Rethinking Private Land Conservation in the Face of Climate Change: A California Case Study & Future Options

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Private land conservation is about to get a whole lot harder. Private land trusts such as The Nature Conservancy have played a significant role over the last twenty years in protecting natural landscapes for their biodiversity and other values.[1] Reflective of the success of private land conservation, over 1700 land trusts (up over 50 percent in the last decade) currently protect some 37 million acres of land in the United States – an area larger than almost a quarter of all the states and again double the amount of private land protected just a decade ago. Climate change, however, threatens virtually every category of land conservation and will require conservation organizations to rethink their strategies and tools. Sea-level rise and increased incidence of flooding, for example, threatens even relatively "insensitive" categories of conservation such as open space.

Some forms of land conservation, however, are more vulnerable to climate change than others. Perhaps most vulnerable is biodiversity protection. Of all the purposes of land trusts, the most common is wildlife protection; over 90% of the land trusts responding to the most recent survey of the Land Trust Alliance reported that they protected important natural areas of wildlife habitats. Yet climate change threatens the traditional strategy of protecting critical habitat for focal species in perpetuity. In response to climate change, the distribution of species is already shifting and tightening; sea-level rise, fires, and other climatic effects are destroying existing; population sizes are dropping; wildlife diseases, parasites, and zoonoses are spreading; and invasive species are also spreading and competing with indigenous species.[2] All of these impacts make it less likely that habitat protection by itself will save a species and, equally importantly, call for a more dynamic approach to habitat protection and management. Other categories of conservation, including agricultural preservation, also face significant risks from climate change; studies, for example, suggest that many prime agricultural areas will face increasing climatic threats from heat, drought, and floods.[3]

This Article looks at how private land conservation may need to be rethought in the face of climate change, with a particular emphasis on the protection of biodiversity. In February 2009, the Stanford Woods Institute for the Environment brought together approximately two

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[1] See, e.g., Barton H. Thompson, Jr., Providing Biodiversity Through Policy Diversity, 28 Idaho L. Rev. 355 (2002) (describing the role of private philanthropic organizations in protecting biodiversity); Barton H. Thompson, Jr., Conservation Options: Toward a Greater Private Role, 21 Va. Envtl. L.J. 251 (2001) (discussing the important role that private conservation organizations have played in protecting environmentally important lands);

[2] Jonathan R. Mawdsley, Robin O'Malley, & Dennis S. Ojima, A Review of Climate-Change Adaptation Strategies for Wildlife Management and Biodiversity Conservation, 23 Conservation Bio. 1080, 1081 (2009).

[3] See, e.g., N.S. Diffenbaugh, M.A. White, G.V. Jones, & M. Ashfaq, Climate Adaptation Wedges: A Case Study of Premium Wine in the Western United States, 6 Envtl. Res. Letters 024024 (2011) (analyzing the potential impact of climate change on premium wine regions of California).

dozen scientists and legal scholars to discuss what conservation organizations would need to do to accomplish their missions in the face of climate change and whether existing conservation tools, in particular conservation easements, were up to the task.[4] Realizing that we knew little about how climate change would likely play out in actual practice, a number of participants decided to teach parallel seminars in which graduate students, using a common research methodology would investigate the implications of climate change for conservation organizations in their state. This "distributed graduate seminar" ultimately included students at six universities: Stanford University, State University of New York, University of Denver, University of Indiana, University of South Carolina, and University of Wisconsin.[5] The distributed seminar examined 28 regions in six states (California, Colorado, Indiana, New York, South Carolina, and Wisconsin). *See Illustration 1 (immediately below).* In the process of the study, students studied the practices of 60 conservation organizations, interviewed 73 staff members, and examined and coded 260 conservation easements (including both their purposes and provisions).

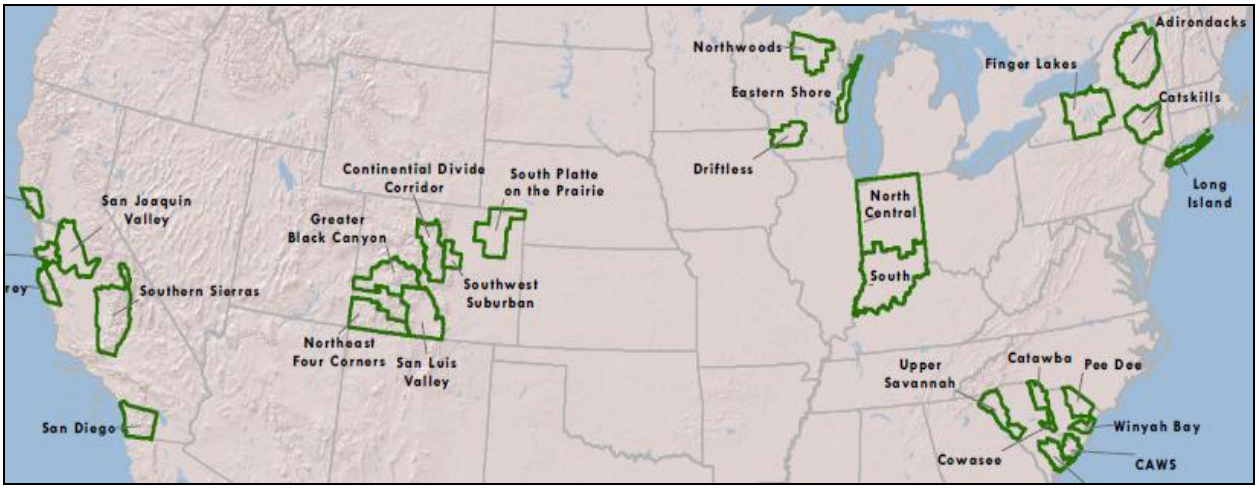

Illustration 1: 28 Regions were studied in six states.

Part I describes the principal problems that climate change will pose for private land conservation, with a particular focus on the protection of imperiled species. Part I also describes the primary methods that private conservation organizations might use to address these problems; of particular relevance to this paper is the possibility of creating more flexible and dynamic conservation reserves. Part II then examines the results of the California case study, along with a brief overview of the national results from the distributed seminar, and considers what the results suggest about the conservation sector's preparedness for climate change. Finally, Part III analyzes various options for creating more dynamic reserves and the limitations of existing tools for private conservation, including conservation easements. The Article looks only at land conservation and does not consider the challenges that climate change poses for either marine conservation or the protection of fish through the protection of freshwater flows.

[4] See Stanford Woods Institute for the Environment. Conservation & Climate, http://woods.stanford.edu/ideas/climateconservation.html.

[5] For a description and analysis of the distributed seminar, see Jessica Owley & Adena R. Rissman, Distributed Graduate Seminars: An Interdisciplinary Approach to Studying Land Conservation, 2 Pace Envtl. L. Rev. Online Companion 88 (2011).

The Article also focuses on private land conservation and only incidentally addresses public and regulatory efforts to achieve conservation goals, including protection of imperiled species, through public land ownership and regulatory measures such as the Endangered Species Act.

I. THE CHALLENGE OF CLIMATE CHANGE

A. Climate Change Will Seriously Impact Conservation

Little time need be spent discussing the types of climate change, and associated problems, that the nation and World will face over the next century and beyond. By now the litany is well known,[6] and in most cases climate change is already taking place. Temperatures in many regions will increase. Indeed, mean land surface temperature already has risen almost 1º Celsius over the last century.[7] Sea level is also already rising, both as a consequence of the inflow of freshwater from melting glaciers and from thermal expansion. From 1961 to 2003, scientists estimate that the average sea level rose 1.8 mm per year, plus or minus half a millimeter, with an increase also in "high water events" (defined as sea-level extreme that exceed the 99th percentile of historical occurrences).[8] The effect of climate change on precipitation is harder to predict. Precipitation will increase in some regions and decrease in others.[9] However, extreme conditions, both droughts and floods, will increase in frequency and severity.[10] Regions dependent on snow melt, moreover, are likely to see decreased flows because of rising temperatures and thus less snow.[11] Changes in precipitation and snowpack in turn will lead to increases in both the probability of wildfires and other ecosystem disturbances.[12] As the projections of increased droughts and floods illustrate, changes in means will be just a small part of the challenge of climate change. Far more worrisome will be the increased frequency and intensive of extremes, which often will take us beyond previously experienced conditions and present the risk of nonlinear shifts in climatic and ecological systems.

Not surprisingly, these changes pose significant risk for a variety of different types of private conservation efforts. Climate change can both undermine the purposes for which a conservation organization is holding and protecting land and, in the case of conservation easements, increase the difficulty of meeting particular easement requirements. In 2006, The Nature Conservancy (TNC) conducted a study of the potential impacts of climate change on the

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[6] The literature on climate impacts and adaptation has grown geometrically over the last decade. See Patty Glick, Helen Chmura, & Bruce A. Stein, Moving the Conservation Goalposts: A Review of Climate Change Adaptation Literature (June 2011).

[7] K.E. Trenberth et al., Observations: Surface & Atmospheric Climate Change, in Climate Change 2007: The Physical Basis (S. Solomon et al., eds. 2007).

