

DRAFT Summary of CCRC Indicators Review  
 Part #1: comments on the indicators  
 March 30, 2007  
 Grey Hayes and Larry Ford

## Introduction

On February 28, 2007, I sent Larry Ford and Lynn Huntsinger’s document “Indicators of Sustainable Rangeland Stewardship” to a number of scientists and rangeland planners asking for their review. In the course of the review, I also heard in various ways from additional reviewers. All are included in Table 1. Reviewers were instructed to scrutinize the document for accuracy, provide any additional relevant literature, and to specifically focus on whether the authors adequately covered the indicators necessary for monitoring the sustainability of rangeland stewardship. They were given the choice of submitting written comments or having me take notes on their review during a conference call and then circulating these notes back to them for finalization. Most chose the second option, a few the first. The following summary is a draft summary, pending circulation of the conference call notes back to the reviewers. The purpose of this draft is to give CCRC Subcommittee members an idea of the progress, and to allow Larry, Lynn, and John to move forward with design of their testing strategy, which begins next week.

In the following sections, I attempt to summarize the substantive concerns raised by reviewers. Complete notes are available from each of the reviewers upon request; these should be archived centrally with the CCRC. After each section, I make several suggestions to address the reviewers’ concerns. I urge the CCRC to formally consider these suggestions in discussion at some date in the near future, after which time I can help to finalize this stage of the process.

Table 1: Reviewers of Indicators of Sustainable Rangeland Stewardship. \* denotes final review recorded. All else in process, with notes from conversations being transcribed and circulated for final review.

Name	Organization	Date	Review format
Bush, Lisa	Consultant	March 20	Conference call with Larry Ford
Barrett, Reg*	UC Berkeley	March 13	Telephone conversation
Gustafson, Jon	NRCS	March 30	Telephone conversation
Allen-Diaz, Barbara*	UC Berkeley	March 27	Written
Bartolome, James*	UC Berkeley	March 21	Written
Harrison, Susan*	UC Davis	March 8	Written
Marshall, Susan	Humboldt State	March 12	Conference call with Larry Ford

Fisher, Andy	UC Santa Cruz	March 13	Conference call with Larry Ford
Christian, Caroline	Sonoma State	March 15	Conference call with Larry Ford
George, Mel*	UC Davis	March 20	Written
Butterfield, Scott*	TNC		Written
Oster, Ken*	NRCS		Written
Guenther, Keith	Wildland Solutions	March 14	Telephone conversation
Hillyard, Deborah	CDFG	March 20	Written
Gennett, Sasha	UC Berkeley	-pending-	
Lewis, David	NRCS	-pending-	
Cody, Martin	UCLA	-pending-	

## **The Concept**

The vast majority of reviewers were wholly supportive of the work of the CCRC on creating a science-based indicators system that is simple and useful to non-professionals.

### **Suggestions for the *Indicators* overall**

Some substantive comments suggested that the CCRC proposed indicators need to be better outlined as part of an overall scheme of setting strategic goals, tactical planning objectives, and outlining operational practices. Clarifying this structure would be an important part of revising the current document, as outlined in the next section ('The Document' section, below).

My suggestion:

- The CCRC should work with the NRCS, UC Extension, and other efforts that are helping to frame rangeland health to logically communicate and nest the Indicators project with other work.

### **Getting to the Big Picture**

Other important suggestions on the overall indicators concept focused on the need for the CCRC to contrast a wide range of practices over appropriately long time intervals. As many of the wise members of the CCRC have pointed out throughout the past many years, trends are slow to develop and record, and data makes most sense as a time series over the long term; reviewers strongly urged such an approach.

Moreover, whereas the CCRC has thus far considered only contrasting a certain suite of approaches to sustainable rangeland management with the kind of outright rest that increasingly occurs on lands set aside for conservation, one reviewer suggested that the CCRC also take data on what the group considers to be rangelands that are managed in

ways that are less than sustainable. The danger, said this watershed scientist, was that by comparing rangelands that were not ‘disturbed’ with those with ‘moderate’ levels of disturbance, the CCRC might be missing the opportunity to tell the other side of the story – for example, that some ranchers are reducing sediment loads in streams by 30% compared with more traditional ranching.

Reviewers stressed that it is important for the CCRC to develop management recommendations to improving indicators as the project progresses; this will require clear communication of management methodologies by CCRC participants.

