Panda Downlisted but not Out of the Woods

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Abstract
The giant panda (Ailuropoda melanoleuca) is no longer Endangered on the International Union for the Conservation of Nature’s (IUCN) storied Red List. The decision to downlist the panda to Vulnerable has its foundation in a systematic assessment of population parameters as determined by China State Forestry Administration’s circa decadal national survey and other scientific outputs, compared to standardized criteria used by IUCN to determine the status of all species. This decision has not been without controversy and disagreement, perhaps reflecting disparities between how people view the term “Endangered” and the criteria established by the IUCN. Here, we explore the architecture of recovery of this iconic “Endangered” species, make transparent the process of the IUCN downlisting decision, evaluate emerging threats to pandas on the horizon, and contemplate the meaning of this milestone for endangered species conservation. Through this revelation, we find profound reasons for hope for species conservation everywhere, and a useful example of success in the making. However, this positive message comes with measured caution. The Chinese government and conservation community must maintain its focus and investment on panda conservation, and contend with strategies to address new threats. If they do not, the panda will return to “Endangered” status once again.

Introduction
With the revelation that the giant panda (Ailuropoda melanoleuca) no longer meets the International Union for the Conservation of Nature (IUCN) criteria for Endangered and must be downlisted to Vulnerable (Swaisgood et al. 2016) comes the cautionary tale of a species still struggling to overcome a number of anthropogenic threats to its continued existence. The panda may have escaped its most immediate danger that nearly led to its extinction (principally deforestation), but now faces new and emerging threats. Downlisting implies increasing safety from the risk of extinction, but this new, and hopeful, designation does not mean that the panda does not require continued conservation effort. In accordance with the idiom, the panda is not yet “out of the woods.” Woods, or rather forests, are of course the source of the panda’s salvation (Zhang et al. 2011; Swaisgood et al. 2016): China’s extraordinary protection and restoration measures for forests in the panda’s range (Loucks et al. 2001; Liu et al. 2016) are indisputably the conservation measures most responsible for this downlisting milestone (Swaisgood et al. 2016).

In the anthropocene era, most species’ population trends are unidirectionally downward (an average a 28% reduction in individual abundance across all species of vertebrates in the last 40 years (Dirzo et al. 2014)) and nearly one-fifth of the world’s extant vertebrates are considered Threatened (Critically Endangered, Endangered, or Vulnerable in IUCN terminology; Hoffmann et al. 2010). Species loss and decline, or defaunation, has recently been identified as one of the major drivers of global environmental change with incalculable costs for humanity and nature (Hooper et al. 2012). Against this backdrop, the reversal of fortunes of such a key and iconic species (Figure 1) as the panda merits examination. And perhaps
reason for hope. The cases for such reversals are few but almost always occur only when concerted, strategic conservation actions are taken, particularly those targeting the primary threat that led to species decline (Hoffmann et al. 2010). The events surrounding the panda’s incipient recovery illustrate how intensive human intervention and political will can bring about a dramatic turnaround in the circumstances of one of the globe’s most endangered mammals.

**Downlisting the panda**

Why does the panda qualify for downlisting under IUCN criteria? Having established an international team of thousands of species experts and objective evaluation criteria, the IUCN Red List is the accepted global authority for listing Threatened species. The technical criteria for establishing various categories of endangerment are explicit and stringent under IUCN Red List guidelines. The process is also an exhaustive and transparent one that incorporates all the best available data. In the case of the panda, we are fortunate to have the results of one of the largest endangered species survey efforts on the planet, conducted by China’s State Forestry Administration on a circa decadal schedule (SFA 2015). During the Fourth National Survey, China invested more than 60,000 person-days surveying more than 4 million hectares. Although the methods for population estimation are necessarily crude for such an elusive species and changing methodologies across surveys confound results to some extent, the trends are clear and undeniable (SFA 2015; Swaisgood et al. 2016). Panda populations have been trending upward for two consecutive surveys, range is increasing, forest cover is increasing, and habitat is recovering (although increasing fragmentation remains a problem).