[8] N.L. Bindoff et al., Observations: Oceanic Climate Change and Sea Level, in Climate Change 2007: The Physical Science Basis (S. Solomon et al., eds. 2007); Philip L. Woodworth & David L. Blackman, Evidence for Systematic Changes in Extreme High Waters since the Mid-1970s, 17 J. Climate 1190 (2004).

[9] Barton H. Thompson, Jr., Facilitating Adaptation to Climate Change: Themes for Law & Policy (forthcoming 2012).

[10] P.Y. Groisman et al., Contemporary Changes of the Hydrological Cycle over the Contiguous United States: Trends Derived from In Situ Observations, 5 J. Hydrology 64 (2004).

[11] See, e.g., Amy Lynd Luers & Susanne C. Moser, Preparing for the Impacts of Climate Change in California: Opportunities and Constraints for Adaptation – White Paper (2006).

[12] See, e.g., Steven W. Running, Ecosystem Disturbance, Carbon, and Climate, 321 Sci. 652 (2008); Steven W. Running, Is Global Warming Causing More Larger Wildfires?, 313 Sci. 927 (2006).

diverse purposes for which they acquire and hold conservation easements in the United States.[13] Table 1 lists all of the various purposes for which TNC holds conservation purposes, in approximate order of importance; as shown, TNC's principal purpose (reflected in a number of the more specific purposes shown in Table 1) is to protect natural landscapes and the species reliant on them. Those TNC purposes that climate change is likely to affect are indicated in bold type. Not surprisingly, climate change significantly undermines TNC's efforts to use its easements to try to protect endangered or other imperiled species by, for example, protecting property in its "natural" state, creating and protecting mitigation routes and other forms of connectivity among parcels of protected land. As explained in the next section, the ranges of species are likely to shift and shrink, at the same time that they come under increased stress from a variety of conditions, making it harder to protect species on stationary parcels of land. As Figure 1 shows, however, floods, sea level rise, and other climate changes also will make it more difficult to a number of TNC's other goals including the protection of grazing and heritage ranching, critical water flows, forest conservation, and public access to areas of scenic enjoyment.

	Conservation Purpose
1	**Retain property/habitat undisturbed in natural state/condition**
2	Prohibit certain further development activities, fragmentation
3	**Protect endangered species**
4	**Protect marine/aquatic habitat or communities (e.g., shoreline, wetlands)**
5	**Protect habitat for migration routes**
6	Protect unique features (e.g., cliff, geothermal, etc.
7	Buffer for habitat or feature
8	**Contribute to viability/connectivity of surrounding protected areas**
9	Protection of larger landscape through conservation easements
10	**Manage in accordance with a conservation plan or agreement**
11	**Restoration activities**
12	**Satisfy mitigation components**
13	Protection of historic value (e.g., land uses, structures)
14	**Compatible grazing, heritage ranching**
15	**Species re-introduction site**
16	**Natural water and nutrient retention, with rights to flood, flow, & store water on property**
17	Accommodation of educational and/or scientific activities/facilities
18	**Public benefit: access, services, and/or scenic enjoyment**
19	**Demonstrating easements as effective conservation tool for area (e.g., forest conservation, ranch stewardship)**
20	Priority acquisition for TNC or other partners
21	Donor cultivation
22	Landowner/community relations
23	Partner relations
24	Board member relations

[13] Shaw study 2006.

25	Owner preferred TNC over other partners (e.g., government, land trust)
26	Easement acquisition required (e.g., by grant, lawsuit)
27	Sold through/involved in conservation buyer program
28	Prevent uses that would impair, degrade or interfere with conservation values
29	Any commercial use

Figure 1: TNC Conservation Easement Purposes
(easements affected by climate change shown in bold type)

Climate change will affect not only conservation organizations like TNC that focus on protection of natural habitats and imperiled species, but also the growing number of organizations established to protect agricultural, ranching, and timber-cutting operations. 61% of the land trusts surveyed as part of the Land Trust Alliance's 2010 "census" reported that one of their primary purposes was to protect working farms or ranchlands. Organizations such as the American Farmland Trust and the California Rangeland Trust focus exclusively on such protection. A slightly smaller number of the reporting land trusts in the 2010 census (54%) reported protecting working forest lands. Changing temperatures and weather conditions, however, will reduce the ability of many prime farm areas to produce the high quality crops that they current do, including premium wine grapes and fruits.[14] Although ranching is somewhat less vulnerable than high-valued crops to climate change because cows can survive under a wider range of conditions, ranching productivity is still likely to decline in many regions as a result of drier conditions.[15] Climate change also will seriously harm forests in many parts of the United States.[16]

Land trusts with other purposes may fare better. Other major purposes include open space (which was the third most common purpose in the 2010 census of land trusts, mentioned by 77% of the responding trusts), recreation (46%), historic or cultural resources (36%), and urban parks and gardens (27%). In many cases, climate change is unlikely to seriously undermine these purposes. Even here, however, climate change can pose concerns. Flooding or sea-level increases, for example, could threaten urban parks or historic buildings.

As noted, climate change will not only undermine the purposes of private land conservation but also make it more difficult to accomplish specific requirements of conservation easements. Figure 2 lists the major restrictions that TNC includes in many of its conservation easements, with those in bold again indicating a negative impact from climate change. For the reasons mentioned above, climate change may make it difficult for the owners of some lands subject to conservation easements to continue to use them for agricultural purposes. Climate change also will make it more difficult, if not impossible, for owners to maintain particular harvest rates or conservation conditions. Although climate change will not affect the ability of land owners to avoid *intentional* introduction of exotic species, it will increase the receptivity of some lands to exotic species migrating or introduced unintentionally.

[14] See, e.g., Diffenbaugh et al., supra note xx; Elke Luedeling, Minghua Zhang, & Evan H. Girvetz, Climatic Changes Lead to Declining Winter Chill for Fruit and Nut Trees in California during 1950-2099, PlosOne (in publication).
[15] See, e..g., A.M. Reilly, Agriculture: the potential consequences of climate variability and change for the United States (2002).
[16] See, e.g., Virginia H. Dale et al., Climate Change and Forest Disturbances, 51 BioScience 723 (2001).

Subdivision/Development Restrictions
Number of parcels and structures
Number of residents
Number and intensity of roads
Land Use Restrictions
Land use types
Agricultural use and extent
Resource Restrictions
Harvest rates (residual dry matter for rangeland; timber for forests; fishing)
Invasive species intentional introduction (not control)
Maintaining conservation values
Water source development and export

Figure 2: TNC Restrictions for Compliance Monitoring
(restrictions shown in bold will be affected by climate change)

B. Impact of Climate Change on Biodiversity Protection

As noted, of all of the purposes of private land conservation, biodiversity protection faces the greatest threat from climate change. Climate change, moreover, poses a more serious and universal challenge to biodiversity than perhaps any other stressor encountered to date.[17] The climate effects of greatest concern fall into five, often overlapping categories. First, climate change will reduce or eliminate important habitat for some species.[18] For example, species that rely on coastal habitat may find significant portions of their habitat inundated, while species that live in glacial regions may find their habitat disappearing.

Second, the distribution of some species will shift, with the consequence that currently protected habitat will no longer serve as an effective home for the species.[19] In fact, species are already seeking more hospitable climatic conditions by migrating higher and toward the poles.[20] Where impediments such as urban development stand in the way of needed migration, species may not be able to successfully move to new, more hospitable areas. The challenge of shifting distribution is complicated by the highly fragmented nature of most landscapes today, which makes it less likely that a particular species will be able to move effectively to a new habitat in the face of climate change.[21]

Third, the habitat of a species also may shift.[22] Plants on which a species is reliant, for example, might shift away from land on which the land is currently In some cases, the shifting

[17] Jonathan Mawdsley, Design of Conservation Strategies for Climate Adaptation, 2 WIRES Climate Change 498, 499 (2011).
[18] Mawdsley, O'Malley, & Ojima, supra note xx, at 1081.
[19] Id. at 1081; Lee Hannah, Protected Areas and Climate Change, 1134 Ann. N.Y. Acad. Sci. 201, 201 (2008).
[20] Hannah, supra note xx, at 203.
[21] Lee Hannah & Lara Hansen, Designing Landscapes and Seascapes for Change, in Climate Change and Biodiversity 329, 329 (Thomas E. Lovejoy & Lee Hannah, eds. 2005).
[22] Mawdsley, O'Malley, & Ojima, supra note xx, at 1081.

of either a species' distribution or its habitat might decouple the species from its habitat, leading to the loss of usable habitat for the species.

Fourth, climate change may subject a species to new threats.[23] For example, changes in climate could lead to the spread of diseases, parasites, or zoonoses of danger to a native species. Changes in climate also can open an area to the increased spread of invasive species that compete with or injure native species.