My suggestion:

- The CCRC might consider clarifying a timeline of expected outcomes
- Future monitoring should include rangelands managed with more traditional approaches (continuous grazing, low RDM).
- The CCRC should work to standardize a recording methodology for management methods to be used by rangeland managers to document the tools and methods that can be used to help explain outcomes (more specific guidelines in sections below)
- The CCRC should work to clarify the time periods that should trigger changes in management should suggested ‘standards’ be surpassed.

## **The Document**

Many reviewers inquired about the audience of the document and suggested major revision prior to further circulation. A common suggestion was that the document be re-written in line with CCRC goals, so that non-technically trained rangeland stewards would benefit from reading it. Reviewers felt that the document was too technical and lacked the background information necessary to be understood this audience. In particular, there were important suggestions at standardizing the language that the CCRC uses with other efforts at promoting rangeland health, for instance in the most recent documents by the NRCS. Reviewers commented that the terms ‘universal indicators,’ ‘primary indicators,’ and ‘secondary indicators’ were particularly confusing and perhaps ill matched to the objectives of the project. A number of specific comments were made to improve the document. From these, I make the following recommendations:

- the CCRC should consider re-writing the document to include:
  - background on the CCRC – who they are, why they are doing what they are doing, and what they expect to gain
  - explicit discussion of how the indicators evolved out of extensive discussions to formulate goals
  - how the CCRC envisions sustaining monitoring of the indicators

- replacing some terms such as ‘universal’ ‘primary’ and ‘secondary’ indicator and ‘standard’ with more understandable terms.
  - for consistency, revision of terms to reflect current NRCS terminology on rangeland monitoring, such as rangeland health attributes (the 4 central concepts), etc.
  - clear connection between the CCRC’s stated goal of catalyzing self awareness with the indicators project.
- to ensure clear and adequate inclusion of all viewpoints, each member of the CCRC should be interviewed by CCRC Subcommittee members about the document to ensure input and understanding. Subsequently, the document should be revised on these comments.
  - after CCRC revision, the document be circulated back to key members of those involved with the scientific review for further comment before posting to a wider audience

## **Monitoring**

### **Professionalism**

Reviewers suggested that the CCRC be clearer about the level of expertise required for monitoring the indicators. In some cases the document refers to ‘professional judgment’ being required to record an indicator; but, it is not clear what level of training this level of judgment would require. Furthermore, reviewers encouraged the CCRC to consider credibility issues with data collected by amateurs who might place sampling locations in inappropriate locations.

### **Sampling design**

A widely shared concern was that the indicators were meant to be sampled quickly and easily, in contrast to the complex large landscapes that would be required to sample.

### **Sustainability**

An ongoing criticism of all indicator monitoring systems is that they are rarely continued because of lack of resources. Reviewers suggested that the CCRC more clearly state how this system will solve this ongoing issue.

### **Covariates**

Many reviewers strongly suggested that the CCRC collect covariate data along with the indicators themselves, to identify sources of stresses along with potential solutions.

My suggestions:

- The CCRC should identify the closest meteorological station to each property sampled and file the following data with yearly monitoring reports. These data may one day be useful with computer modeling to represent the high degree of elevational and regional variation between weather stations.
  - Rainfall amount monthly
  - Max/min monthly temperature
- CCRC participants should report, using maps, trends with rangeland management, including:
  - Physical activities directed at plant control
  - Areas of high use intensity
- Rancher partners in the CCRC should record stocking rate and timing per pasture

## **Analysis**

### **Covariates**

An important thread of the reviewers' suggestions focused on the need to consider environmental factors in explaining the variation we see with the indicators. The following covariates were suggested: rainfall, temperature, slope, aspect, and soils. There was concern about spatial autocorrelation between sites with other measures, such as RDM, thatch, and bare soil; in these cases, reviewers suggested creating a good spatial database on sampling locations to facilitate analysis and interpretation.

## **Indicators**

### **Suggestions for Additional Indicators**

There were two types of suggestions for additional indicators. First, there were suggestions to include all indicators that have been used in other well reviewed efforts. Second, there were suggestions of augmenting the CCRC indicators with one or two additional indicators that seemed crucial to reviewers in capturing specific rangeland processes.

With the first type of suggestion, reviewers reflected considerable misunderstanding about the purpose of the CCRC indicators. In large part, this was due the lack of reviewers' understanding of the background on the Indicators, and that they were derived from extensive conversations within the CCRC about this partnership's unique formulation of rangeland stewardship goals. And perhaps this was also in part due to the need for the CCRC to better articulate justifications for certain indicators to be 'universal' and irrespective of individual stewards' goals. In order to address the inclusion of the most widely-used rangeland health indicator system, Larry and I created a cross reference table to illustrate how his proposed indicators overlap with the 17 indicators adopted by the NRCS. Two of the 17 indicators are overlooked by the CCRC indicators: an indicator dealing with extensive wind erosion (not applicable to the CCRC

project areas), and an indicator for plant mortality (avoided at this time as not presently a priority goal identified by CCRC land stewards)(Appendix 1).

