. But these directives are sometimes ignored, too. For example, Congress created Channel Islands National Park in 1980 and required the Secretary of Interior to send a wilderness recommendation to the President within three years. However, thirty years later, the National Park Service has yet to conduct a wilderness study, let alone provide any proposals. Based on information provided to me by the NPS office in Washington, DC, at least several dozen NPS units have never been studied for possible wilderness. (The DC office does not maintain a

complete list of wilderness studies, so the actual number of unassessed NPS units is unknown.) The agency has, however, completed studies of many of its units. After the NPS completes wilderness studies, recommendations are to be forwarded to the President, who ultimately provides the recommendations to Congress. This progression is complicated by managerial and political factors, though. Consequently, recommendations may sit in administrative land classifications for years before reaching Congress.

The National Park Service has defined ten categories of “wilderness land status,” all of which differ from the terms used by the other three land management agencies (Ashley Adams, Natural Resource Specialist for the Washington Office, *personal communication*). The categories are used to describe NPS lands along a progression from original assessment to designation. For the purposes of this study, five of the categories were considered “wilderness proposals”:

- *Proposed wilderness*: Lands where a wilderness study has been completed, but the conclusions of proposed wilderness areas remain with either the Park Superintendent, National Park Service Director, Secretary of Interior, or President (i.e. the proposal remains within the Executive Branch and has yet to reach Congress.)
- *Proposed potential wilderness*: Same as above, but land may have incompatible uses that would need to be removed before wilderness designation.
- *Recommended wilderness*: Lands where a wilderness study has been completed, and the President has forwarded recommendations to Congress, but Congress has not yet voted on the status.
- *Recommended potential wilderness*: Same as above, but land may have incompatible uses that would need to be removed before wilderness designation.

- *Designated Potential Wilderness*: Lands designated by Congress as “Potential Wilderness,” indicating that one or more incompatible uses need to be removed before wilderness designation. For lands in this status, either (1) the agency has not removed those activities or (2) the agency removed those activities but Congress has not voted since on the status.

Notably, the National Park Service does not use the term “Wilderness Study Area” (used by the BLM and Forest Service.) And the National Park Service is the only agency to use the word “potential” to discriminate between different types of proposals or recommendations.

At the beginning of this study, the National Park Service did not have a complete national-level dataset of any of the wilderness land status categories. In fact, the headquarters in Washington, DC did not have GIS data for boundaries of *any* of the wilderness proposals (Garry Oye, Chief of NPS Wilderness Stewardship Division, *personal communication*).

Web searches provided better results. The National Park Service maintains a centralized data download webpage called the NPS Data Store. (Despite the name, information is provided to the public free of charge. See <http://science.nature.nps.gov/nrdata/>). The page includes GIS data for a variety of natural and cultural resources, including wilderness and wilderness proposals. It includes a search engine to locate relevant data. I began my data collection at this website. However, for the majority of wilderness proposals, no data are publicly available on this site or elsewhere.

The lack of aggregated datasets for National Park Service lands is due in part to the extreme regionalization of the National Park Service administration. There are only four Washington Office staff dedicated to wilderness issues. Instead, most administrative decisions are made at the “region” level, and staff from these regions are the data stewards. The National

Park Service has six regions: Alaska, Pacific West, Intermountain, Midwest, Southeast, and Northeast. Hawaii, Guam, and American Samoa are included in the Pacific West Region; Puerto Rico and the U.S. Virgin Islands are included in the Southeast Region. Additionally, the NPS has a National Capitol Region that is entirely contained within the Northeast Region. It focuses on the many NPS-administered sites around the Washington, DC metropolitan area. At the beginning of this study, none of the NPS Regions had a region-level dataset of any of the wilderness land status categories (including designated wilderness.) The Midwest Region was the only region with even a partial dataset. The Pacific West, Intermountain, and Northeast regions maintain the data separately at each individual park unit. The Alaska and Southeast Regions have not mapped any of their eligible or proposed wilderness parcels, so no GIS boundary files exist (Joni Piercy, GIS Team Manager for the Alaska Region & Elena Robisch, Regional GIS Coordinator for the Southeast Region, *personal communications*).

After extensive communication with both the DC and regional NPS offices, I found that the bulk of the data on wilderness proposals was kept only at individual park units. The National Park Service administers some 392 park units, making data aggregation difficult – particularly for someone not employed by the government. But many of the NPS units are small and were originally designated to protect historic resources (e.g. the birthplaces of prominent U.S. presidents.) Such units are unlikely to contain wilderness character. Therefore, I focused my continued search on the larger units that protect natural resources: National Parks, National Monuments, National Preserves, National Lakeshores, National Seashores, and National Recreation Areas. I contacted staff from these units to locate and request GIS boundary files. The resulting dataset is the most complete record of NPS wilderness proposals ever compiled. It

comprises 55 wilderness proposals in 22 NPS units. The proposed areas cover approximately 2,341,529 hectares.

The dataset I created is lacking at least five wilderness proposals: one proposal within Cape Lookout National Seashore, which has been proposed to the President but not yet mapped in a GIS; one proposal each in Cumberland Gap National Historic Park and Great Smoky Mountains National Park, which have been recommended to Congress but not yet mapped in a GIS; one proposal in El Malpais National Monument, which was recommended to Congress but the NPS has refused to share the boundary information with the public; and one proposal in Grand Teton National Park, which was recommended to Congress but for which the NPS is unable to locate the existing GIS data. My dataset may be lacking other wilderness proposals, but the disjointed data stewardship in the NPS makes this difficult to determine.