Finally, climate change can place new stresses on species, increasing the chances of extinction. Increased temperatures and precipitation changes, for example, are likely to affect both demographic rates and population size.[24]

C. Possible Adaptive Measures

Land trusts and other conservation organizations can take a variety of actions to try to combat these and other climate impacts to biodiversity that they are trying to protect. The particular mix that a land trust might pursue depends on the particular threat that the biodiversity faces. The most promising adaptive measures fall into four overlapping categories: (1) changes in what and how much land is protected, (2) finding ways to assist species to migrate to new habitats in which they can survive in the face of climate change, (3) managing lands to reduce stressors, and (4) finding ways to create more flexible and dynamic reserve networks. Underlying all four of these categories is the "need to move from a paradigm of protection and restoration to one that is open to anticipating and actively managing change."[25]

Land Selection. Recognizing that habitat and species' distribution may shift in the face of climate change, land trusts may need to rethink what lands to protect.[26] Ideally, land trusts would protect not only current habitat, but also areas to which a species is likely to move over time along with any necessary migration corridors – an "integrated web of land" that could support species change in the face of climate change.[27] Unfortunately, although tools and data to plan such integrated webs are increasingly available, the particular migration path of a species, including its new habitat, is often unpredictable, species are not likely to all follow the same corridors, and protecting the necessary amount of land can be prohibitively expensive.[28] The closest that a land trust might be able to come to this strategy therefore is to protect a variety of natural areas along with the most logical pathways between them (e.g., riparian corridors). Because protecting large amounts of land and migration corridors can be expensive, conservation organizations often will need to work together and with governmental land owners to create

[23] Id.
[24] Id.
[25] Glick, Chmura, & Stein, supra note xx, at 10.
[26] Mawdsley, O'Malley, & Ojima, supra note xx, at 1082.
[27] John Kostyack, et al., Beyond Reserves and Corridors: Policy Solutions to Facilitate the Movement of Plants and Animals in a Changing Climate, 61 BioSci. 713, 717 (2011); Mawdsley, supra note xx, at 504; Hannah & Hansen, supra note xx, at 329; Kostyack, supra note xx, at 713; Hannah, supra note xx, at 204.
[28] Kostyack, supra note xx, at 713; Mawdsley, O'Malley, & Ojima, supra note xx, at 1083; Hannah & Hansen, supra note xx, at 331 & 335 Hannah, supra note xx, at 205. We also have little sense of how effective migration corridors are in facilitating species movement. Kostyack, supra note xx, at 713. The "individualistic movements" of different species "are not likely to align with one another closely or be readily captured in linear source-to-destination corridors." Hannah, supra note xx, at 205.

needed matrices of protected lands and connections.[29] An increase in the amount of land protected also can combat loss of habitat from various climate effects.[30]

Where even this strategy appears to be out of reach for monetary, political, or practical reasons, land trusts alternatively can seek to protect lands that are most likely to prove effective at conservation in the face of climate change. For example, land trusts could try to identify and protect refugia that will prove relatively resilient to climate change.[31] Alternatively, land trusts could seek to protect a representative sample of major ecosystem types rather than lands that currently serve as habitat for particular species, with the goal of trying to maximize the number of species that ultimately will be protected as species' ranges shift.[32] In a similar fashion, land trusts can seek to add new reserves that represent climates underrepresented in current reserve systems, in order to maximize the range of climatic conditions to which species can move.[33] Finally, land trusts can design reserves to maximize the flexibility of species within them. For example, rather than using watershed divides as reserve boundaries, land trusts might include high-elevation habitat on either sides of the divide into reserves, recognizing that species are likely to move upgradient in response to climate change.[34]

Assisting Migration. Recognizing that species will be moving, land trusts also can try to ensure effective migration. Protecting potential migration corridors, discussed immediately above, is an example of this adaptive strategy.[35] Alternatively, land trusts can try to increase the permeability of the land area through which a species is likely to move (e.g., by promoting various agrienvironmental land uses).[36] In some cases, land trusts or other entities may need to directly assist a species in migrating, either because a species' range of movement is not large enough for the species to move naturally to new habitat, or because there are obstacles such as cities in the species' path.[37]

Management Actions. Land trusts could try to manage their lands in ways that help reduce the impact of climate change and other stressors.[38] For example, land trusts can lower fire risks by reducing the fuel loads on their properties or stave off inundation from rising sea levels by renourishing beaches or constructing levees.[39] Where habitat is lost, land trusts also

[29] Gustavo A.B. Da Ponseca, Web Schrest, & Judy Ogletorpe, Managing the Matrix, in Climate Change and Biodiversity 346, 348 (Thomas E. Lovejoy & Lee Hannah, eds. 2005).
[30] Hannah, supra note xx, at 203.
[31] Karen A. Paiani et al., Redesigning Biodiversity Conservation Projects for Climate Change: Examples from the Field, 20 Biodiversity Conservation 185, 195 (2011).
[32] The problem with this strategy, of course, is that existing ecosystems may disassemble, with new ecosystems reassembling in quite different patterns elsewhere. Mawdsley, supra note xx, at 506; Mawdsley, O'Malley, & Ojima, supra note xx, at 1082; Glick, Chmura, & Stein, supra note xx, at 10.
[33] Hannah, supra note xx, at 204.
[34] Id. at 208.
[35] See Hannah, supra note xx, at 205; Thomas E. Lovejoy, Conservation with a Changing Climate, in Climate Change and Biodiversity 325, 327 (Thomas E. Lovejoy & Lee Hannah, eds. 2005) (noting that connectivity will become an even more critical element of conservation in the future in light of climate change).
[36] Mawdsley, supra note xx, at 506-507; Kostyack, supra note xx, at 713; Mawdsley, O'Malley, & Ojima, supra note xx, at 1084.
[37] Paiani, supra note xx, at 195; Mawdsley, supra note xx, at 507; Kostyack, supra note xx, a 716-718; Mawdsley, O'Malley, & Ojima, supra note xx, at 1084; Hannah, supra note xx, at 209-210.
[38] Hannah & Hansen, supra note xx, at 338; Lovejoy, supra note xx, at 327 (noting that climate change will "require active management to an 0065tent never envisioned previously").
[39] Mawdsley, supra note xx, at 506; Mawdsley, O'Malley, & Ojima, supra note xx, at 1082;

can try to create new nearby habitat.[40] For example, as coastal wetlands are lost to sea-level rise, land trusts could help to create replacement wetlands along the moving tideline.[41] In response to droughts, land trusts can purchase water rights from others.[42] Land trusts also can manage their lands to minimize other stressors, such as invasive species.[43]

Climate change will call on land trusts to engage in more meaningful adaptive management than they have in the past.[44] Because both climate change and its effect on habitat and species will often be unpredictable, land trusts will not be able to plan out all needed management actions in advance. Instead, land trusts will need to carefully monitor their reserves to ensure that their management actions are having the desired effect. Where they are not, land trusts will want to modify their actions to take into account the changed conditions and understanding.

Flexible Reserves. Finally, land trusts may want to consider creating more flexible reserves. As discussed in Part III, land trusts might find it valuable to retain the option of selling land or conservation easements if the habitat value of the land decreases and using the proceeds from that sale to buy new land with greater conservation value. Lee Hannah and Lana Hansen have suggested the option of creating dynamic reserves in which the level and types of protection applicable to any portion of the reserve would change over time in response to shifting conditions.[45]

II. THE LAND TRUST STUDY

As noted earlier, six universities simultaneously ran a distributed graduate seminar in order to examine what threats climate change posed for land trusts in the United States, how (if at all) land trusts were responding to these threats, and whether conservation easements (which claim to be perpetual) are sufficiently flexible to deal with climate change. This section provides a brief overview of the six-state results and then dives more deeply into the lessons of the California study.

A. Six-State Results

The distributed seminar examined 60 conservation organizations in 28 regions of the six-state study area (see Map 1). For each region, students identified and interviewed key land trusts (as well as a small number of government conservation organizations) holding conservation easements in the region. All students used an identical questionnaire for purposes of the interview; the interview inquired into the organization's goals, operations, conservation easements, and potential response to climate change. Students also asked each land trust for four conservation easements from the region; to ensure both representativeness and uniformity, students asked for the oldest, middle, newest, and largest conservation easements. The

[40] Paiani et al, supra note xx, at 195.
[41] Mawdsley, supra note xx, at 506; Mawdsley, O'Malley, & Ojima, supra note xx, at 1083. See, e.g., Sam H. Parsell, III, Managing for Future Change on Albermarle Sound, in Climate Change and Biodiversity 358 (Thomas E. Lovejoy & Lee Hannah, eds. 2005) (discussing TNC effort to protect and restore inland area to deal with sea-level rise).
[42] Paiani et al., supra note xx, at 195.
[43] Mawdsley, supra note xx, at 504-505.
[44] Id. at 500.
[45] Hannah & Hansen, supra note xx.

conservation easements had a broad set of purposes. The most common purposes were protection of relatively natural or wildlife habitat and open space, but sizable numbers also sought to protect water quality, agriculture, grazing, forestry, and public recreation.[46] Students reviewed each easement and coded the easement's provisions using a standard format designed to understand the key characteristics of each easement. These regional studies ultimately amassed a database of 73 interviews and 260 conservation easements.