A species’ status under IUCN Red List criteria is determined by a number of factors, including population size, population trends, and geographic range (IUCN 2012). A full account of all the listing criteria is beyond the scope of this article, but we provide an overview of the process of the assessment here. Of overarching importance in any Red List assessment is the way in which uncertainty is handled. IUCN (2012) acknowledges that uncertainty prominently characterizes most assessments and provides guidelines on how to handle uncertainty. However, it is strongly discouraged to use uncertainty, which is almost inevitable, to list a species as “Data Deficient” because doing so would quickly lead to a meaningless assessment process in which most species’ listing decisions are avoided due to inherent limitations to available data. This philosophic stance on uncertainty is vital to understanding the listing decision for the giant panda because one of the strongest counterarguments to the listing decision is that the population estimate may be inaccurate (Kang & Li 2016). It is worthwhile
noting in this regard that the giant panda population estimate is based on one of the most thorough and labor-intensive animal censuses yet achieved (SFA 2015; Swaisgood et al. 2016), and thus invoking uncertainty is highly problematic.

With an estimated population of 1,864 (excluding cubs <1.5 years of age), many would surmise that small population size alone would qualify the panda as Endangered, but this is not the case under IUCN criteria. In fact, to qualify as Endangered based on numbers alone requires fewer than 250 mature individuals and <1,000 adults to qualify as Vulnerable under criterion D. As is often the case, the metric we have for a population estimate for pandas (numbers include immature subadults but not cubs <1.5 years old) is different from the metric used in IUCN criteria (mature adults only), requiring additional calculations to make the assessment. We thus used demographic data available from the national survey to estimate the number of mature pandas, arriving at an estimate of 1,040 mature pandas. Given this number was so close to criterion of 1,000 individuals, we invoked uncertainty and decided to list the panda as Vulnerable under criterion D, reasoning that the confidence intervals included values below 1,000. If adult population size was underestimated by even a small amount, then the panda would not qualify as Vulnerable and would be downlisted an additional step to Near Threatened according to IUCN population size criteria alone. It may indeed be the case that the Fourth National Survey underestimated population size, since comparison of results using DNA census in the Third National Survey in one reserve yielded a much larger population size than the method employed during national surveys (Zhan et al. 2006).

This assessment has been challenged on the basis that the population estimate may be an overestimate because of the methodology employed by the Chinese government’s survey (Kang & Li 2016). The panda survey uses a combination of approaches that rely on indirect sign, rather than direct sightings of pandas. However, a survey based on direct sightings is completely unrealistic for this species due to the extreme difficulty locating pandas (in our experience many days or weeks are required to locate a single panda) and the difficulties in recognizing individual pandas (Zheng et al. 2016). The sign survey for pandas uses feces, individually idiosyncratic variation in bite-size bamboo stem fragments in feces, and knowledge of typical home range size, and thus is understandably subject to measurement error. However, when tested against more reliable molecular census techniques, the bite-size method underestimated panda population size, suggesting the panda population may actually be substantially larger than indicated by the national survey (Zhan et al. 2006).

Thus, we have no reason to suppose that there are in fact fewer than the 250 mature pandas required to meet the requirements for Endangered under criterion D. The giant panda also fails to qualify for Endangered based on criterion A, which requires a reduction in population size of >50% over the previous three generations. By contrast, the past two surveys, which employed the same methodologies to allow the evaluation of trends, indicate that the panda population has increased from an estimated 1,596 in 2004 to 1,864 in 2014. Previous estimates using slightly different methods had shown a precipitous decline from 2,459 in 1977 to 1,216 pandas in 1988 before beginning to increase in the last two surveys. Even with uncertainty around these estimates, it seems clear that the criterion of reduced population has not been met. Furthermore, there is little uncertainty that panda habitat and occupied range has increased (SFA 2015; Swaisgood et al. 2016), thus supporting the inference that panda populations could be increasing.