Forest Service:

The Forest Service has the longest history of wilderness preservation among the four federal land management agencies. The agency began designating wilderness administratively in 1924. When Congress passed the Wilderness Act in 1964, all of the Forest Service wilderness areas were automatically designated as part of the new National Wilderness Preservation System. The Act also required the agency to complete a review of all Primitive Areas (a different administrative land designation) within ten years. The Secretary of Agriculture completed the review within the required time and provided recommendations to Congress. Congress has since made decisions on nearly all of the former Primitive Areas. Today only one remains: the Blue Ridge Primitive Area in Arizona, which still awaits Congressional action. The Forest Service has also conducted reviews for possible wilderness character through the Roadless Area Review and Evaluation (RARE I, conducted between 1971 and 1973) and RARE II (conducted between

1977 and 1979.) As a result of these studies, the Forest Service named hundreds of Wilderness Study Areas. Congress has acted on many (but not all) of these areas, designating some as wilderness. Semantically, Forest Service “Wilderness Study Areas” are essentially the same as BLM “Wilderness Study Areas.” Like the BLM’s WSAs, Forest Service WSAs are to be managed so that wilderness character is preserved until Congress can make the final determination. Furthermore, the Forest Service conducts new reviews for possible wilderness areas during the revision of each National Forest’s management plan. Recommendations from the results of these studies are termed “Forest Plan Recommended Wilderness” areas.

The Forest Service does not have a national-level dataset of its Wilderness Study Areas or Forest Plan Recommended Wilderness areas (Steve Boutcher, FS Wilderness Information Manager & Terry Knupp, FS Wilderness Program Leader, *personal communications*). Administration in the Forest Service is regionalized, and practices across regions are not standardized. The Forest Service has nine regions.³ But none of the regions maintain regional-level datasets. Instead, all GIS data relevant to designated and proposed wilderness are kept at the individual Forest Service units. The agency administers 155 National Forests and 20 National Grasslands, making data aggregation extremely difficult. Furthermore, only some of the National Forests and National Grasslands have websites that share information with the public. For other units, it is necessary for interested members of the public to contact agency employees to request information. During my data search over the course of ten months, emails and phone calls to Forest Service employees received a response rate of about 50%. Ultimately, I was unable to obtain or create a national-level dataset for Forest Service wilderness proposals due to a variety of factors. These factors included: lack of webpages; outdated webpages; lack

³ Forest Service Regions are numbered 1 through 6 and 8 through 10. There is currently no Region 7. The previous Region 7 was eliminated in the 1960s and its forests were divided among Regions 8 and 9.

of geospatial data standardization; vague naming schemes (e.g. “Administratively Endorsed Area”); inaccurate naming schemes (e.g. apparently naming WSAs as “Official Wilderness” in geospatial datasets, despite having no Congressional designation as wilderness); and, in one region, changes in leadership (Region 5 had a succession of three different wilderness program leaders during my data search.) I was able to assemble 29 wilderness proposals by the Forest Service. But the complete number of proposals is probably much higher. Due to the dearth of information, I did not rank the 29 proposals of the Forest Service.

Fish and Wildlife Service:

The Wilderness Act of 1964 directed the Fish and Wildlife Service to review roadless areas of at least 5,000 acres and all roadless islands in the National Wildlife Refuge System for wilderness character. The agency was given ten years to complete the review, and it did so on time in 1974. Some (but not all) of the agency’s recommendations were designated by Congress as wilderness. Later, the National Wildlife Refuge System Improvement Act of 1997 required each national wildlife refuge to prepare a Comprehensive Conservation Plan (CCP) that would outline a management framework for the unit (P.L. 105-57). During the development of some CCPs, the FWS identified new recommendations for wilderness. Some (but not all) of these recommendations were designated by Congress. Thus, today the agency has some remaining “Wilderness Study Areas” from the first set of reviews as well as “Proposed Wilderness” and “Recommended Wilderness” from more recent reviews. Many national wildlife refuges still lack CCPs, so the agency may make more wilderness recommendations as the plans are completed in the coming years.

It is unclear whether the Fish and Wildlife Service maintains a national-level dataset of wilderness proposals. No such dataset is publicly available online, and repeated queries to the

Washington, DC office of the agency were ignored or avoided. The agency is administered as eight semi-autonomous regions under separate Regional Directors. Of these regions, two do not have any wilderness proposals: FWS Region 2, which is comprised of Arizona, New Mexico, Oklahoma, and Texas (Tom Harvey, Refuge Supervisor, *personal communication*) and FWS Region 3, which is comprised of Minnesota, Iowa, Missouri, Wisconsin, Illinois, Indiana, Michigan, and Ohio (Sandra Siekaniec, Assistant Refuge Supervisor, *personal communication*). FWS Region 7 (Alaska) has at least seven wilderness proposals: in Alaska Maritime, Alaska Peninsula, Becharof, Kenai, Kodiak, Togiak, and Yukon Flats National Wildlife Refuges (Brian Anderson, Alaska Region Wilderness Coordinator, *personal communication*). The remaining five FWS regions either do not maintain region-level wilderness information or do not share that information with the public. Information on wilderness proposals is presumably kept at the individual FWS units. I attempted to assemble the data by contacting individual units in Regions 1, 4, 5, 6, and 8, but the task became overwhelming. (The National Wildlife Refuge System totals nearly 800 units.) The only other proposed wilderness boundary I located was for Maine Coastal Islands National Wildlife Refuge. In total, I was able to assemble eight wilderness proposals by the FWS. But the agency probably has more proposals that are unavailable to the public. Due to the scarcity of information from the FWS, I did not prioritize the eight wilderness proposals.

Prioritization results

Protected areas in the United States are not distributed evenly across ecoregions (Fig. 2, Fig. 3). Roughly half of the ecoregions in the Lower 48 States have less than 1% of their area protected in categories I, II, or III. And three ecoregions have no such protected areas: The

Southern Gulf Prairies and Marshes, the Southern High Plains, and the Western Glaciated Plains. On the opposite extreme, some ecoregions are very well-protected. The Northern Rockies is the most protected ecoregions, at 65%. The Yellowstone Highlands and Idaho Batholith are also highly protected (51% and 41%, respectively.)