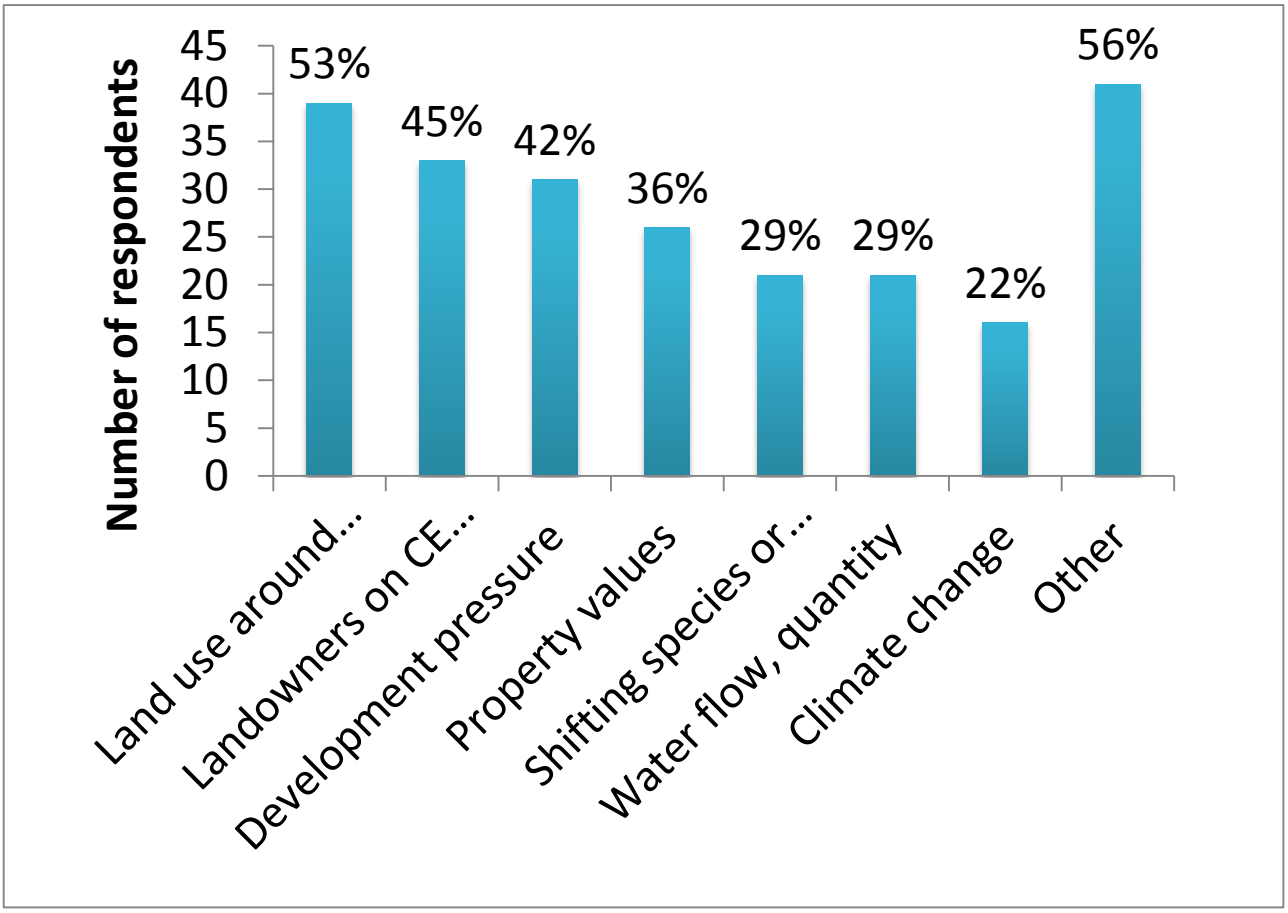

Figure 3: "What social or ecological changes do staff perceive as having affected their conservation easements?"

The seminar team is still analyzing the results,[47] but preliminary data reveal a number of interesting findings. First, almost a quarter of the interviewees believed that climate change was

[46] The three most common purposes of the conservation easements reviewed were protection of "relatively natural habitat" (88%), protection of wildlife habitat (80%), and open space (73%). 39 percent of the easements explicitly sought to protect endangered or rare species. Other major purposes included scenic enjoyment (70%), protection of wetlands or riparian areas (55%), protection of water quality (38%), agriculture (32%), grazing (21%), forestry (19%), and public recreation (18%).

[47] Adena Rissman, an assistant professor in the Department of Forest and Wildlife Ecology at the University of Wisconsin–Madison, leads the analysis team. The other faculty members involved in the project are all law professors and include the author of this Article, Fred Cheever (Denver University), Josh Eagle (University of South

already affecting their organizations' conservation easements. Interviewees were asked what social or ecological changes they perceived as already having impacted their conservation easements. As shown in Figure 3, the most common impacts were attributed to neighboring land uses (53%), property owner actions (45%), and development pressure (42%). 22 percent of the interviewees, however, reported that climate change had affected their conservation easements. 29%, moreover, reported effects from "shifting species or habitat," and an equal percentage said that changes in water flow had affected their easements. As described in Part I, both changes are potentially attributed to climate change.

Second, the vast majority (88%) of the interviewees were concerned that climate change would be "likely" to influence the region in which they operated. Only three percent reported no concern; the remainder was unsure of the likelihood of climate impact in the region. More importantly, over half of the interviewees believed it was likely that climate change would negatively impact the conservation goals of their organization's conservation easements.[48] By contrast, only a quarter of the interviewees thought it unlikely.[49] The remainder (19%) was unsure of the potential impact.

Although a majority of interviewees were concerned about the potential negative effect of climate change, a high percentage believed that they had sufficient flexibility in their conservation easements to address climate change impacts. 71 percent of the interviewees stated that their organizations' conservation easements "have enough flexibility to adapt to changing environmental and climatic conditions." The respondents cited amendment clauses and broad statements of conservation values and purposes as providing sufficient flexibility. Only 14 percent reported that they did not believe that their conservation easements were sufficiently flexible. These respondents noted various reasons for concern in connection with their conservation easements, including that the baseline document report assumed a static landscape, the conservation easement did not contain an amendment provision, the listed goal(s) were vulnerable to climate change, and/or the conservation easement lacked a management plan. 15 percent of the interviewees stated that they did not know whether their conservation easements were sufficiently flexible.

Turning to specific provisions of the conservation easements of relevance to climate change, two-thirds (66%) of the conservation easements examined contain amendment clauses.[50] Only half (50%) of the conservation easements granted the holder of the easement any right to conduct "active land management" on the property, even though 70% on the interviewees reported that active land management is "important for meeting your organization's goals on the conserved properties" and even though, as discussed in the Part I, active land management is likely to be necessary to protect species in the face of climate change.[51] Only 35% of the

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Carolina), Jessica Owley (SUNY-Buffalo), and Bill Weeks (Indiana University). For an evaluation of the seminar approach, see Owley & Rissman, supra note xx.

[48] 18 percent of the interviewees believed that it was "very likely" that climate change would negatively impact the conservation goals, 16% believed that it was "likely," and 22% believed that it was "somewhat likely."

[49] 10 percent believed that it was "somewhat unlikely," 12% reported that it was "unlikely," and 3% said that it was "very unlikely."

[50] The discussion of the California regional study looks in more detail at the nature of these amendment provisions.

[51] It is possible that many of the conservation easements that do not contain provisions for active land management do not have the protection of endangered species or other wildlife as one of their goals. This possible correlation is currently being studied.

conservation easements, moreover, specifically granted the holder the right to conduct scientific research or ecological monitoring, even though such monitoring is a prerequisite for the type of adaptive management that is likely to be critical in addressing climatic changes.

Finally, a number of interviewees reported that their organizations had taken or would take a variety of actions to prepare for climate change. Most reported that they were responding by choosing land areas that were likely to be more resilient in the face of climate change or by acquiring more or larger properties. A number reported that they were working with other land trusts or partners to learn more about the risks of climate change or to engage in broader landscape-level planning. A few added climate change clauses to their newer easements. Finally, some reported greater emphasis on management plans. The types of actions taken or contemplated by California land trusts and other conservation organizations are discussed in more detail in the next section.

B. California Study

1. Study design.

The California study encompassed six different regions of the State. In selecting the regions, our goal was to include (1) a variety of different ecosystems facing varying climate threats, (2) conservation easements with diverse goals (e.g., biodiversity protection, agricultural), and (3) different institutional backdrops (e.g., areas with regional habitat conservation plans or significant federal lands). Because one of the major purposes of the study was to examine the flexibility of conservation easements in the face of climate change, the presence of a significant number of conservation easements was a minimum requirement for selection as a region. This requirement excluded some regions that otherwise might have been selected. For example, we did not include any desert regions of California because, somewhat to our surprise, there are virtually no conservation easements in the California desert, perhaps because land is cheap and land trusts can therefore simply buy fee simples.