The panda also qualifies as Vulnerable due to the additional risks from subpopulation division and a projected continuing decline under criterion C2a(i) (Table 1). Fragmented into 33 areas (SFA 2015), the maintenance of genetic diversity and habitat connectivity are two of the defining issues facing future panda conservation efforts. However, even with this fragmentation, the panda does not meet the criterion for Vulnerable unless it is also experiencing current or imminent population decline. Panda numbers are currently increasing so here we must invoke the worrisome projections of climate change models predicting significant losses of panda habitat (Tuanmu et al. 2013), increasing fragmentation due to road and other infrastructure construction (SFA 2015), and increasing livestock encroachment (Wang et al. 2015; Liu et al. 2016), which compromise the panda’s future and keep it listed as Vulnerable (Figure 2). Only one IUCN Red List criterion could currently lead to a classification of Endangered for the panda. This criterion stipulates that the size of the largest subpopulation must be <250 adults, but even with a high degree of habitat fragmentation, the panda’s largest subpopulation seems to surpass this number. Based on a number of rigorous genetic studies (Wei et al. 2012; Zhao et al. 2013), the panda population comprises five genetic clusters, with the largest subpopulation in the Minshan mountains estimated to contain more than 400 adult pandas. Further subdivision of this population may be occurring (SFA 2015), but it has not resulted in restricted gene flow.

The news of the panda’s downlisting will no doubt be met with skepticism and doubt in some quarters. However, as the authors of the Red List assessment (Swaisgood et al. 2016), we contend that anyone applying the best available data to pandas—acknowledging
Panda downlisted but conservation reliant

Table 1  
Listing of the giant panda as Vulnerable under IUCN’s criterion C2a(i)

| Criterion | Evidence evaluation |
|-----------|----------------------|
| C: Population <10,000 mature adults | Population estimated at 1,040 mature adults |
| 2: A continuing decline, observed, projected, or inferred, in numbers of mature individuals | Although evidence from the national surveys provides strong evidence, the population has increased recently, climate change projections allow us to project a future decline |
| a(i): No subpopulation contains more than 1,000 mature individuals | Largest subpopulation estimated to contain fewer than 500 mature pandas |

Figure 2  
Emerging threats facing giant panda conservation: (a) livestock is encroaching at increasing rates into protected and unprotected panda habitat, with unknown consequences; (b) agricultural expansion (facilitated by climate change) eats away at the lower elevation panda habitat; (c) bamboo, the principal food source of pandas, is predicted to experience distributional shifts under climate change; (d) remaining old-growth forests, an important ecological factor providing den sites and associated with panda occupancy, will need protection; (e) roads further fragment an already subdivided panda population; and (f) ecotourism is increasing in China, which may be a source of disturbance and habitat degradation.

Lessons learned from panda conservation

What policy and management lessons can be learned from the panda conservation success story for other endangered species programs? The lead for this story should be a cautionary tale about giving up. Two decades ago one of the leading giant panda biologists penned a book entitled The Last Panda (Schaller 1993). Based on trends and practices of that day, Schaller worried that the panda would soon disappear. Surely without someone like Schaller raising the alarm, the panda would have continued on its path toward extinction, as has been the case for many species that had fewer champions, less public engagement, and weak policy and planning (Woinarski et al. 2016). Many have argued that we should let the panda go extinct (review in Wei, Hu et al. 2015), proclaiming that pandas are not worthy of the effort or that they are somehow ill-adapted, at an evolutionary dead end. Contrary to unfounded commentary, the giant panda is exquisitely adapted to its environment (Wei, Hu et al. 2015). And now we can say definitively...
that the panda can be saved. It is being saved due to the visionary policies of the Chinese government and international efforts to keep attention—and science—focused on panda recovery. While it might be argued that the future security of one species, even the panda, did not merit the degree of attention and effort invested in pandas, this position is rendered indefensible by the many other forms of life that find shelter under the umbrella of the panda reserves and protective measures (Li & Pimm 2016). The creation of 67 reserves for pandas also provides protection for an ecosystem that rivals the diversity found in tropical ecosystems—perhaps the most diverse in the temperate world (Mackinnon 2008)—making the panda one of the most effective umbrella species of all time. The challenge that lies ahead is in the extrapolation of the panda strategy to other deserving, yet less charismatic species. While some of these species already benefit as a byproduct of sympathy with pandas, China could apply more directly some of the methods employed with giant pandas toward the recovery of these species, including 14 mammal, 20 bird, and 82 amphibian species in need of protection in panda reserves (Li & Pimm 2016).