When the wilderness proposals are overlaid on the ecoregions map, it becomes apparent that some are much more urgently needed for conservation than others. I intended to categorize the proposals into five groups based on the current level of ecoregion protection, and those proposals which lie in ecoregions that currently lack protected areas would be deemed most urgent. However, no proposed wilderness areas lie within the unprotected ecoregions. Consequently, I used four groups: ecoregions with less than 1% protection (highest priority), 1-5% protection (high priority), 5-10% protection (medium priority), and greater than 10% protection (low priority.)

Among the Bureau of Land Management proposals, Beaver Creek WSA in Colorado ranks highest in this prioritization because it would add protection to two underrepresented ecoregions (Table 2). It would add nearly 5,000 hectares of protection to the Arkansas Tablelands, of which only 0.05% is currently protected (highest priority) and nearly 6,000 hectares of protection to the adjacent Northern Parks and Ranges Section, of which only 8.88% is currently protected (medium priority). Twenty-seven other WSAs, mostly located in Wyoming, would add protection to ecoregions that currently have less than 1% protected and are therefore “highest priority” proposals.

Using this prioritization, nearly half of the BLM’s WSAs are deemed low priority because they are located in ecoregions that already have greater than 10% protection (Fig. 4). The Owl Creek Wilderness Study Area in Wyoming ranks lowest in this prioritization because it

is located entirely within the Yellowstone Highlands, of which 51% is already protected. Also near the bottom of the ranking are 37 wilderness proposals in the Grand Canyon Lands ecoregion, of which 33% is already protected.

The National Park Service has nominated only 16 proposals among 12 NPS units that lie within currently underrepresented ecoregions (Table 3). The Recommended Wilderness in Assateague Island National Seashore ranks highest in this prioritization because it is located in the Middle Atlantic Coastal Plain, an ecoregion that currently has only 0.04% of its area protected. The Proposed Wilderness in Bighorn Canyon National Recreation Area and the Proposed Wilderness in Sleeping Bear Dunes National Lakeshore rank second and third, respectively, because each of those proposals is located in an ecoregion with less than 1% current protection.

Nearly all of the National Park Service wilderness proposals (39 of 55) are deemed low priority (Fig. 5). Of particular note are the 32 proposed areas located in the Mojave Desert and Grand Canyon Lands, ecoregions that are already 25.98% and 33.06% protected, respectively. These are very well-protected ecoregions that do not urgently need conservation.

Discussion:

Existing ecosystem representation

The current system of protected areas in the United States is not sufficient to meet national and international conservation goals. Of 163 ecoregions in the contiguous states, only 30 ecoregions have at least 10% of their area protected in IUCN Categories Ia, Ib, II, or III. This is far below the benchmark set by the Convention on Biological Diversity – a goal of at least 10% protection of each of the world’s ecosystems by the year 2010. Of particular concern is

how far from the goal individual ecoregions are. Roughly half of the ecoregions of the Lower 48 States have less than 1% protection, demonstrating a considerable need for vast new areas of protection before the 10% goal can be reached in those areas.

Furthermore, the current system of protected areas is not representative of the nation's ecoregions. Almost all of the highly protected ecoregions are located in the West (26 of 30). Only four ecoregions located east of the Mississippi River have at least 10% of their area protected: the Northern Superior Uplands (Minnesota), the Everglades (Florida), and the Adirondack Highlands and Catskill Mountains (both in New York.) This demonstrates a critical need for additional land conservation efforts in the Midwest and East.

There are three factors limiting land protection in the Midwest and East, however. The first is that the federal land management agencies administer very little land there. In particular, this explains the relative scarcity of federal wilderness areas east of the Mississippi River. However, some Eastern states have initiated state wilderness programs, including Maryland and New York. State wilderness programs can be very effective. For example, the New York State Wilderness System has helped the Adirondack Highlands ecoregion reach 37% protection. However, most states do not have state wilderness programs. Instead, many eastern protected areas are administered as conservation easements or other short-term protections. As such, they rank low in the IUCN categorization of protected areas. One potential solution for this factor would be for federal land management agencies to partner with or advise state governments to identify and conserve crucial areas in underrepresented ecosystems. Ultimately, more eastern states should consider creating state wilderness programs.

A second important factor limiting ecoregion protection in the East is the geographic size of the states. Because several of the Eastern states are smaller than ecoregions, the efforts

necessary to meet conservation goals will require multi-state collaboration. For example, the Lower New England ecoregion, of which only 0.35% is currently protected, spreads across parts of Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, New Hampshire, and Maine. Actions in any one state will be insufficient to reach conservation targets. For this ecoregion to reach at least 10% protection, the eight applicable states must work together to conserve land, creating a collective action problem. This differs markedly from the geography of the West. For example, the Northern Rockies ecoregion (65% protected) is located entirely within the state of Montana and the Sierra Nevada ecoregion (32% protected) is located almost entirely within the state of California. In these areas, state-level advocacy groups can have great sway in conservation efforts, leading to better land protection. Organizational hurdles in the East will make the road to long-term land conservation more difficult.