The Appendix to this Article provides detailed information about the six chosen regions. As discussed in the Appendix, the regions share three traits: (1) all regions include significant numbers of endangered species, (2) three or more land trusts or conservation organizations hold conservation easements in each region, and (3) every region faces significant threats from climate change over the next 50 to 100 years. The six regions (see Illustration 2) are:

- **Elkhorn Slough:** The western portion of Monterey County, along the central coast of California, was chosen because of the significant efforts in the region to protect coastal habitats, many of which are threatened from sea-level rise or increased flooding. A central feature of the region is Elkhorn Slough, a 7-mile long tidal estuary that contains the largest tract of tidal salt marh in California outside San Francisco Bay.

- **Mount Hamilton:** The region just south of San Francisco, running from the Pacific Ocean to the border of California's Central Valley, was chosen because of its location near a major metropolitan area (San Jose and Silicon Valley), the significant conservation work taking place in the area, and the substantial work that has been done by TNC and universities to understand how climate change will affect the region. With the help of two local foundations, five land trusts and conservation organizations came together in

early 2011 to launch the "Living Landscape Initiative," an ambitious plan to protect 80,000 additional acres in the region over the next 20 years. A portion of the region centered on the City of Santa Cruz also is in the planning process for a combined Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP), which would shape future development to protect crucial habitat for local species.[52]

- **San Diego County:** The county of San Diego, in the southwestern corner of California, was chosen because it adopted one of the State's earlier HCP/NCCPs, providing an opportunity to see how well such conservation plans are addressing climate change. As a result primarily of development pressures from the City of San Diego in the south and from Orange County to the north, San Diego County is home to 47 endangered species, the highest number of any the regions studied; the HCP/NCCP, which seeks to protect all imperiled species whether listed or not, covers anywhere from 63 species in the northern portion of the county to 151 in the East.

- **San Joaquin Valley:** The northern portion of the San Joaquin Valley, which lies in the center of the State near the confluence of the San Joaquin and Sacramento rivers, was chosen for its largely rural setting, the multiple threats that it faces in addition to climate change, and its unique ecology. Most of the region is either agricultural or rangeland. Once an area of vast wetlands and riparian forests because of the multiple rivers flowing from the neighboring Sierra mountains to the East, most of the river water is now captured and used for irrigation or drinking water.

- **Sonoma County:** Sonoma was chosen because of its dominant agricultural use and the high number of agricultural easements held by local land trusts and conservation organizations. The county also includes a wide variety of land forms.

- **Southern Sierra:** The Southern Sierra mountains were chosen as the final region for three reasons. First, the region includes a large new conservation effort to protect 240,000 acres of land on the legendary Tejon Ranch, which sits at the confluence of four major ecological regions just Northeast of Los Angeles. Second, a number of land trusts and conservation organizations have banded together to provide great conservation coordination of the region nder the banner of the "Southern Sierra Partnership." Finally, researchers from The Nature Conservancy and California universities have already engaged in significant study of how climate change will affect the region.

Teams of three to four students were assigned to each region. After studying the region, each student took responsibility for a land trust or other conservation organization working in the region. The student researched the organization and its background, interviewed key officials of the organization, and obtained and coded four of the organization's easements (the newest,

[52] California law provides for a unique form of regional HCP known as Natural Community Conservation Plans or NCCPs. NCCPs try to protect multiple species, both listed and unlisted, from urban development across a large region. Analysts often point to NCCPs as a particularly effective approach to the protection of endangered species. For more on the NCCP program, see Gail L. Presley, California's Natural Community Conservation Planning Program: Saving Species Habitat amid Rising Development, in The Endangered Species Act and Federalism: Effective Conservation through Greater State Commitment 115 (Kaush Arha & Barton H. Thompson, Jr., eds. 2011).

oldest, and largest, as well as a fourth easement when available between the newest and oldest). The study in total encompassed 19 land trusts and 69 conservation easements.

Illustration 2: Map of California Study Regions

2. Findings.[53]

a. General background on the organizations and easements.

The conservation organizations involved in the study ranged from global entities such as The Nature Conservancy to small local land trusts with only one or two professional staff members. One of the organizations was a public entity created specifically to promote local conservation and open space and to hold conservation easements; otherwise, all of the organizations were private non-profits. The goals of the organizations also ranged widely. Most sought to protect natural landscapes and wildlife, either statewide or locally. Several of the organizations, however, specifically focused on the protection of farmland and rangeland.

All of the conservation easements that were studied were perpetual (which is not surprising because California law requires that all easements be perpetual[54]). Almost half of the easements were donated in whole (42%) or in part (4%). About a third of the easements were purchased, and 19% were obtained through governmental mitigation or exaction programs. Most of the latter were in San Diego, where developers must dedicate land or contribute funding for the purchase of conservation land as part of the HCP/NCCP for the county.[55]

The vast majority of easements were relatively sophisticated. However, a few, primarily older easements gave the appearance of having been taken off a shelf with little thought at all of their general applicability to the particular land being protected. For example, a number of the easements specifically referenced statutory provisions of other states, such as Maryland or New York, regarding subjects such as amendment rights, even though such provisions would not apply in California.

As shown in Figure 4, the easements have a wide variety of purposes. The most common purpose is protection of natural habitat; indeed, all but five of the 69 easements listed this as a purpose. About half of the easements seek to protect endangered or other specific species.[56] Over a third list the protection of grazing as a purpose, with a smaller percentage (14%) listing agriculture and an even smaller percentage (7%) listing forestry. However, higher percentages of the easements permitted various types of working uses on the property. Half of the easements, for example, permitted grazing, even if that was not a purpose of the easement, so long as the grazing was managed in a manner consistent with the underlying purposes of the easement. 29 percent allowed commercial forestry, and 20 percent permitted farming.

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[53] All of the conservation organizations that participated in the study were promised anonymity. For that reason, they are identified here by the region in which they operate (ES=Elkhorn Slough, MH=Mount Hamilton, SD=San Deigo; SJ=San Joaquin, SO=Sonoma, and SS=SouthernSierra) and a random number (e.g., ES3). Some of the land organizations operate in more than one region, in which case they are identified separately for each region in which they were interviewed. Conservation easements are identified by the identifier for the organization and a letter indicating which easement it represents (e.g., N=Newest, M=Middle, O=Oldest, L=Largest). Thus, SD2-O would be the oldest easement of one of the conservation organizations operating in San Diego County. Where necessary to protect the identity of a land trust, easements quoted in this Article have been redacted or edited to eliminate the identifying information.

[54] Cal. Civ. Code § 815.2(b).

[55] See Keith A. Greer, Habitat Conservation Planning in San Diego County, California: Lessons Learned After Five Years of Implementation, 6 Envtl. Prac. 230 (2004).

[56] Slightly over half of the easements (54%) list specific species within their purpose clauses.

About two thirds of the conservation organizations (68%) reported that the substance of their conservation easements had changed over time. In most cases, the easements have become longer, more detailed, and tailored to the specific land being protected over the last decade or so. According to many of the conservation organizations, they have attempted to make their easements more specific in order to provide better guidance on the rights and responsibilities of the parties to the easement and in order to improve enforceability. A number of the organizations cited the Land Trust Alliance guidelines as encouraging more specific easement language. However, two of the conservation organizations (ES4 and appear in recent years to be moving in the opposite direction. These organizations are now seeking to make their conservation easements shorter and less specific in order to increase flexibility. One conservation (SJ-3) reported that it also had moved away from trying to prescribe particular behavior by the landowner to focusing instead on constraints, noting that constraints are easier than prescriptions to implement and enforce. Whether these movement back toward less specific easements and away from prescriptions is a new trend is unclear, but as discussed below, climate change is likely to require the type of increased flexibility that such easements provide.

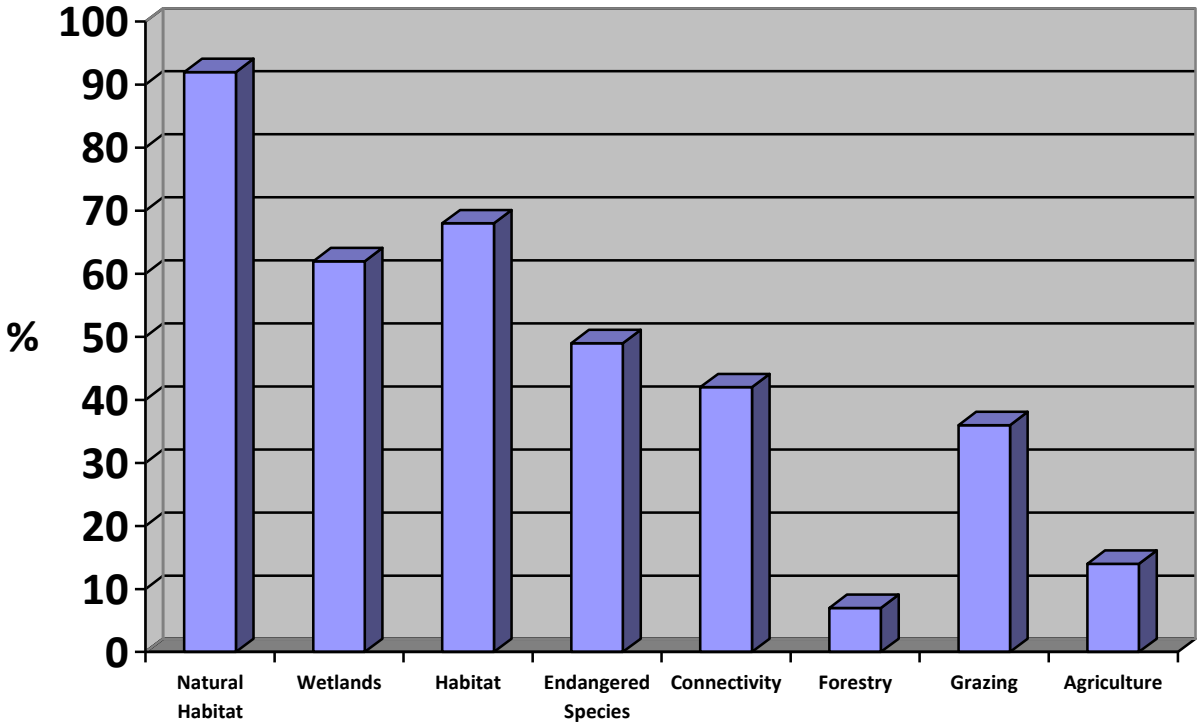

Figure 4: Conservation Purposes
(only purposes relevant to climate change are listed)

b. Perspectives on climate change.