Several specific indicators were suggested, though with clarification reviewers realized that many were already a part of the indicators system.

1) *Biotic diversity*: Reviewers were concerned that the indicators did not explicitly include the maintenance of native species diversity (plants and animals). These reviews strongly suggested adding these components.

2) *Soils compaction*: Reviews were mixed about using soil compaction as an indicator, even amongst well-respected soils experts. A strong concern of one reviewer was that the CCRC include an indicator that adequately captured the soil's ability to capture and regulate water.

3) *Nutrients*: Reviews were mixed concerning the use of an additional indicator for nutrient cycling. Some reviewers were comfortable with the indicators of thatch and RDM as indicators for this. Other reviewers felt that the CCRC did not adequately address this issue; these reviewers were divided over the feasibility of sampling nutrients and drawing conclusions from any monitoring results. Some reviewers suggested that the CCRC further explore the feasibility of sampling nutrients in runoff, including timing such sampling with certain runoff events.

4) *Habitat structure*: One reviewer was concerned that habitat diversity was inadequately captured, and suggested adding 'structure' to the indicators. I am aware of an increasing call to measure both structure and habitat heterogeneity in rangelands, but am unfamiliar with methodologies.

5) *Carbon sequestration*: A reviewer suggested that adding carbon sequestration might be considered by the CCRC given the inevitability of this as a regulatory issue.

6) *Water harvesting*: A reviewer mentioned the possibility of water harvesting from rangelands, and issues relating to the sustainability of that practice considering the overall impacts to ecosystems, especially in years of lower rainfall.

My Suggestions:

- Make explicit that all 'special indicators,' *when present* at a specific site, **WILL** be considered as core indicators of sustainability.
- Add a new indicator, soil compaction. Measure with a soil penetrometer or metal rod during the appropriate soil moisture regime. Test with a great deal of replication. Do not use a single ring infiltrometer: this is too time consuming for routine testing, but could be useful to verify soil penetrometer readings. Could be tested using photo monitoring and mapping of the extent of barren hoof traffic areas, if the technology above is too involved.

- Add another indicator: maintenance of species diversity, based on baseline surveys of the participating properties. Develop these surveys as time and funding allows with each participating landowner maintaining a list that is periodically updated with NRCS partners of the CCRC.
- Add carbon sequestration as a special indicator
- Add water harvesting as a special indicator
- The CCRC might consider further deliberation with rangeland water quality experts on nutrient sampling protocols. But, as emphasized by reviewers, it is not currently advisable for the project to use this indicator
- Similarly, the CCRC might consider further deliberation with rangeland scientists on ways to quantify and monitor habitat structure as a core indicator of habitat diversity.

### **#1: Stewardship Planning**

Reviews on the stewardship planning indicator were mixed. While some reviewers supported the concept, others suggested that it was unreasonable to link written plans to sustainability because it has been shown that good stewardship can take place without them. There were many suggestions on ways to improve this indicator.

One important suggestion that was made by more than one reviewer included supplementing or substituting this indicator with an interview process that would indicate the depth of awareness and planning for elements of sustainable rangeland stewardship.

Two reviewers suggested adding baseline information on species diversity to the stewardship plan and specifically stating in the plan the intention of maintaining species diversity. For wildlife, a reviewer suggested inclusion of analysis by a simple tool – the Wildlife Habitat Relations (WHR) – which predicts wildlife species appropriate to a given geographic area. This would then be paired with a baseline assessment of extant wildlife, which could be accomplished even over large landscapes in one day. For plants, reviewers supported actual plant species lists being included as baseline and confirmed, somehow, over time.