Third, the high degree of development in the East has reduced the land available for nature conservation, including the designation of wilderness areas. For example, the Middle Atlantic Coastal Plain ecoregion (0.04% protected) includes Baltimore and the edges of Washington, DC. And the aforementioned Lower New England ecoregion (0.35% protected) includes the urban centers of New York and Boston. But this factor only highlights the need for system-wide studies such as this prioritization. The importance of proposed wilderness areas located in otherwise mostly developed ecoregions becomes apparent when analyzed via GIS prioritizations. The recommended wilderness in Assateague Island National Seashore ranks high in this study's prioritization because it is located in the underrepresented Middle Atlantic Coastal Plain ecoregion. And the potential wilderness in Fire Island National Seashore is located within the underrepresented Lower New England ecoregion. If the National Park Service, which administers both proposals, were to use national-level spatial analysis, then perhaps these two

wilderness proposals would receive greater attention in terms of funding or staffing. However, the agency does not even maintain geospatial data for the Fire Island National Seashore wilderness or potential wilderness (Nigel Shaw, GIS Coordinator for the Northeast Region, *personal communication*). Furthermore, the National Park Service has devoted only meager resources for stewardship of the potential wilderness at Fire Island NS, hampering conservation efforts there (Michael Bilecki, Chief of Resources Management at Fire Island, *personal communication*).

The role of wilderness proposals in ecosystem protection

This study reveals the ecoregions most in need of additional preservation as well as the proposed wilderness areas that can help reach conservation goals. This sort of information could aid environmental advocacy groups such as the American Wilderness Coalition, the Campaign for America's Wilderness, the Sierra Club, the Wilderness Society, and the Wildlands Project by prioritizing areas for conservation and helping focus resources toward the most urgently needed areas. The wilderness proposals that rank high in this study should receive attention first. Scientists, environmental advocates, and land managers should examine the ecological conditions, wilderness character, and political feasibility of each of the highly ranked proposals to ensure that wilderness designation is still appropriate (considering that conditions may have changed since the time of the original proposal.) Additionally, advocacy groups may want to devote less effort to the areas ranking lowest in this study. Wilderness proposals in already highly-protected ecoregions are not as urgently needed for conservation. For example, the multitude of wilderness proposals in the Grand Canyon Lands ecoregion (of which 33% is already protected) are already designated as National Park lands or National Recreation Area

lands. Failure to designate them as wilderness would not be detrimental to conservation because they will continue to receive some level of protection. Finally, Congress should use systematic studies such as this to decide which areas should receive long-term protection. From the legislative perspective, one advantage to using wilderness proposals to meet conservation goals is that the bills are essentially already drafted. Unlike completely new proposals for parks, proposed wilderness areas have already been described and delineated by government agencies. Basically, these areas just need the “yea” or “nay” votes of Congress. The advantages of GIS prioritization for conservation planning are numerous. Looking forward, there is tremendous opportunity for the federal land management agencies to adopt a systematic approach to conservation in order to improve resource management at the most crucial locations.

A call for increased systematic conservation planning

If the four federal land management agencies were to implement systematic conservation planning and explore GIS prioritizations, they would be able to provide Congress and the public with quantifiable rationale for their management decisions. This would increase government transparency and lead to fewer protests and lawsuits. The problem with the current fragmented approach to conservation can be seen in the public arena today. In February 2010, some Western Congresspersons and landowners were outraged to learn that the Department of Interior was considering fourteen sites for new National Monuments, which could be designated by President Barack Obama under the Antiquities Act (P.L. 59-209). The DOI memorandum describing the sites was labeled as an “Internal Draft – NOT FOR RELEASE.” However, Representative Rob Bishop (R-UT) discovered the draft and posted it on his webpage (Dept. of Interior 2010). He and others were angered to learn that new protected areas may be designated in the West, and the

DOI was criticized for the seemingly arbitrary decisions (Burr 2010; Johnson 2010). In the memorandum, “nationally significant landscapes” administered by the BLM are named as prospective new conservation areas. Crucially, however, no quantitative analysis is described to demonstrate that the areas are actually nationally significant. Instead, the descriptions are reminiscent of a tourist’s diary, describing the scenic beauty of the sites. For example, justification for protection of one of the sites begins,

“Tucked away in California’s northeast corner, the Modoc Plateau contains some of the State’s most spectacular and remote lands. This wild and largely undiscovered region features an array of natural riches: unbroken vistas, abundant wildlife, and millions of acres of intact, undisturbed landscapes” (Dept. of Interior 2010).

The description is evocative, but it is not science-based and is likely insufficient to convince those who are not already conservation-minded. I would suggest adding the following information to the proposal: the Modoc Plateau is currently underrepresented in our nation’s system of protected areas, and at 1.92% protection it is the least-protected ecoregion out of California’s 17 ecoregions. Such information can only be discovered by system-wide GIS analysis. Admittedly, adding numerical and geospatial data to a conservation proposal may still be insufficient to convince local stakeholders or decision-makers in Congress. But such information would strengthen the existing text and help justify the department’s rationale.

Necessary steps toward improved systematic planning

Several institutional changes are necessary in order to implement systematic conservation planning at the federal level. First, the agencies need to reduce inconsistencies in definitions and data standards. Crucial terms like “Proposed Wilderness” differ across and even within federal

agencies. Sometimes a term like “Proposed Wilderness” is used to identify a Congressionally legislated area, while other times it may refer to an administrative designation made at the local (field office) level. Worse yet, the term “Official Wilderness” is used liberally among Forest Service offices for areas that are not actually designated as such. (The term is often used for Wilderness Study Areas and Forest Plan Recommended Wilderness Areas, as well as areas seemingly unrelated to wilderness designation.) The severity and extent of this inaccuracy prohibited analysis in my study; correcting the geospatial data tables will require intensive quality control efforts. Consequently, compiling multi-region and multi-agency datasets requires intricate knowledge of local jargon. The national offices of each of the four federal land management agencies should lead data standardization efforts.