Most of the California conservation organizations appeared to be quite knowledgeable about climate change. One of the organizations, The Nature Conservancy, has scientists who are

actively studying how climate change will impact their conservation properties.[57] All of the organizations reported that they were receiving relevant information about climate change and conservation, with only three citing general literature when asked where they obtained their information. Five of the organizations relied at least in part on local climate-adaptation initiatives (such as the climate program of the Bay Area Open Space Council[58]), five were working with local universities to evaluate potential climate impacts, three relied on scientific studies distributed by TNC, and two received information by attending conferences or webinars sponsored by federal agencies.

Perhaps because of their active efforts to better understand climate change, more of the California organizations were convinced that climate change was already undercutting their conservation efforts than their peers elsewhere in the nation. For example, almost a third of the California organizations (32%) believed that climate change was already affecting their conservation easements, compared to only 22% across all six of the studied states. Looking at potential manifestations of climate change, almost half of the California organizations believed that shifting species or habitats was already affecting their easements – compared to 29% for the study as a whole. And 42% of the California organizations stated that they believed that reductions in water flow were affecting their easements – compared again to 29% of the organizations in the overall study.

Almost of the California organizations, like their peers elsewhere, believe that climate change is likely to influence the region in which they operate in the future. 89 percent of the California organizations reported that they believed that climate change would (compared to a statistically similar 88% for the study as a whole). Almost two thirds of the California organizations (63%) estimated that climate change is likely to negatively impact the conservation goals of their conservation easements (compared to 56% studywide).[59] In order of the frequency that the impact was listed, interviewees reported that they were concerned that climate change would undercut the purposes of their easements through:

- *Changes in habitat conditions.* The most frequently mentioned concern is that a variety of climate changes will undermine the ability of current habitat to continue to support their native species. As a result, many of the conservation organizations emphasized the need to find refugia that could continue to support species even in the face of climatic shifts.

- *Droughts and floods.* Perhaps because California is a dry state with period floods, another frequently mentioned concern is the possibility of more frequent, extreme, and

[57] See, e.g., Carrie A. Schloss et al., Systematic Conservation Planning in the Face of Climate Change: Bet Hedging on the Columbia River, 6 PloS ONE e28788 (2011).

[58] For information about the climate program of the Bay Area Open Space Council, see http://www.openspacecouncil.org/upload/page.php?pageid=45.

[59] California organizations, however, appeared to be more confident that climate change would undercut the goals of their conservation easements. While 28% of the organizations studywide believed that it was "likely" or "very likely" that climate change would negatively impact the goals, 58% of the California organizations stated that it was likely or very likely. Concomitantly, 22% of the organizations studywide believed that it was only somewhat likely, compared to only 5% of the California organizations. 21 percent of the California organizations believed that it was unlikely that climate change would undercut their conservation easements, and 16% were unwilling to give an estimate.

longer droughts, along with an increase in serious floods. Water-related changes were of concern not only to trusts with biodiversity goals, but also to trusts focused on protecting farmland and grasslands.

- *Species movement.* Most of the conservation organizations focused on biodiversity protection also noted the danger that species would need to move in the face of climate change, but that corridors or new habitat would not be available.

- *Farm viability.* Four of the land trusts operating in agricultural regions raised concerns that the farmland on which they hold conservation easements might, because of changes in temperature, water, and other conditions, no longer be able to operate viably.

- *Sea-level rise.* All of the organizations holding coastal properties reported concerns that their easements might be flooded as the ocean rises. ES2 also noted that the presence of infrastructure close to the ocean also will make it difficult to move easements inland as the ocean rises.

- *Wildfires.* One organization noted that increases in temperature and dryness could lead to more wildfires, threatening key flora. Another organization worried more generally about the viability of forests.

- *Increases in invasive species.* One land trust also mentioned the risk that climate change will bring more invasive species.

c. Current adaptation to climate change.

Many of the California conservation organizations already are taking steps to address climate adaptation. In some cases, conservation organizations are adjusting their land acquisition strategies. A handful of land trusts (MH2, MH3, SD2, SD3) said they were placing greater focus on protecting wildlife corridors or creating "stepping stones" to allow movement of species. SO2 similarly stated that it was focusing on topographical diversity (which would presumably preserve a wider variety of potential habitats) and of riparian corridors (along which species might move). And SS3 noted that it was working to "protect a large spread of land with varying elevations and habitats to promote protection of a range of species." ES1 reported that it was now focusing on larger parcels, while SJ1 and SO1 both stated that they were trying to protect more land.

The most commonly mentioned acquisition strategy was to coordinate purchases with other local conservation organizations and with public land agencies to try to create effective mosaics of conservation lands that would permit effective migration and protection. Indeed, all but one of the surveyed organizations (95%) reported that they are coordinating with other organizations in the region "to achieve landscape-scale conservation." SD3 offered that HCP/NCCPs, such as the San Diego Multi-Species Conservation Plan, are useful tools in preparing for climate change because such plans promote conservation at a broader landscape level. SS2 saw similar benefits in local land-trust consortia such as the Southern Sierra Partnership. According to SS2, the Southern Sierra Partnership is designed to create a strategic plan with climate change as a consideration, and will examine the appropriate mix of riparian

corridors, grasslands, and oak woodlands with "an eye toward complementing federal land ownership under climate uncertainty."

California conservation organizations also are beginning to take climate change into account in the provisions and general approaches of their conservation easements. Two of the 19 conservation organizations actually had incorporated climate change adaptation into the purposes of their conservation easements, better ensuring that climate change cannot undermine the legal grounding for the easements and providing at least an argument for interpreting the easement with climate change adaptation in mind. Two of ES1's easements, for example, provides that protection of the underlying land

> Enhances wildlife movement and migration between other nearby protected areas, parks, and watershed areas, and will help to ensure that wildlife populations on the Property and adjacent public and private lands remain healthy and viable in the face of future changes to the climate or ecology of the area.[60]

Under a section entitled "Adapting to Climate Change," the newest of SO3's easements even more explicitly provides:

> The parties recognize that, over time, climate change may significantly alter the ecosystems, their structures and composition. It is the intent of this Easement to adapt to changes to the ecosystems and its associated species over time.[61]

The easement then proceeds to talk about potential changes to the Bishop-pine and Douglas-fir forests on the land and provides that minimum targets for these forests "may be modified to adapt to such changes."[62] The newest easement of SJ3 also references climate change, but only in connection with the liability of the landowner; under the easement, SJ3 cannot bring an action against the landowner "for any injury to or change in the property resulting from causes beyond the landowner's control including … climate change."[63]

Several of the organizations (ES1) also reported that they are seeking to increase the flexibility in their conservation easements. One important approach that several organizations reported using to increase flexibility is to incorporate adaptive management plans into their conservation easements. Some of the organizations similarly noted that they are using their existing management authority under their conservation easements to reduce the risks of climate change.[64] For example, ES3 reported that it is placing greater emphasis on fuel management to address sudden oak death. SO1 noted that it was focusing on fire suppression.

Recognizing that changes in the management of conservation easements can sometimes require the active cooperation of landowners (even if the landowner is not legally required to

[60] ES1-L & ES1-M.
[61] SO3-N.
[62] Id.
[63] SJ3-N.
[64] 89 percent of the conservation organizations reported that they are engaged in active management of their properties. That said, only a minority of the conservation easements that were studied (38%) had provisions for the active management of the easement, and most of these dealt with management of specific activites such as grazing and farming.

sign off on the changes), several organizations also noted that they are working closely with landowners to develop close relationships and even examine possible climate-change scenarios.

A few of the organizations saw little need for shifting strategies or undertaking additional actions at this point in time. For example, SS2 noted that it already was preparing for climate change by protecting the riparian corridor of a significant river in the Southern Sierra, which is likely to provide an important migration corridor. SD2 noted that its easements were in higher areas that would be more important in the face of climate change. ES2 stated its belief that good conservation inevitably will address climate change needs. Three organizations (SD1, SD2, SO3 & SS1) reported that they were preparing for climate change by developing better baseline data and looking at studies of potential climate impact, which was necessary to prepare appropriate adaptation measures in the future. SJ2 said simply that it was engaging in dialogue on the issue of climate adaptation.

d. Flexibility for future adaptation.