The details of the panda’s recovery can be found in policies and protective measures mandated by China’s State Forestry Administration, in a conservation joint venture between East and West on a grand scale, and in the application of scientific knowledge to judicious management decisions and policy construction (Wei, Swaisgood et al. 2015; Liu et al. 2016; Swaisgood et al. 2016). Beginning in the wake of alarming findings of precipitous decline in China’s Second National Survey, China enacted the Wildlife Protection Law of 1988, which banned panda poaching and made it a capital offense. Prior to the enactment of this law, poaching had been a major cause of the panda’s decline (Li et al. 2003). A few years later China implemented its National Conservation Project for the Giant Panda and its Habitat, which over the next two decades led to the creation of 67 “panda reserves” protecting 1.4 million acres of panda habitat, 58% of the panda’s range (SFA 2015).

The panda benefited from additional government policies that were not implemented solely for panda conservation. As a result of these revolutionary programs, China has become one of the few countries with increasing forest cover (FAO 2010), with the giant panda as a primary beneficiary. The Natural Forest Conservation Program of 1997 banned logging throughout much of China, including most of the panda’s range, largely as a measure to prevent soil erosion and mitigate against flooding, yet this policy was embraced by conservation managers and policy makers to further panda conservation efforts (Zhang et al. 2011). As a result, the amount of available habitat for pandas has increased as secondary forests mature and become more suitable, a process that may be driving the panda’s observed range expansion by 11.8% in the past decade (SFA 2015). The Grain-to-Green Program provided economic incentives for farmers to convert cropland to forest (Loucks et al. 2001; Liu et al. 2016). Although this ecoscenicompensation program is the largest reforestation program in the world, it has largely resulted in the establishment of forest monocultures that do little to promote biodiversity conservation (Hua et al. 2016). Clearly, policy revisions could do much to facilitate the conservation value of this program, including the provision of more suitable panda habitat, yet even in its current form it plays a role in increasing habitat connectivity for pandas (Vina et al. 2007). It seems doubtful that pandas rely heavily on these monoculture forests, but they likely represent less of a barrier to movement and dispersal than the intensive agricultural landscapes they have replaced.

There are already many lessons learned from China’s payment for ecosystem services programs (Yang et al. 2015; Liu et al. 2016). What works best is a combination of top-down regulations, such as designation of protected areas and enforcement, and incentive-based programs targeting local communities. A strong focus on economic incentives and social norms in local communities is particularly important. When the community is also enlisted to monitor and patrol violation of ecoscenicompensation terms, the goal of forest protection is further supported by social pressure that deters activities that jeopardize compensation rates for the entire community. These livelihood alternatives also may help foster cultural change, away from dependence on local resource extraction, thus having effects that endure beyond the tenure of the ecoscenicompensation program.

On this backbone of regulatory policy, national and collaborative international conservation science (Figure 3) has flourished and grown to a degree matched by few other research programs for endangered species, providing new knowledge that informed management and policy decisions (Swaisgood et al. 2010; Wei, Swaisgood et al. 2015). Beginning in the 1970s, China invested heavily in a large-scale monitoring program, which has been responsible for first documenting the precipitous decline in panda numbers, then guiding panda conservation strategies and policies, and finally revealing the recent upswing in panda populations which underlies the downlisting decision. Such investment in long-term monitoring is rare in species conservation, but is vital for devising successful conservation strategies (Bonebrake et al. 2010). A host of scientific studies have informed management by mapping habitat, evaluating positive and negative temporal changes in habitat, delineating population substructure, identifying limiting resources, documenting threats,
examining socioeconomic factors driving habitat impacts, and forming a foundation for adaptive management in the future (Wei, Swaisgood et al. 2015; Liu et al. 2016).