Federal agencies should also provide a clearinghouse for environmental data. Ideally, the information would be available to the public via a webpage. Each agency has already attempted this, but current efforts are insufficient. The National Park Service publishes data at the NPS Data Store (<http://science.nature.nps.gov/nrdata/>) but the site is outdated, sparsely populated, and replete with inconsistent data formats and standards. The Forest Service and Bureau of Land Management co-operate a separate online data clearinghouse, GeoCommunicator (www.geocommunicator.gov). But the site focuses heavily on data relating to resource utilization, such as energy, mineral resources, mining claims, and rangeland. Wilderness-related data is not shared with the public; in fact, no conservation-oriented information is available online. Furthermore, many maps are viewable on-screen as images but the related data are not downloadable. The Fish and Wildlife Service maintains a small data clearinghouse (www.fws.gov/GIS). But very little of the publicly available data pertains to protected areas and land status, and the agency provides no information on wilderness or proposed wilderness.

Instead, the national-level datasets include odd curiosities like a GIS point file depicting FWS office locations. In each of these cases, the existing agency data clearinghouses are inadequate for research.

At all four of the federal land management agencies, the general unwillingness to share environmental data with the public is unfortunate and possibly unlawful. Congress has directed all federal agencies to increase use of electronic information and to make files available to the public.⁴ But the agencies seem to dismiss these requirements. Of the four, the Fish and Wildlife Service is especially clandestine, apparently due to a fear of public outcry or lawsuits directed at the agency's decision-making process. The agency's National Wilderness Coordinator notes that, "We do not wish to alarm people into thinking that all the lands being evaluated for possible wilderness recommendation are on the verge of becoming designated wilderness" (Nancy Roeper, *personal communication*). Regional wilderness directors expressed similar views. Ultimately, the FWS did not share information on proposed wilderness areas. This proclivity for withholding information needs to be reversed in order to meet Congressional directives, improve transparency, and assist independent research.

Administrative regionalization at all four federal land management agencies has prevented a national-level conservation strategy. Additionally, the region boundaries are occasionally illogical, preventing coherent strategizing at even the region level. At the Forest Service, in which regions operate somewhat independently of one another, some region boundaries unite states with similar environmental factors (e.g. Washington and Oregon form Region 6) but other region boundaries unite considerably different environments (e.g. California

⁴ See, for example, the Management Reform Act (P.L. 103-356), Paperwork Reduction Act (P.L. 104-13), Information Quality Act (P.L. 106-554, Section 515), and Freedom of Information Act (P.L. 89-554, with amendments in 1996, 2002, and 2007).

and Hawaii form Region 5.) I would recommend that the agencies drastically reconfigure their regional boundaries in order to match environmental issues, or else the national offices of the agencies should help guide the regions in conservation planning. Fortunately, there is some indication that the federal government may restructure its conservation strategy to align administrative boundaries with environmental conditions. In late 2009, Secretary of Interior Ken Salazar announced a new science-based agency plan to address impacts of climate change, and it establishes a network of “Landscape Conservation Cooperatives” (Dept. of Interior 2009). The Department of Interior has since drawn boundaries for 21 LCCs based on boundaries of watersheds, mountain ranges, climatic patterns, and other environmental features. Eventually, each LCC will be led by a committee comprised of governmental and non-governmental scientists, and scientific research at the LCCs will inform agency decision-making. The LCCs may not be a panacea in terms of protected area management, though. The primary goal of the LCCs will be to address environmental stressors; it remains to be seen whether wilderness stewardship planning will be a part of this landscape-level strategy. And notably, the Department of Agriculture (and hence, the Forest Service) is not a part of this strategy.

Conclusion:

This study is the first compilation of data on proposed wilderness areas. As such, it may be used as the basis for further investigations into protected areas, generally, or wilderness, specifically. Subsequent prioritizations could examine connectivity among existing and proposed parks, the role of inholdings, or the sociopolitical feasibility of designation. There was remarkable interest in such kinds of studies from some of the federal agency staff during this project, which is very encouraging.

Figures and Tables:

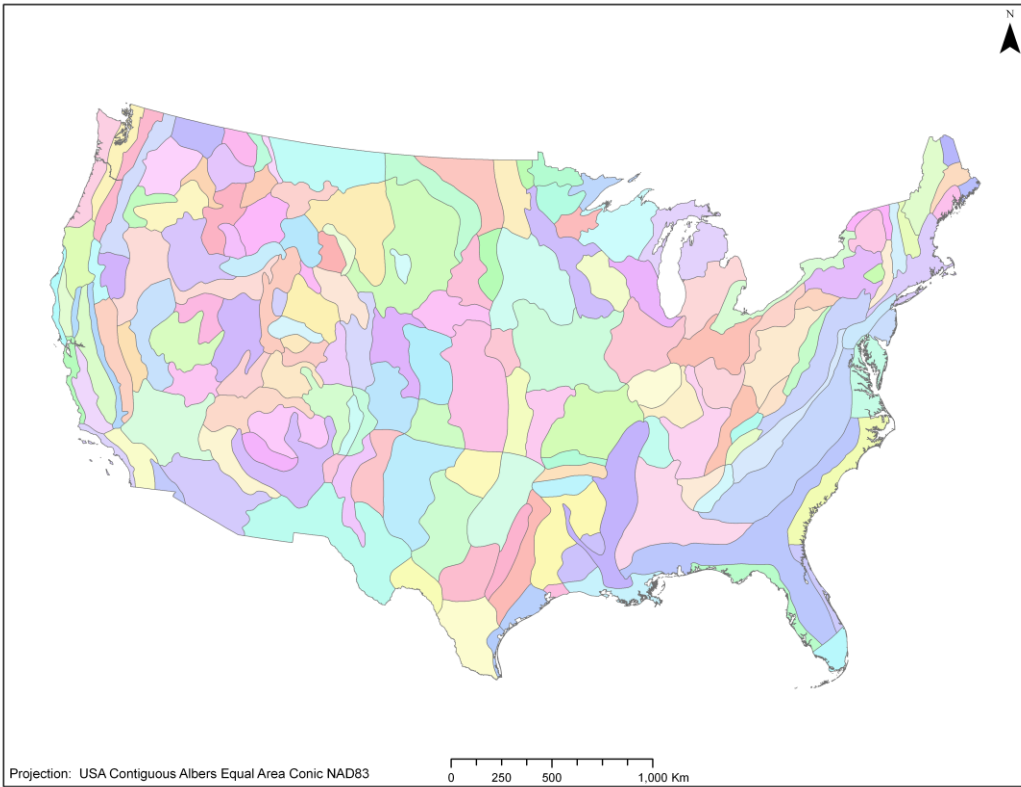


Figure 1: Ecoregions of the 48 contiguous states (from Bailey 1995).