As noted earlier, all of the California conservation easements are perpetual. It therefore is particularly important that easements be sufficiently flexible to deal with future climate changes. Virtually all of the conservation organizations studied in California (79%) reported that their conservation easements "provide enough flexibility to adapt to changing environmental and climatic conditions."[65] Only 16 percent felt that they had insufficient flexibility; one organization was not sure. The reasons for this confidence varied but broke down into three general views:[66]

- *Broad purposes.* Many organizations emphasized that the purposes of their easements were multiple and broad, permitting them to defend the easement even in the face of climate changes that might make one or more of the specific purposes difficult to achieve.

- *General breadth.* Several organizations emphasized that some or all of their easements were quite broad and vague, allowing them to adjust to changing climate. This is particularly true where easements provide either broad powers to the easement holder or broad obligations on the part of the underlying land owner. As SS1 noted, its easements were designed to be open-ended and flexible. MH1 noted the irony that the trend over the last decade has been toward more specific easements.[67] Unlike their new easements, their older easements were "vague enough to provide flexibility to adapt to changing conditions." Several organizations noted that their more recent easements might prove less flexible in trying to adapt to climate change.

- *Management plans.* Two of the organizations (ES1, ES3) noted that their conservation easements permitted them to modify and update their management plans on a periodic basis.

[65] This is a slightly higher percentage than for the six-state study as a whole, where 71% felt that their easements had sufficient flexibility. See note xx supra and accompanying text.
[66] While 79% of the conservation organizations felt that their easements were sufficiently flexible, many organizations could not explain why in any detail. Others noted that, although they believed their easements were sufficiently flexible, the easement language could be better.
[67] See notes xx-xx supra and accompanying text.

- *Amendment clauses.* Conservation organizations also reported that their easements had amendment clauses that would permit them to respond where necessary to significant changes in underlying conditions.

How accurate were these perceptions?

Purposes. A review of the conservation easements reveals that the purposes of the easements are indeed written broadly and are unlikely to be challengeable simple because climate changes reduce the value of the easement for one or another specific purpose. A recent easement in the Southern Sierra illustrates the broad and general nature of most statements of purposes:

> The Parties to this Agreement desire to protect in perpetuity substantial and significant natural resource values of the [property]. These natural resource values include an extraordinary diversity of native species and vegetation communities, numerous special status plants and animal species, intact watersheds and landscapes supporting natural ecosystem functions and regionally significant habitat connectivity. …. The objective of this Agreement is to maintain the bulk of [the property] in this unaltered condition and, as appropriate, enhance and restore naturaaal resource values.[68]

Although a majority of the easements (54%) list specific species that the easements are meant to be protect, none of these easements limit their purposes only to the protection of those species. Even the narrowest easements are written in a manner that is likely to ensure continued validity even in the face of significant habitat or environmental loss. For example, one of the easements of ES2 designed to protect the Santa Cruz tarplant references the tarplant only as a specific instance of a broader goal to protect natural habitats: "PURPOSES: The purposes of the Easement are to protect and preserve the significant relatively natural habitats on the Property, *including, but not limited to* habitat for Santa Cruz tarplant."[69]

Broad purpose clauses, however, only deal with half of the challenge that climate change will present to holders of conservation easements. They reduce the chances that a landowner will be able to challenge an easement because its purpose is no longer achievable. However, they do not by themselves increase the easement holder's ability to use the easement to achieve its goals in the face of undercutting climate change. To ensure long-term viability, easements also must provide sufficient authority and flexibility to address new biophysical challenges as they arise.

Broad Provisions. As noted, California conservation organizations believe that three aspects of their easements can help provide such flexibility. The first is the incorporation of either broad powers for the easement holder or broad commitments by landowners, allowing the exact requirements of the easement to change over time in response to changing conditions.

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[68] SS1-O.

[69] ES2-M (emphasis added). MH2-O has perhaps the most narrow purposes clause of any of the conservation easements encountered in the California study: "The purpose of this conservation easement is to assure that the property will be retained forever in its predominantly natural, scenic, and open space condition by preserving the redwood, douglas fir, and hardwood trees on the property from cutting for commercial use."

Although there has been little experience with the application of these provisions over time, they would seem to provide the type of flexibility needed in the face of climate change.

Many of the easements appear to allow for broad, and presumably flexible, authority by the conservation organization. For example, the middle easement of ES2 authorizes the land trust, in very broad terms, to "enhance the natural ecosystems and unique native flora on the Property."[70] Similarly, the largest easement of MH3 awards the land trust the right "to identify, preserve and protect the Conservation Values" of the property. At least one of the easements imposes broad and changing obligations on the landowner (who apparently was as committed to long-term stewardship as the conservation organization):

> To the extent feasible, Grantor shall manage the Property according to the following management principles: (1) Manage ranch lands in an integrated and balanced manner so that ranch operations are sustainable both ecologically and economically; (ii) Protect and maintain the natural attributes, including natural resources and habitats; (iii) Experiment with a variety of flexible and adaptive management approaches in order to define a set of best management practices while meeting the terms of this Conservation Easement; and (iv) Work with a variety of public and nonprofit partners to document, improve and enhance natural resources, habitats, and species on the Property.MH3-N.

A majority of easements, however, do not contain these types of broad provisions and, as noted earlier, the trend has been toward greater specificity and thus less potential flexibility.

Management Plans. Another flexibility mechanism mentioned by California land trusts are management agreements, in which the grantor and grantee of an easement periodically agree on plans for the management of certain aspects of the easement. 38 percent of the easements reviewed in this study contain some form of management agreement. In theory, such agreements can provide for periodic updates of conservation practices on a property and thus allow for adaptive management in the face of climate change.

Ideally, such management plans would deal with a broad range of issues (including both affirmative and negative conservation obligations) and provide for relatively open-ended changes. A few of the conservation easements appear to provide that broad flexibility and are discussed in more detail in the next section of this Article. An easement from the San Joaquin Valley, however, illustrates the potential breadth that can be provided through management plans:[71]

> As a general matter, [Land Trust] believes that a written management plan is a useful tool for guiding resource stewardship …. If the Baseline Conditions Report, or subsequent monitoring, has identified circumstances requiring improvements to the Conservation Values, Landowner, upon written notice from [Land Trust], shall develop a written management plan that addresses a particular resource management concern(s) identified by [Land Trust]. …. The required scope of the plan and the time allowed for its development shall depend on the

[70] ES2-M.

[71] Another set of easements explicitly incorporate HCP/NCCP provisions and thus in theory once again provide for broad flexibility.

> nature and severity of the identified problems. The management plan shall be subject to [Land Trust's] approval. …. [Land Trust] shall monitor implementation of the plan, and results therof, during its periodic monitoring, and may require modifications of the plan as the resource conditions warrant. …. If Landowner does not diligently act to develop a management plan required under the preceding … circumstances, or if an identified problem persists, or if Landowner and [Land Trust] disagree regarding the resource management concern(s) identified by [Land Trust], then [Land Trust], at Landowner's expense, shall engage a … qualified professional to develop a management plan …."

Unfortunately, most of the management plans found in the study are quite limited in their scope – focusing on grazing practices, agriculture, and the management of timber and wood removal. Many of the management plans, moreover, focus on restrictions (e.g., unwanted grazing practices) rather than on affirmative obligations to restore or protect the conservation values of the easement. Others provide for management plans, without explicitly requiring them or setting out specific standards for the plans.[72]

Amendment Clauses. A final flexibility mechanism is the power to amend a conservation easement. Interestingly, almost a third of the easements (29%) contain no amendment provisions, presumably leaving the power to amend up to state legislation and judicial decisions. One easement specifically prohibits any amendments, while another easement limits amendments to those cases where an amendment is required to comply with local laws. But the vast majority of the easements (65%) explicit authorize amendments, subject to a variety of different conditions, many of which would probably be required by state law even if they were not contained in the easement terms themselves.

- *Written Approval.* The most common requirement is that any amendment be in writing. All of the amendment clauses (65% of all easements) have such a requirement.

- *Consistency with Original Purpose.* Also popular (52%) is the requirement that any amendment be consistent with the original conservation purpose(s).

- *Perpetuity.* About half of the amendment clauses (32%) provide that the easement remain perpetual.

- *Consistency with federal or state law.* Most donated easements (26% of all easements) require that amendments be consistent with section 170(h) of the Internal Revenue Code. Approximately the same number (25%) require that amendments be consistent with California law.

- *Governmental approval.* A minority of easements (20%) require that any amendment be approved by the California Department of Fish and Game or another state or federal agency. In most of these cases, the agency contributed at least part of the funding for the easement.

[72] Flor example, SJ3-N provides that "the landowner *intends to prepare*, in coordination with [Land Trust], a plan for the adaptive management of the property," but does not dictate conditions for when or how such a plan is to be developed.