My suggestions:

- The CCRC should consider removing the caveat that written plans are an *essential* component of sustainable rangeland stewardship. Instead, the group might consider a requirement that sustainable rangeland stewards be able to communicate clearly and consistently:

- Strategic planning goals that align with the current science of sustainable rangeland stewardship;
  - Tactical planning objectives that are well targeted at reaching these goals, and;
  - The tools and practices that they are using to reach those objectives.
- The CCRC should work with participating ranchers who would *like* to have a written plan to help them:
    - Write one on their own, or;
    - Work with NRCS or UC Extension in the CCRC to develop a plan
  - The CCRC should work on an interview that (ideally) could be recorded through a simple checklist and which could be evaluated through a rating system. The interview would ask each rangeland steward:
    - If they are aware of each of elements of sustainable rangeland stewardship (as outlined in the CCRC guidelines on stewardship planning)
    - If they manage for each of these elements, and, if they do:
    - What are their goals, objectives, tools and practices for achieving sustainability
  - The CCRC should explore partnerships with the California Native Plant Society and others to help participating stewards to develop plant species lists for each participating parcel. Eventually, a parcel-specific herbarium or photograph album could be given to each CCRC participant, to ease confirmation of the plant list through time by amateur plant id'ers.
  - The CCRC should explore funding to assess the potential and actual wildlife on participating parcels using the WHR methodology. This could be an important, and even key, component of the 'education and outreach' stage of our work.

## **#2: Bare Ground**

Many reviewers were supportive of including this indicator, but leery of adequately sampling for its measurement. Other reviewers felt that spatial and natural variability of this indicator were so formidable as to negate its value as an indicator. An important point was made suggesting that the main areas of concern with bare soil are usually unpaved roads, which serve as sediment points more than the grasslands themselves in many rangelands. Reviewers suggested combining on-the-ground estimates of bare soil with remote sensing (aerial photograph) assessment to approach sampling at a more meaningful scale.

My suggestions:



- Add an evaluation of unpaved roads to the bare ground analysis, complete with a question in the interview process about road sections that could be contributing to sediment.
- Add an interview component to assessment of bare ground, where the land steward is asked to identify significant bare soil areas. See first suggestion for RDM, below.
- The CCRC should consider working with landscape-scale analysis using remote sensing to assess bare ground in project areas and/or next.
- Over the coming year, the CCRC should consider a rapid assessment technique developed to identify and rank sources of sediment at the landscape scale developed by the University of California.

### **#3: Aquatic macro-invertebrates**

Reviewers were unanimous in their support for this indicator, but were concerned that there might be a lack of appropriate aquatic habitat in some areas. Reviewers seemed familiar with the concept and development of this indicator, and some suggested that the CCRC work closely with existing efforts by DFG and others to further develop this tool. The concerns raised focused on the difficulties of rangelands with ephemeral streams, years of drought, or where rangelands had no appropriate sampling area, at all.

My suggestions:

- The CCRC should present its initial year's data to other groups working with aquatic macro invertebrates to refine methods and better understand monitoring conclusions
- In cases of lack of appropriate habitat for sampling, see final suggestion for bare ground (above)
- Data collected on aquatic macro invertebrates may need to be collected along with some characterization of the stream course sampled.

### **#4: RDM (autumn)**

Reviewers were unanimous in their support for this indicator, but were concerned about sampling methodology and the use of this indicator as indicative of some sustainability concepts. As with bare ground, reviewers recognized the heterogeneity of RDM at the local and regional scale. Several reviewers suggested the time intensity of sampling RDM on large landscapes; on the other hand, reviewers also suggested mapping visual estimates of levels of RDM across the whole ranch. And, as with bare ground, reviewers were concerned that factors (e.g., invertebrates, mice, and drought) beyond the control of land stewards could account for a large degree of the variability.

Finally, reviewers suggested changing the suggested standards for RDM. They suggested adjusting the standards to allow for realistic levels of precision when monitoring RDM over large scales. And, they suggested a smaller range of acceptable limits, the lowest part of that range reflecting a conservative approach from UC guidelines.

My suggestions:

- Because of difficulties sampling randomly over very large landscapes, baseline monitoring be established via steward interview at the outset of the survey, where areas are mapped as 'high' 'moderate' or 'low' RDM; subsequent field testing can sample these areas paired with randomly sampled areas to capture spatial variability. This method would allow hypothesis testing of self awareness of the managers as well as response of RDM to management versus the environment.
- RDM monitoring should be recorded using spatial databases ("residue maps"), with various classes of RDM estimated per polygon
- Sampling of RDM needs to be sufficient to capture spatial variation.
- Standards should be adjusted to be more realistic and conservative according to UC guidelines.

#### **#5: Thatch persistence**

Reviews were mixed for the thatch persistence indicator. As with many indicators, reviewers were concerned about interseasonal and interannual variability as well as spatial variability that could confound management effects. While one reviewer concurred that thatch persistence was a good indicator of "the function of soil to cycle nutrients," many other reviewers were leery about the science indicating that persistent thatch indicated anything about the integrity of nutrient cycles. Some reviewers pointed out that decomposition rates for thatch varied between species, and so standards would be difficult to derive; this could be overcome by setting a standard to reflect thatch persistence as a percentage of spring peak live biomass. One reviewer suggested that thatch monitoring be combined with RDM monitoring with an adjustment to the RDM standard to include a maximum RDM level. Through the reviews, it became evident that if thatch accumulation is kept as an indicator, it should be monitored in the spring.