Table 1: Protected area categories (IUCN 1994).

Category		Management objectives
Ia.	Strict nature reserve	Preservation of biodiversity and/or outstanding physical features; conservation research
Ib.	Wilderness area	Naturalness; undisturbed and unmodified by humans
II.	National park	Ecosystem protection and limited recreation
III.	Natural Monument	Conservation of aesthetic, natural, or cultural features
IV.	Habitat/species management area	Conservation through human intervention
V.	Protected landscape/seascape	Protection of distinctive features; recreation; traditional interventions allowed
VI.	Managed resource protected area	Sustainable resource extraction

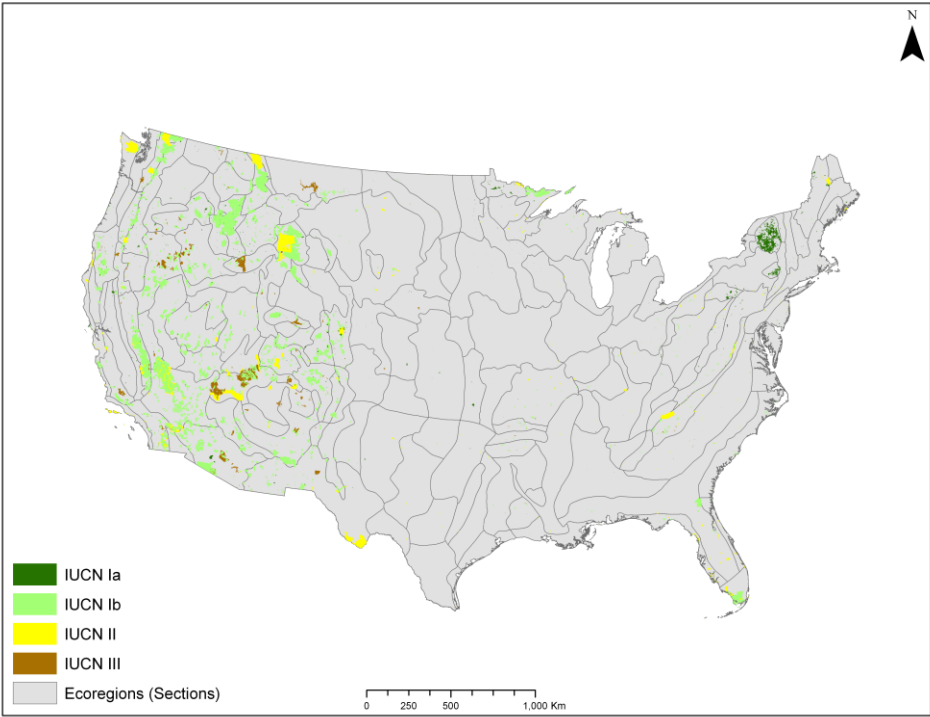


Figure 2: Existing protected areas of the 48 contiguous states, overlaid on a map of ecoregions.

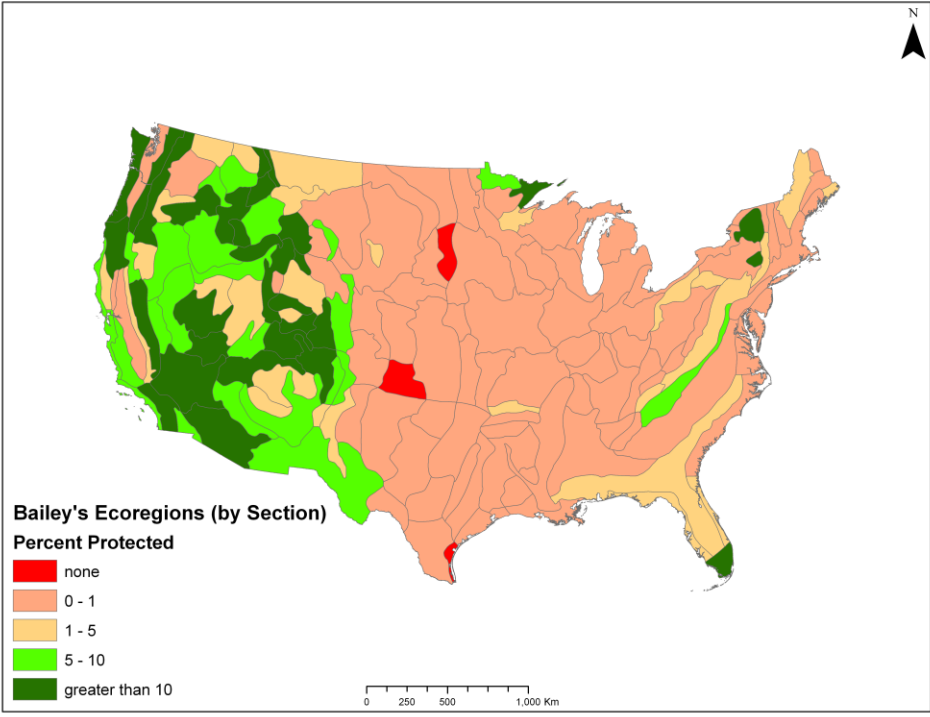


Figure 3: Percent of each ecoregion protected under IUCN categories I, II, or III. Almost all ecoregions that meet the CBD goal of 10% protection are located in the West.