Although such amendment clauses are quite broad, none of the conservation organizations that were interviewed had used the amendment provisions to date to change the terms of their easements. As discussed in Part IV, moreover, various state and federal laws can constrain amendments, even when an easement explicitly authorizes them.

Changed Conditions. Although none of the land trusts mentioned the opportunity to terminate easements, a majority of easements (50%) provide for termination in cases where changed conditions make it impossible to continue to achieve the original purposes of the easement. The other half of conservation easements do not discuss the possibility of termination. Of those that explicitly authorize termination, 15% provide that termination must be approved by a court, while the other 35% both require judicial approval and provide that, in the case of termination, a portion of the proceeds from any subsequent sale of the property must go to the conservation organization to protect other natural habitat.

III. THINKING FLEXIBILITY FOR THE FUTURE

APPENDIX

THE SIX CALIFORNIA STUDY AREAS

Elkhorn Slough. Monterey County was chosen as one the six study areas because of its coastal prominence and thus risk from sea-level rise. The county includes coastal plains, coastal cliffs and riparian plains to mountains. Little of the county has been developed; over 90 percent of the county consists of annual grassland, oak woodland, agricultural crops, baccharis scrub, and oak savanna (in order of prominence). The specific study area chosen was the area of Monterey County west of Highway 101. A prominent feature of this area is Elkhorn Slough, a 7-mile long tidal estuary that contains the largest tract of tidal salt marsh in California outside San Francisco Bay. The area is home to almost 350 species of bird (including the acorn woodpecker, brown pelican, Caspian tern, great blue heron, great egret and the snowy plover) and such mammals as the sea otter, harbor seal, California sea lion, mountain lion, and bobcat. The area's primary endangered species are Hickman's potentilla (an herb), the Santa Cruz long-toed salamander, the Santa Cruz tarweed, the southern steelhead trout, and Yadon's piperia.

Climate change is likely to bring much more water to the Elkhorn Slough area as a result of sea level rise, which is estimated to be approximately 20 cm per century, and more frequent flooding. Areas at particular risk include wetlands (from sea level rise, tidal erosion, and marsh drowning), beaches, and coastal farmland. At the same time, climate change is likely to bring increasing droughts and wild fires, which combined with heavier rainfall later in the year could bring increased mudslides. By the end of the century, annual temperature is currently projected to increase by approximately 5 degrees Fahrenheit (although the exact temperature change obviously will depend on global emissions of greenhouse gases). Climate changes in the region are also likely to attract a number of invasive species, including the Asian mudsnail, European crab, and upland weeds.

Mount Hamilton. The Mount Hamilton region, which sits just south of San Francisco Bay, was chosen because of the substantial private conservation taking place there. In addition, ith the help of the Moore and Packard Foundations, five land trusts and conservation organizations (the Land Trust of Santa Cruz County, The Nature Conservancy, Peninsula Open Space Trust (POST), Save the Redwoods League and Sempervirens Fund) came together in early 2011 to launch the "Living Landscape Initiative," an ambitious plan to protect 80,000 additional acres in the region over the next 20 years. Part of the area also is currently trying to agree on a combined Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP).[73] The region consists of four distinct geological segments that run longitudinally: the Pacific coastal plains, Santa Cruz Mountains, Santa Cruz Valley, and interior Diablo Range. Most of the coastal plains and interior valleys have been converted to urban use or irrigated agriculture, with Silicon Valley and the San Jose metropolitan region extending south along the Santa Cruz valley and eventually giving way to agricultural production. With coastal, mountain, and valley habitats, the Mount Hamilton region supports a variety of fauna. Endangered species include mammals (southern sea otter, salt-marsh harvest mouse, San Joaquin kit fox), amphibians (California red-legged frog, California tiger salamander, Santa Cruz long-toed salamander), fish (coho salmon, steelhead trout, and tidewater goby), and many coastal bird species.

[73] See note xx supra.

Given the wide range of geography, the Mount Hamilton region is subject to a wide variety of climate risks. The entire area is subject to increased risks both of large storms and floods and of droughts. At the coast, sea level is rising at a rate of approximately 20 cm per century. Average annual temperature is projected to rise 5 degrees Fahrenheit by the middle of the century. As a result of various climate shifts, the area is likely to see significant changes in vegetation. For example, conifer forests and mixed evergreen woodland is likely to give way to shrubland and grassland; blue oak woodlands also are likely to decline.

San Diego County. San Diego was included in the study because it adopted one of the State's earliest HCP/NCCPs, providing an opportunity to see how well such conservation plans are addressing climate change. Agriculture dominates land use in the county, with many types of citrus, nuts, grapes, and other crops being grown. Large military bases, including especially the Camp Pendleton Marine base and Naval bases at Point Loma and San Diego, also help protect much of the land from development. At the same time, the county is facing increasing development pressure, which is what led to the development of the HCP/NCCP. Housing for the County's 3 million plus inhabitants is concentrated around the City of San Diego at the southeast corner of the county and up the coast toward Orange County. San Diego County is home to 47 endangered species, with notable/representative species including the San Diego fairy shrimp, Torrey Pine, San Diego Horned Lizard, San Diego thornmint, leatherback sea turtle, Del Mar manzanita, and Mexican flannelbush. The HCP/NCCP covers 63 species in the northern portion of the county, 151 in the East, and 81 in the San Diego urban area.

Like the Mount Hamilton region, San Diego County faces diverse climate risks. Annual temperatures are projected to increase approximately 5 degrees Fahrenheit by the end of the century (with Spring temperatures projected to increase by as much as 6.4 degrees). The region is likely to face both increased drought (which will be problematic in a region already suffering from low annual rainfall) and severe floods. Sea level rise will increase the flooding problem in coastal regions, while the droughts are projected to increase wildfires. These and other climate changes also are expected to increase the number of invasive species, which are already a severe problem in the county.

San Joaquin Valley. California's vast Central Valley is drained in the north by the Sacramento River and in the south by the San Joaquin River. The area north of the delta that is formed by the juncture of the two rivers is known as the Sacramento Valley, while the area south is known as the San Joaquin Valley. The San Joaquin Valley constitutes a 50-mile by 400-mile alluvial plain. We chose to study the northern portion of the San Joaquin Valley (consisting of Merced, San Joaquin, and Stanislaus counties, as well as part of Madera county) because of its unique matrix of landscapes and the presence of a number of prominent rivers (prominent at least for California), including not only the San Joaquin, but also the Stanislaus, Tuolumne, Merced, and Fresno rivers. The area is California's top agricultural region, and farmers there grow all kinds of fruits, nuts and vegetables. While significant areas of grassland remain, most of the Valley's traditional grasslands have been converted to farmland. Despite its agricultural prominence, the region received very limited precipitation (often limited to six inches per year, usually in the winter). Although the Valley as a whole is home to numerous endangered species, the study are provides habitat to only five federally-listed endangered species: the California red-legged frog, Delta smelt, Alameda whipsnake, Paiute cutthroat trout, and large-flowered fiddleneck (plant).

The region is likely to suffer from two principal climate impacts. The first is a significant increase in temperature and major heat waves. Nightime temperature increases have already had an impact; a 30-percent reduction in the number of winter-shilling hours in the Central Valley has reduced the acreage capable of supporting apples, cherries, and pears (a billion dollar industry) from half of the valley to only four percent of its land.[74] The second is a dramatic decline in and temporal shift of water flows, resulting from a decrease in the snow pack in the neighboring Sierra Nevada mountain and earlier melting of the snow pack. While the region is projected to suffer from more frequent and intense droughts, climate projections also estimate that there will be an increasing frequency of floods.

Sonoma County. Sonoma County was chosen because of its dominant agricultural use and the high number of agricultural easements held by local land trusts. Sonoma County includes a wide diversity of land forms including the broad flat Santa Rosa plain, the Sonoma mountains in the east, low coastal hills in the West, redwood and mixed conifer forests of the highlands, dairy lands, marshlands, coastal prairies in the south, and Pacific Coast in the west. Agriculture and dairy are dominant land uses, along with recreation. Endangered species include the California clapper rail, Salt Marsh Harvest Mouse, Northern Red-legged Frog, Sacramento splittail, and California freshwater shrimp.

Like much of California, Sonoma County is likely to see a significant increase in temperature. Mean average temperature, as well as both highs and lows, have already increased over the last half century. Rainfall is projected to decline, although there also will be an increase in extremes, leading to significant flooding in both coastal and valley regions. In addition, the county's coastal regions will suffer from increased sea level rise.

Southern Sierra. The Southern Sierra was chosen as the final study region because it is the site of a large new conservation effort on the former Tejon Ranch, slated for significant development; there has been significant study of climate risks in the region; and a number of the land trusts in the region are attempting to work together as part of the "Southern Sierra Partnership." The region is relatively dry and cool and is located at high elevation. Vegetation includes pines, conifers, and firs in the forested areas; ryegrass is dominant in grassland areas. Endangered species include the desert tortoise and the California condor, as well as the Sierra Nevada Bighorn Sheep and Golden Trout.

[74] Luedling et al., supra note xx.