The panda program thus provides a model for species conservation. We know that swift and early intervention by the Chinese government and the international conservation community was vital, a lesson learned with other species (Martin et al. 2012). We also know that investment in conservation makes a difference (Hoffmann et al. 2010; Tranquilli et al. 2012), and can be certain that the panda’s decline would have continued if no interventions were made. Conservationists living in the anthropocene epoch must often take hope in slowing the loss of nature rather than bringing it back to its pristine state, a hope that all too often leads to despair (Swaisgood & Sheppard 2010).

**Contemplating the implications and broader meaning of panda downlisting**

The giant panda has become nearly synonymous with the term “endangered,” so what is a panda if it is not endangered? We suggest that we do not need to revise our view of the panda, a species that will continue to rely on conservation intervention for the foreseeable future. Instead, we need to review the concept of species endangerment and recovery through a different lens. The process of recovery is often confused with the end state of “recovered.” Here, we emphasize that the panda is undergoing a process of recovery, and should not be considered “recovered” just because it has been downlisted one step on IUCN’s Red List of Threatened Species. In a general sense, all species on the Red List are “endangered” in that they are at risk of extinction—that is what being on the list means. If we want to continue to give the panda the label “Endangered,” the IUCN criteria will have to be modified to be more liberal.

Several authors have recently explored terminology surrounding endangerment and recovery and concluded that these concepts should be viewed as lying on a continuum, with several stages of recovery (Redford et al. 2011; Westwood et al. 2014). Redford and colleagues (2011) provide a framework emphasizing the degree of human intervention and management required to sustain a species. Westwood and colleagues (2014) proposed five stages of recovery, founded upon diagnosis and intervention in the medical community. Following their terminology, pandas have been diagnosed (population decline and threats evaluated), treatment has commenced (recovery strategy implemented and population decline slowed), and pandas have entered the stabilization stage (some threats mitigated, population beginning to increase). Yet to come for the panda are two additional stages of recovery, rehabilitation, and recovered. We look...
forward to witnessing the continued rehabilitation of the giant panda, but must acknowledge that the panda will likely always be conservation-dependent, relying on conservation management and intervention indefinitely.

These esoteric and academic arguments are unlikely to resonate with the general public, most of whom will view the panda downlisting in one of two ways. Some will see the news as an unqualified success deserving of celebration, soon followed by forgetting: box checked, panda saved. Others will see the downlisting as abomination, an unfair and overly optimistic opinion that all is well for the panda. Neither viewpoint is correct and as we have tried to articulate, the truth lies in a gray area somewhere between these extremes. Still, people will worry. Will China stop protecting the panda? Will people stop caring about—and funding—panda conservation? Will WWF change its logo? We can only speculate about the latter question, but as to the Chinese government, they have stated in unqualified terms that they will continue their protection program and work to counter emerging threats (SFA 2015). It is also important to note that the IUCN Red List status has no legal ramifications—all national and international protective measures currently in place will stay in place and the panda is still considered endangered by the Chinese government.

The most difficult question to answer is how this all will play out in the media and the arena of public opinion. Pandas may get a little less attention, but we can hope that another deserving species will fill that vacuum. There are plenty of them. Among mammals, approximately 10 times as many species were uplisted as downlisted on the recent Red List assessments. The panda story can become a call to action, showing the public that species conservation can have successes, and rally them to the cause of other species in dire need. All the evidence suggests that people are motivated by “hope,” that indefinable belief that one’s actions can make a difference and bring about positive change (Swaisgood & Sheppard 2010; Garnett & Lindenmayer 2011). People also like to join a winning cause, not a losing one. The panda hasn’t won, but it is winning, and it might just be the case that more people will be drawn to support panda conservation. We certainly hope so, because the panda is not yet out of the woods.

We do not expect that these arguments will satisfy all detractors. Some consider the “Endangered” status a badge of honor, a birthright of the panda. In the endangered species conservation culture, there is a certain amount of “lobbying” that goes on, with political pressure to extend the “endangered” label to one’s species of choice. These sentiments have no business in listing criteria, however, and belong only in the public discourse if anywhere.