Table 2: The highest ranking wilderness proposals under administration by the BLM.

Wilderness Proposal	Ecoregion	Current Protection
Beaver Creek WSA	Arkansas Tablelands	0.05%
McCullough Peaks WSA	Bighorn Basin	0.17%
Trapper Creek WSA		
Alkali Creek WSA		
Medicine Lodge WSA		
Cedar Mountain WSA		
Honeycombs WSA		
Red Butte WSA		
Sheep Mountain WSA		
Bobcat Draw Badlands WSA		
Pryor Mountain WSA		
Burnt Timber Canyon WSA		
Big Horn Tack-on WSA		
Zook Creek WSA	Powder River Basin	0.21%
Fortification Creek WSA		
Terry Badlands WSA		
Buffalo Creek WSA		

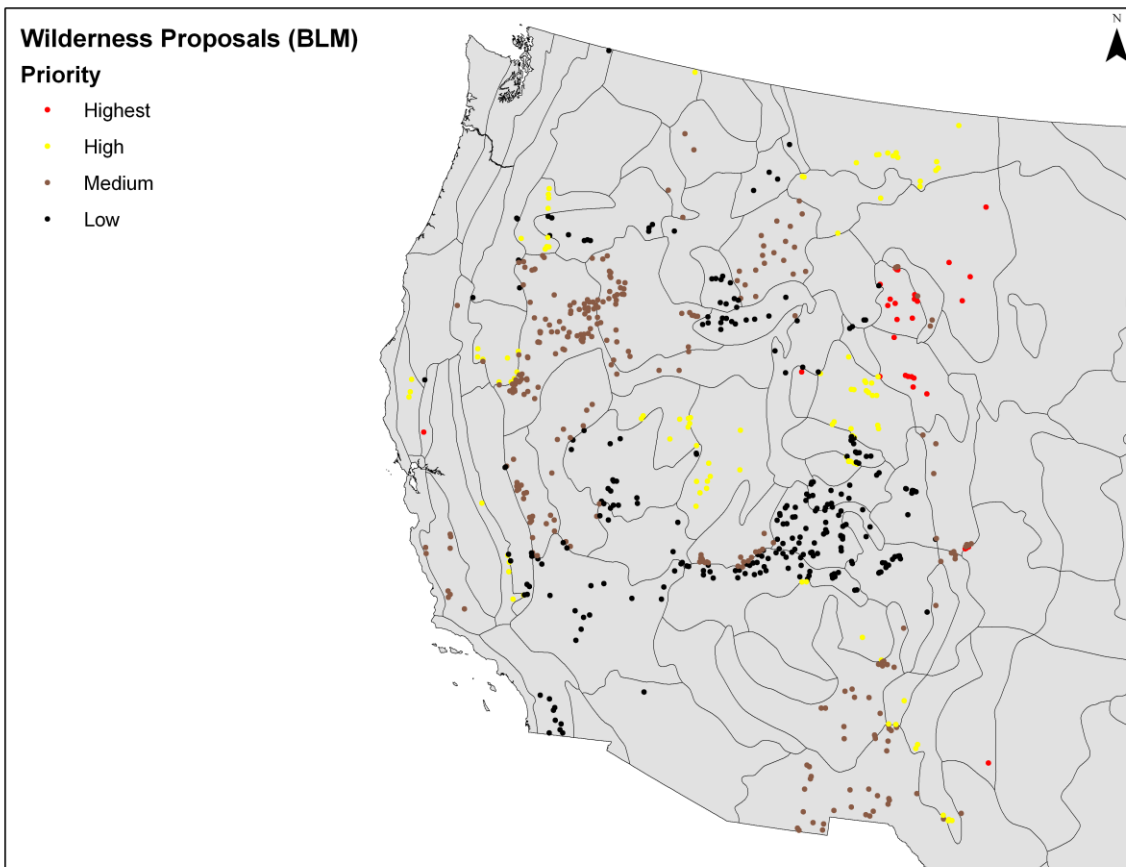


Figure 4: Prioritization of Wilderness Study Areas administered by the BLM. They are grouped by the current level of ecoregion protection: ecoregions with less than 1% protection (highest priority), 1-5% protection (high priority), 5-10% protection (medium priority), and greater than 10% protection (low priority.) All BLM WSAs are located in the Western states. Most proposed areas are too small to be seen on a map of this scale; the points here represent the centroids of their locations.

Table 3: Wilderness proposals under NPS administration and located in underrepresented ecoregions.

Wilderness Proposal	Ecoregion	Current Protection
Assateague Island National Seashore Recommended Wilderness	Middle Atlantic Coastal Plain	0.04%
Bighorn Canyon National Recreation Area Proposed Wilderness	Bighorn Basin	0.17%
Sleeping Bear Dunes National Lakeshore Proposed Wilderness	Northern Great Lakes	0.37%
Dinosaur National Monument Recommended Wilderness & Potential Wilderness	Uinta Basin	1.57%
Chaco Culture National Historical Park Potential Wilderness	Navajo Canyonlands	3.00%
Glacier National Park Recommended Wilderness & Potential Wilderness	Flathead Valley	4.32%
Joshua Tree National Park Potential Wilderness & Potential to Full Wilderness	Sonoran Colorado Desert	5.03%
Big Bend National Park Recommended Wilderness & Potential Wilderness	Basin and Range	5.27%
Voyageurs National Park Proposed Wilderness	Northern Minnesota & Ontario	5.77%
Lassen Volcanic National Park Proposed Wilderness	Southern Cascades	8.97%
Bryce Canyon National Park Recommended Wilderness	Utah High Plateaus and Mountains	9.32%
Cedar Breaks National Monument Recommended Wilderness		