My suggestions:

- See first suggestion for RDM, above.
- Thatch levels should be recorded using spatial database (maps)
- Set thatch standard as a percentage of standing peak biomass in the spring.

## **#6: Desirable or undesirable plant occurrence**

Reviewers had a few suggestions to improve this indicator. Reviewers suggested that undesirable plants would be easier to characterize and agree upon as being 'bad,' and that these ought to be mapped to facilitate spatial analyses. A reviewer suggested that the species monitored be 'binned' into categories, such as 'native perennial grasses' or 'thistles' to make it possible to compare trends across landscapes even when the species vary. Several reviewers were concerned about the scale of the proposed sampling; it did not seem sufficient to effectively monitor most species, and it in particular would not capture woody species.

My suggestions:

- Change indicator to include animal species
- Monitoring of species should be via a spatial database (maps)
- Monitor at the species level, but bin the species into groups for comparison across regions
- Consider sampling at some larger scales: perhaps a modified Whittaker plot

## **#7: Infrastructure function index**

Reviewers were concerned about scoring this indicator. Some suggested that infrastructure is so tied to the purpose of managing the land that complications would arise when monitoring infrastructure. Other reviewers suggested difficulties in setting scores – for instance, how to weigh a major ¼ mile break in a fence versus a badly deteriorating fence stretching for miles? Practical concerns were raised with the ability to effectively monitor all infrastructure.

My suggestions:

- Participating land stewards could work with the CCRC to create baseline inventories of infrastructure and rank elements, creating a checklist for future interviews. This checklist could also come in handy for insurance claims in the event of fire, etc.
- Once a baseline is created, infrastructure monitoring could rely primarily on land steward interviews to identify and weigh the severity of the issues
- Spot inspections can verify interviews

## **#8: Rangeland stability and profitability index**

One reviewer suggested that the methods of monitoring this were too arbitrary and required refining with real economic analysis to be credible. Another reviewer importantly pointed out the necessity of including hunting in this indicator, as hunting is often a function of rangelands and can determine their 'profitability' in a number of ways. Finally, a reviewer suggested that the CCRC monitor the potential for smooth transfer of rangeland stewardship responsibilities.

My suggestions:

- The CCRC should convene a special meeting to discuss the goals of participants in analysis of rangeland stability and profitability. This should include conservation lands managers (and their high-level administrators) as well as private lands stewards.
- Add 'hunting' as an optional caveat for monitoring
- Monitor potential for and actuality of smooth transfer of rangeland stewardship responsibilities (management constancy over time)

## **Special indicators**

### **Major Pollution Control**

One reviewer suggested that this indicator be monitored through analysis of the receiving waters if major pollutant sources are present.

My suggestion:

- add monitoring methodology of testing receiving waters to the CCRC document

Appendix 1: Cross walk between NRCS' 17 indicators and the proposed CCRC indicators

<b>Category</b>	<b>17 Indicators</b>	<b>CCRC Tier 1 Indicators</b>
S,H	Rills	Bare ground, RDM
S,H	Waterflow patterns	Bare ground, RDM
S,H	Pedestals and/or Terracettes	Bare ground, RDM
S,H	Bare Ground	Bare ground
S,H	Gullies	Major erosion
S	Wind-Scoured, Blowouts, and/or Deposition Areas	-na-
H	Litter Movement	Soil compaction, RDM, thatch, bare ground
S,H,B	Soil Surface Resistance to Erosion	Bare soil, RDM, thatch
S,H,B	Soil Surface Loss or Degradation	Bare soil, RDM, thatch
H	Plant Community Composition and Distribution Relative to Infiltration and Runoff	Other special interest species and communities occurrence
S,H,B	Compaction Layer	Soil compaction
B	Functional/Structural Groups	Desirable/undesirable plant species (binned) from ESD
B	Plant Mortality/Decadence	-not covered-
H,B	Litter Amount	RDM, thatch
B	Annual Production	Rangeland stability and profitability index, economically important species occurrence
B	Invasive Plants	Desirable/undesirable plant species (binned) from ESD
B	Reproductive Capability of Perennial Plants	Desirable/undesirable plant species from ESD – time series