This dialogue begs the question, how should the public and policy makers invest in endangered species conservation? We return again to the five stages of recovery. All species in any stage of recovery, just like patients battling a medical issue, deserve support throughout the process, not just at the emergency room door (Redford et al. 2011; Westwood et al. 2014).

Conclusion

Looking forward, there will be fewer opportunities to set aside more land for panda conservation and emphasis will shift instead to increasing habitat connectivity, supplementing small, isolated populations to maintain genetic diversity, and applying the wealth of newfound scientific knowledge (Swaisgood et al. 2010; Wei, Swaisgood et al. 2015) to better management of resources that support pandas inside reserves. Adaptive management approaches to identify and manage limiting factors will also guide future policy and management strategies to increase panda carrying capacity inside protected areas. China’s State Forestry Administration (SFA 2015) reports a number of threats to pandas that are increasing, including the expansion of livestock grazing, which is slowly eroding and degrading the panda’s habitat, infrastructure development, and increasing habitat fragmentation. Plans to manage and offset these threats will be required for the continued recovery of the panda.

Ecocompensation programs (Loucks et al. 2001; Yang et al. 2015; Liu et al. 2016) will provide critical incentives to protect pandas and habitat both inside and outside of protected areas. Already, these programs can claim a good deal of the credit for panda recovery, but they can become much more powerful tools for conservation if lessons learned are applied. Future programs should include both regulations and incentives, and should emphasize establishment of social norms and community self-policing. The Grain-to-Green program urgently needs to be steered away from encouraging monoculture tree plantations to focus on mixed-species forests of native trees that will enhance its value for biodiversity conservation (Hua et al. 2016) and create better habitat for giant pandas.

In contrast to these mature programs, strategies to increase habitat connectivity between fragmented populations are just getting underway. The Chinese government recognizes that fragmentation is the most immediate and important remaining threat and scientists have begun to test the efficacy of habitat corridors (Wang et al. 2014; Wei, Swaisgood et al. 2015). For areas where corridors cannot be established in the near future, active intervention such as translocation will be required to maintain the genetic viability of small, isolated popula-
tions. China has also established a large successful conservation breeding program, often with the help of foreign zoos and NGOs (Wildt et al. 2006; Martin-Wintle et al. 2015), and has a nascent program for releasing giant pandas into areas in need of genetic rescue and population supplementation. These efforts will form an important component of the overall panda recovery strategy, particularly for safeguarding some of the smallest subpopulations.

Climate change is an additional emerging threat requiring proactive intervention. Although climate change-mediated effects on panda habitat have not yet been detected, several models predict significant habitat loss of more than 50% in some models (Soner et al. 2011; Tuanmu et al. 2013; Fan et al. 2014; Li et al. 2015). These models are largely based on current and projected elevational and latitudinal distribution of bamboo species on which giant pandas depend. Current protected areas containing giant pandas may suffer range contractions in these bamboo species, leaving pandas without sufficient food if they cannot migrate to higher elevations or more northerly latitudes that contain these bamboo species. However, these researchers do not model how bamboo species historically at lower elevations, and which formerly sustained panda populations, may also experience a distributional shift and replace the bamboo species pandas currently consume. Bold experiments may be required to proactively mitigate against the effects of climate change, for example, experimentation with assisted migration of lower-elevation bamboo species to higher elevations where pandas currently reside (Wei, Swaisgood et al. 2015). If suitable habitat cannot be created to support pandas in their current range, the entire reserve system, and issues of connectivity among reserves, will need to be addressed.

Today the giant panda’s outlook is much brighter and the species once iconic for its rarity, conservation urgency, and presumed evolutionary failures now has come to represent progress and even hope (Pan 2014; Wei, Swaisgood et al. 2015). Panda conservation is not a success, it is success in the making. While reason for optimism can be found in the panda’s improved status, there is still much work to be done to address the number of current and future threats facing the giant panda. The Chinese government and global conservation community need to prepare for the most difficult phase of species conservation, as the panda will likely always be conservation-dependent and require active management and intervention indefinitely. The panda’s recovery is a fragile one, thus this newfound hope must be counterbalanced with renewed resolve to keep this conservation program on the path to success, and keep the panda safe in the woods.

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