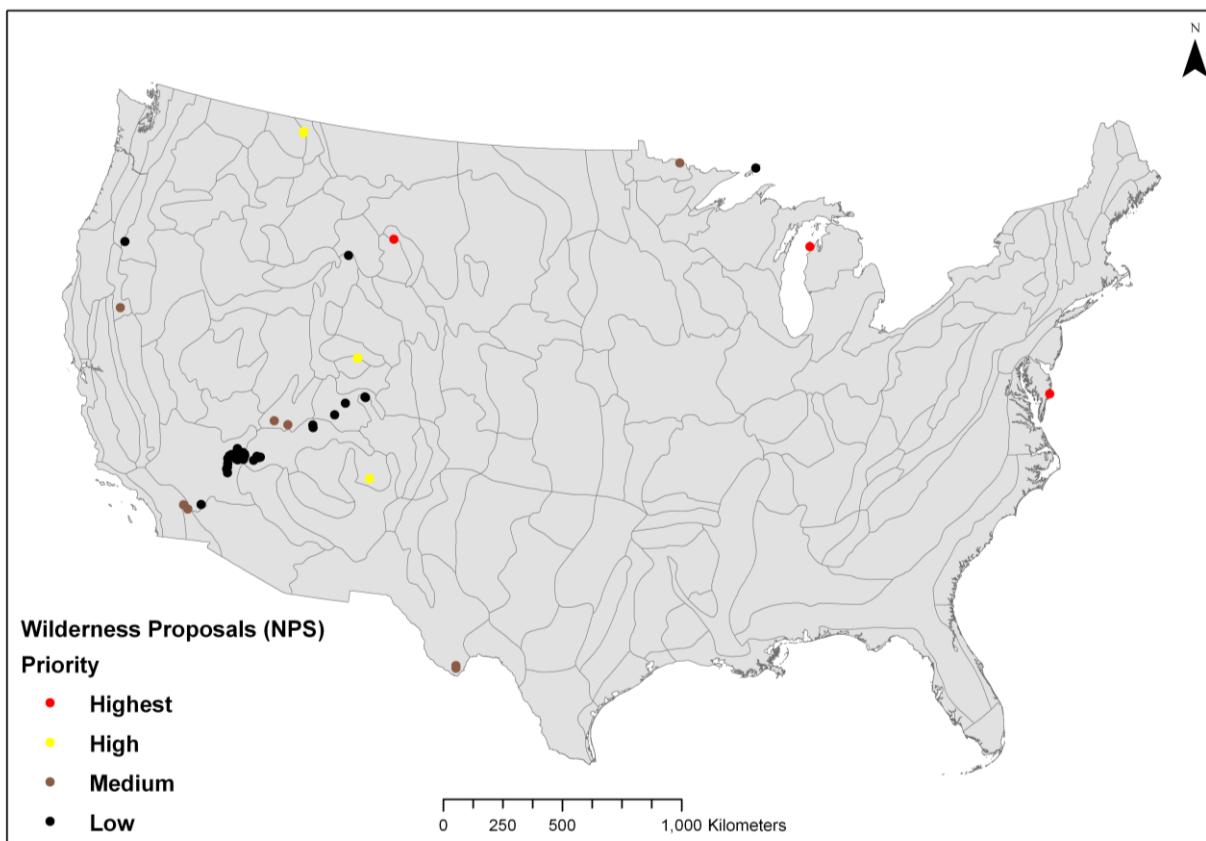


Figure 5: Prioritization of NPS wilderness proposals. They are grouped by the current level of ecoregion protection: ecoregions with less than 1% protection (highest priority), 1-5% protection (high priority), 5-10% protection (medium priority), and greater than 10% protection (low priority.) Most proposed areas are too small to be seen on a national map; the points here represent the centroids of their locations.

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References:

- Bailey, R. 1995. *Description of the Ecoregions of the United States*, 2nd Ed. USDA Forest Service, Miscellaneous Publication #1391. Washington, DC. 108 pp.
- Burr, Thomas. 2010. "Two more monuments planned in Utah?" *The Salt Lake Tribune*. 19 February.
- Convention on Biological Diversity. 2004. COP 7 Decision VII/30. Goal 1, Target 1.1 <<http://www.cbd.int/decision/cop/?id=7767>>
- Department of Interior. 2010. "Prospective Conservation Designation: National Monument Designations under the Antiquities Act." Unpublished internal memorandum. Available at: <http://robbishop.house.gov/UploadedFiles/states_for_designation.pdf>
- . 2009. "Secretarial Order 3289." 14 September. Available at: <<http://www.doi.gov/archive/climatechange/SecOrder3289.pdf>>
- Erb, Christina. 2009. "Growth in Mountain Biking May Put Western Trails Off Limits." *New York Times*. 11 October.
- IUCN. 1994. *Guidelines for Protected Areas Management Categories*. Cambridge, UK: IUCN Publications. 261 pp.
- Jenkins, Clinton N. and Lucas Joppa. 2009. "Expansion of the global terrestrial protected area system." *Biological Conservation* 142: 2166-2174.
- Johnson, Kirk. 2010. "In the West, 'Monument' Is a Fighting Word." *New York Times*. 20 February.
- Julyan, Robert. 1998. *New Mexico's Wilderness Areas: The Complete Guide*. Boulder, CO: Westcliffe Publishers, Inc. 318 pp.
- Loomis, John and J. Chris Echohawk. 1999. "Using GIS to identify under-represented ecosystems in the National Wilderness Preservation System in the USA." *Environmental Conservation* 26 (1): 53-58.
- United States Geological Survey. 2009. Protected Areas Database for the United States. Downloadable data at: <<http://www.protectedlands.net/padus/>>